

EMPOWERMENT AND
INTERPROFESSIONAL COLLABORATION
TO IMPROVE MATERNAL NUTRITION



RENSKE M. VAN LONKHUIJZEN

PROPOSITIONS

1. Fathers have a more significant influence on maternal nutrition choices than healthcare professionals.
(this thesis)
2. Narratives capture empowerment processes that quantitative data overlook.
(this thesis)
3. Critical thinking emerges through writing rather than through reading.
4. PhD defences without laymen talks widen the gap between science and society.
5. The expression ‘breast is best’ prioritizes biological ideals over maternal wellbeing.
6. Family vlogging is a contemporary form of child labour.

Propositions belonging to the thesis, entitled

EMPOWERMENT AND INTERPROFESSIONAL COLLABORATION TO IMPROVE MATERNAL NUTRITION

R E N S K E M . V A N L O N K H U I J Z E N

Wageningen

**EMPOWERMENT AND
INTERPROFESSIONAL COLLABORATION
TO IMPROVE MATERNAL NUTRITION**

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EMPOWERMENT AND INTERPROFESSIONAL COLLABORATION TO IMPROVE MATERNAL NUTRITION

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ABBREVIATIONS

95% CI	= 95% Confidence Interval
BCW	= Behaviour Change Wheel
BMI	= Body Mass Index
C-RCT	= Cluster Randomised Controlled Trial
COM-B	= Capability, Opportunity, and Motivation Behaviour
DHD2015-index	= The Dutch Healthy Diet index 2015
DHD-P	= The Dutch Healthy Diet Index for Pregnant Women
GALA	= Gezond en Actief Leven Akkoord
GSRH	= General Self-Rated Health
HCP	= Healthcare Professional
IQR	= Interquartile Range
LOCF	= Last Observation Carried Forward
mHealth	= Mobile Health
MI	= Motivational Interviewing
NFP	= Nurse Family Partnership
P4GZ	= Power 4 Gezond Zwanger
P4HP	= Power 4 a Healthy Pregnancy
PRES	= Pregnancy-Related Empowerment Scale
QOL	= Quality of Life
SD	= Standard Deviation
SES	= Socioeconomic Status
SOC	= Sense of Coherence
SPIRIT	= Standard Protocol Items Recommendations for Interventional Trials
SRH	= Self-Rated Health
VAS	= Visual Analogue Scale
WHO	= World Health Organization



Chapter 1

GENERAL INTRODUCTION

This doctoral dissertation describes an interdisciplinary research project that merges nutritional and social sciences to develop and evaluate an empowerment programme to improve pregnant women's diet quality. The study integrates biomedical insights on maternal nutrition with social-ecological perspectives of dietary behaviour. This research extends beyond traditional educational approaches by viewing pregnant and postpartum women as active agents rather than passive recipients of care. It examines how interprofessional collaboration between midwives and dietitians can support women in developing their capacity to make healthier food choices during pregnancy and postpartum.

This chapter outlines the key elements that provide the context and theoretical foundation of this thesis, summarises the current state of knowledge in the field, and describes the Dutch healthcare setting in which the study was conducted. First, it provides pregnancy-related information, highlighting the importance of maternal nutrition, the unique opportunity pregnancy offers for behaviour change and the specific role of midwives in the Netherlands. Second, it examines current practices in nutritional support during pregnancy, focusing on the complementary roles of midwives and dietitians. Third, it elaborates on empowerment as the central theoretical framework guiding this research. Fourth, relevant theoretical models are introduced to provide a comprehensive understanding of the determinants of diet quality among Dutch pregnant women. Fifth, the "Power 4 a Healthy Pregnancy" (P4HP) programme is presented. Finally, the specific aims and scope of this thesis are outlined, followed by an overview of the subsequent chapters and their methodological approaches.

While this research initially focused on developing, implementing, and evaluating the P4HP programme, the scope expanded throughout the study period. As the project progressed, it became increasingly apparent that adequate nutritional support requires a continuous care approach that transcends beyond pregnancy into the postpartum period, with consideration for the broader social network of the woman. This insight led to further investigation into the role of partners in supporting dietary choices during pregnancy and assessing nutritional care in the postpartum phase. These expanded areas of inquiry represent initial steps toward establishing a comprehensive, continuous care pathway spanning pregnancy through postpartum, addressing a significant gap in current maternal nutritional support frameworks.

1.1 PREGNANCY

THE IMPORTANCE OF NUTRITION DURING PREGNANCY

Nutrition during pregnancy is crucial for both foetal and maternal well-being, with long-term health implications (Christian et al., 2015; Harding, 2001; Raghavan et al., 2019). Poor diet quality of the mother is associated with various adverse health outcomes, including an increased risk of pre-eclampsia, gestational diabetes, excessive gestational weight gain, hypertension, and caesarean delivery (Jouanne et al., 2021; Mousa et al., 2019; Ramakrishnan et al., 2012). Suboptimal maternal nutrition also correlates with adverse birth outcomes, such as premature birth and low birth weight, and is linked to long-term health risks for the child, including a higher likelihood of chronic diseases, obesity, diabetes, and heart disease later in life (Koletzko et al., 2019; Langley-Evans et al., 2022; Versle, Debekker, et al., 2021).

The World Health Organization (WHO) emphasises the importance of a balanced diet that includes a variety of foods, such as vegetables, meat, fish, beans, nuts, whole grains, and fruit, to ensure an adequate intake of energy, protein, vitamins and minerals (World Health Organization, 2016b). Similarly, the Health Council of the Netherlands has outlined specific dietary recommendations for pregnant women, including adequate intake of vitamin D, folic acid, iodine, iron, and calcium, while advising against certain foods such as alcohol and liver products to promote optimal foetal development (Health Council of the Netherlands, 2021).

In the Netherlands, despite the availability of such guidelines and the documented importance of proper nutrition, adherence remains suboptimal across the general population (van Rossum et al., 2023). Based on the Dutch National Food Consumption Survey 2019-2021, a substantial majority of Dutch women aged 18-79 years did not meet key dietary recommendations, with only 29% meeting the guidelines for vegetables, 19% for fruit, 8% for unsalted nuts and seeds, and approximately 28% consuming fish once a week as recommended, while legumes were consumed on average only 0.4 days per week instead of the recommended weekly consumption (van Rossum et al., 2023).

During pregnancy, women generally consume adequate nutrients such as protein (75-88g/day), vitamin A, vitamin B12, and several other micronutrients. However, supplements are still necessary to meet the recommended levels of folate and vitamin D. There are concerns, however, about insufficient consumption of fruits, vegetables, and fatty fish (ter Borg et al., 2023). For example, only 23-35% of pregnant women meet the recommended 200g of vegetables daily, and fish consumption averages only 0.4-1.0 servings per week instead of the recommended two servings (ter Borg et al., 2023). Additionally, supplement use among pregnant women varies widely, and the intake of

alcohol, sugary drinks, and salt during pregnancy are reason for concern (ter Borg et al., 2023). Furthermore, pregnant women with lower socio-economic status (SES) are less likely to adhere to nutrition guidelines (Baron et al., 2015; Caut et al., 2020), and adverse birth outcomes have been strongly linked to socio-economic factors (Abu-Saad & Fraser, 2010).

The importance of nutrition during pregnancy gained global attention with the First Thousand Days framework, which stresses the importance of early life nutrition from conception to a child's second birthday for growth and development in later life (Cusick & Georgieff, 2016). In high-income countries such as the Netherlands, this framework often focuses on reducing childhood overweight and obesity, while low- and middle-income countries often focus on reducing childhood stunting (Aubert et al., 2023; Woo Baidal et al., 2016). In the Netherlands, this initiative is covered by the Solid Start action programme (in Dutch: actieprogramma Kansrijke Start), launched in 2018 by the Ministry of Health, Welfare and Sport to provide more children with a strong start in life (van Meijeren-van Lunteren et al., 2024). However, while this initiative focuses primarily on maternal nutrition for child health, it rarely evaluates women's health indicators (Kinshella et al., 2021).

PREGNANCY AS A WINDOW OF OPPORTUNITY

Pregnant women often know the importance of maintaining a healthy diet for themselves and their babies. As a result, they tend to be more interested in nutrition information and are often more willing to change their dietary habits (Phelan, 2010; Super & Wagemakers, 2021; Szwajcer et al., 2005, 2012). In a study among 343 Dutch women, 56% reported a stronger intention to make lifestyle changes because of their pregnancy (Uzan et al., 2024). Therefore, pregnancy represents a key window of opportunity for promoting healthy nutrition, as women are often more receptive to improving their dietary choices during this life stage than others. However, pregnancy is also a period when women experience barriers, such as nausea and cravings, that can make it challenging to implement and sustain dietary changes (Blumfield et al., 2012). Women with lower SES often encounter additional challenges, including limited financial resources, lack of skills, or insufficient information (Baron et al., 2015; Fowles et al., 2011). Therefore, optimising the nutritional support for pregnant women during this teachable moment and critical transition period is essential.

THE UNIQUE POSITION OF MIDWIVES IN THE NETHERLANDS

The Dutch maternity care system is based on the work of independent community midwives, providing primary care to women with uncomplicated pregnancies. For complicated pregnancies, obstetricians provide secondary care in the hospital. A pregnant woman is referred from primary to secondary care when complications arise,

the risk of complications increases, or if pain relief is requested during labour.

Interestingly, there is no direct Dutch equivalent for the term ‘midwifery’. The word midwifery is derived from ‘mid’ (with) and ‘wife’ (woman), meaning ‘with the woman’. In contrast, the Dutch term ‘verloskundige’ centres on the caregiver rather than the woman. While midwives in the Netherlands are responsible for most of midwifery care, other professionals such as obstetricians, paediatricians, or nurses also play a role. In this thesis, referring to midwives, we specifically mean community midwives working in non-medical settings.

In the Netherlands, community midwives play a unique and central role in antenatal care, serving as the primary caregivers for women with low-risk pregnancies within a unique three-tiered maternity care system (De Vries et al., 2013). Dutch community midwives independently manage approximately 80% of pregnancies, unlike many countries where obstetricians lead pregnancy care. They provide continuity of care from the first antenatal visit through labour, delivery, and postpartum care. The Dutch system emphasises a physiological approach to birth, viewing pregnancy as a natural life event rather than a medical condition requiring intervention. This approach contributes to the Netherlands’ relatively low intervention rates during childbirth compared to other developed countries (De Vries et al., 2013; Seijmonsbergen-Schermers et al., 2020).

Midwifery care is preventive and supportive care, focused on empowering women by strengthening their capabilities in respectful relationships, allowing them to give birth in a way that aligns with their preferences (Renfrew et al., 2014). This approach is closely linked to the concept of empowerment, as it prioritises supporting women’s autonomy and enables them to make informed choices about their pregnancies and births rather than imposing external control or standardised interventions. The community midwifery model in the Netherlands embodies these empowerment principles, recognising women as active participants in their care.

1.2 THE POSTPARTUM PERIOD

THE IMPORTANCE OF NUTRITION DURING THE POSTPARTUM PERIOD

The postpartum period marks a critical transitional phase during which parents undergo significant physiological, psychological, and social changes (Fahey & Shenassa, 2013; Martin et al., 2022). For women, this period involves significant physiological recovery following childbirth, the nutritional demands associated with lactation, and the adaptation to new caregiving responsibilities. These challenges occur alongside disruptions in sleep, alterations in daily routines, and evolving family dynamics, all of

which require considerable resilience and adaptation (Makama et al., 2021; Martin et al., 2022).

Healthy dietary habits during the postpartum period are crucial, as maternal nutritional status directly impacts maternal and child health (Marshall et al., 2022). Proper nutrition supports breastmilk production, maternal recovery, nutrient status, prevention of chronic diseases, weight management and overall well-being (Hart et al., 2022; McKinley et al., 2018). Postpartum weight retention, which typically results in an average of 0.5 to 4.0 kg retained by one year after childbirth, contributes to obesity and long-term weight gain (Gallagher et al., 2019; Goldstein et al., 2017; Gore et al., 2003). Despite the critical importance of nutrition during this period, many women, particularly those with low SES, face significant barriers to adopting healthy dietary habits. These barriers include time constraints, limited nutritional knowledge, and financial challenges (Makama et al., 2021; Ryan et al., 2022). Previous research indicates that postpartum women tend to abandon healthy dietary habits they may have developed during pregnancy (Fowles & Walker, 2006; Wiltse et al., 2013).

POSTPARTUM CARE IN THE NETHERLANDS

The Netherlands has established a distinctive system of postpartum care that offers comprehensive support to both women and infants following childbirth. A key feature of Dutch postpartum care is the provision of “kraamzorg”, a specialised home-based maternity care service that is integrated into the standard healthcare system and is largely covered by health insurance (Baas et al., 2017; Laureij et al., 2021). After childbirth, a maternity care assistant (in Dutch: kraamverzorgende) visits the mother and infant at home for a total of approximately 49 hours (minimum of 24, maximum of 80), typically distributed over 8-10 consecutive days (Laureij et al., 2021). These assistants offer practical help with infant care, breastfeeding support, household tasks, and monitor the health and recovery of both mother and infant (de Groot et al., 2018). Annually, around 170,000 women give birth in the Netherlands, and an estimated 90% of these families receive postpartum maternity care assistance in their homes (Baas et al., 2017). Although nutritional counselling is not the primary focus of maternity care assistants, some may offer basic dietary advice, particularly related to breastfeeding and maternal recovery. For infants, healthcare is provided by the child health centre (in Dutch: consultatiebureau), a preventive youth healthcare service. These centres, staffed by physicians and nurses specialised in child health, offer vaccinations and conduct regular check-ups to monitor infant growth, development, and overall well-being until the child reaches the age of four (Dunnink & Lijs-Spek, 2008).

1.3 NUTRITION SUPPORT DURING THE PERINATAL PERIOD

THE ROLE OF MIDWIVES DURING PREGNANCY

Midwives are uniquely positioned to provide nutrition communication, as they are often the first and most trusted source of information for pregnant women regarding nutrition (Baron, Heesterbeek, et al., 2017; Super & Wagemakers, 2021). While midwives recognise the importance of offering nutritional guidance, they experience various barriers in doing so, including limited time and knowledge (Baron, Martin, et al., 2017; Beulen et al., 2021; Szwajcer, Hiddink, Koelen, et al., 2008)

Current nutrition communication by midwives in the Netherlands primarily focuses on food safety, preventing acute foodborne illnesses and related health risks. However, it often lacks support for helping women establish and maintain a healthy diet (Beulen et al., 2021; Szwajcer, 2007). Personalised, specific nutrition-related questions and the underlying motivations for dietary behaviours are rarely addressed (Szwajcer, 2007).

THE ROLE OF DIETITIANS DURING PREGNANCY

Dietitians, with their expertise in nutrition requirements and providing tailored dietary advice, could play a crucial role in filling the gap in antenatal care (Kaiser & Campbell, 2014; Super et al., 2021). Midwives recognise the potential added value of collaborating with dietitians in antenatal care (Arrish et al., 2014; Beulen et al., 2021). Additionally, previous research has demonstrated the benefits of nutritionist-led activities during pregnancy (Di Carlo et al., 2013; Wilkinson & McIntyre, 2012). What makes dietitians particularly suitable for integration into antenatal care is their training in Motivational interviewing (MI), which leverages existing motivations of pregnant women. Through this approach, they create a dialogue about opportunities and barriers to dietary changes that women could implement in their everyday lives.

This approach is essential because the use of MI in dietetics shows potential (Barnes & Ivezaj, 2015; Martins & McNeil, 2009), and knowledge transfer alone is often insufficient to alter deeply rooted dietary habits and shift women towards healthier nutritional patterns (Worsley, 2002). Simply providing dietary advice is not enough – women need support in implementing lifestyle changes in their daily lives. However, existing programmes aimed at changing health behaviour during pregnancy often focus on education rather than empowerment (Brandstetter et al., 2015; Zinsser et al., 2020). For example, former and existing (online) programs, e.g. Hello World (Van Dongen et al., 2012) and Smarter Pregnancy (SlimmerZwanger) (Van Dijk et al., 2016), focus primarily on knowledge transfer rather than on learning with and among pregnant women.

THE ROLE OF THE SOCIAL ENVIRONMENT

Social support is a crucial predictor of mental and physical health during pregnancy (Greenhill & Vollmer, 2019; Grenier et al., 2021). According to Berkman et al.'s (2000) widely recognised social networks and support theory, support can be categorised into four dimensions: emotional (expressions of empathy, love, and caring), instrumental (tangible aid), appraisal (self-evaluation assistance), and informational (advice and suggestions). Pregnant women who receive substantial social support are more likely to make healthier dietary choices (Elsenbruch et al., 2007), including enhanced consumption of healthy foods such as fruits and vegetables (Greenhill & Vollmer, 2019).

Partner involvement is particularly essential for a healthy pregnancy (Firouzan et al., 2018), with the WHO recognising it as an effective strategy to improve maternal and newborn health outcomes (World Health Organization, 2016b). While partner involvement varies across cultures – from financial support and decision-making to emotional engagement and participation in household responsibilities (Galle et al., 2021) – studies specifically examining partner support for dietary intake during pregnancy and postpartum remain scarce (Greenhill & Vollmer, 2019; Versele, Debekker, et al., 2021).

POSTPARTUM NUTRITIONAL SUPPORT

Nutritional support during the postpartum period is essential, as this time presents significant challenges. Generally, HCPs recognise the need for nutritional counselling during this period (World Health Organization, 2015). The World Health Organization (WHO) has emphasised the importance of comprehensive postpartum nutritional counselling and recommends improving tools and training for healthcare providers (World Health Organization, 1998, 2015). However, guidelines addressing postpartum nutrition remain limited in many countries. The Health Council of the Netherlands recently published dietary reference values for vitamins and minerals specifically for lactating women (Health Council of the Netherlands, 2024). Despite the availability of these reference values, postpartum nutritional counselling in the Netherlands remains sparse. The majority of nutritional guidance during the postpartum period is focused on the infant rather than the mother's nutritional needs (Dunnink & Lijs-Spek, 2008; Koninklijke Nederlandse Organisatie van Verloskundigen, 2018), and practical resources to assist women in managing dietary challenges are still lacking. This gap in care represents a missed opportunity to enhance maternal health and positively influence the dietary habits of the entire family. Primiparous women, in particular, represent a promising target population for nutritional education, as they typically show the most consistent positive changes in response to interventions (Olson, 2005).

1.4 EMPOWERMENT

Empowerment serves as a central theoretical framework guiding this research. Empowerment is a concept believed to have been developed by Brazilian educator Paulo Freire (Freire, 2000). Freire studied the oppressed position of illiterate poor people in his country and observed that many perceived their situation as an unchangeable fate, which led to reluctance to take action. He argued that change becomes possible by learning to distinguish between current and potential situations. For Freire, empowerment is not something given but something that arises within individuals. An empowered person initiates changes or actions that foster their growth and strength.

The concept of empowerment originated from the desire for the emancipation of socially disadvantaged individuals and groups. It represents the power of individuals to influence their life circumstances. Empowerment is increasingly recognised as a critical factor in improving health outcomes (Cyril et al., 2016; Prata et al., 2017). While empowerment has been defined in various ways, there is no uniform definition. Nutbeam (1998) defined empowerment in health promotion as the process through which people gain greater control over decisions and actions affecting their health. The empowerment model acknowledges that women's broader life contexts shape dietary behaviours. Sustainable change occurs when choices align with health goals and life circumstances, which require an environment that encourages open communication. Thereby, empowerment goes beyond traditional knowledge transfer, incorporating both external factors, such as facilitating choices and access to resources, and internal factors, including the belief in one's abilities and control over situations (Koelen & Lindström, 2005).

Empowerment can manifest at different levels (individual, community and organisational) and can be understood as both a process and an outcome. Individual empowerment, also known as psychological empowerment, involves a sense of control over one's life regarding personality, cognition and motivation (Koelen & Lindström, 2005). Community empowerment refers to processes through which individuals and organisations interact to improve community living and influence broader social systems (Cyril et al., 2016). Organisational empowerment involves organisations enabling individuals and groups to gain control, influence, and decision-making power over aspects of their work and well-being (Zimmerman, 2000). These levels of empowerment interact and influence each other (Kar et al., 1999). This thesis mainly focuses on individual empowerment, as it most applies to the interaction between pregnant women and healthcare professionals (HCPs).

The definition of empowerment by Tengland (2008) aligns well with this thesis, as the

studies repeatedly emphasise the capacity of individuals to make informed choices and take control of their lives. It highlights the importance of autonomy, shared decision-making, and active participation in health-related processes. See **Box 1.1** for the complete definition of empowerment by Tengland (2008).

“We achieve empowerment (in a combined sense) when a person (or group) A acts towards (in relation to) another person (or group) B in order to support B (by creating the opportunity and environment, and giving ‘expertise’ support) in gaining better control over (some of) the determinants (those relevant for the situation or profession) of her (quality of) life through (necessarily) an increase in B’s knowledge (self-knowledge, consciousness raising, skills development, or competence), or health (e.g., autonomy, self-confidence, self-efficacy, or self-esteem) or freedom (positive and negative), and this acting of A towards B involves minimising A’s own ‘power’ (or influence) over B with regard to goal/problem formulation, decision-making and acting, and B seizes (at least) some control over this situation or process (goal/problem formulation, decision-making and acting).”

BOX 1.1: EMPOWERMENT DEFINITION BY TENGLAND (2008)

EMPOWERMENT IN NUTRITION FOR PERINATAL CARE

In the context of pregnancy and nutrition, an empowerment approach fosters respectful partnerships between women and HCPs, where power is shared equally (Nieuwenhuijze & Leahy-Warren, 2019). This approach requires HCPs to shift from experts to facilitators, supporting pregnant women in identifying and working towards their own meaningful goals (Koelen & Lindström, 2005). Empowering pregnant women is expected to improve maternal and child health outcomes, as women are supported to make healthier nutritional choices (Lindqvist et al., 2017; Zinsser et al., 2020). With empowerment, especially for pregnant women with lower SES, adopting a healthy dietary pattern depends not just on the availability of services and their nutrition knowledge but also on their ability to decide on, act towards and sustain a healthy dietary intake (Portela & Santarelli, 2003). In addition, many factors influence food choices, e.g. perceptions regarding (un)healthy eating, self-efficacy and control beliefs, the social and physical environment, psychological factors (e.g. stress, anxiety and depression) and the often stressful or disempowering contexts in which they live, e.g. substance use/abuse, physically demanding work (Abu-Saad & Fraser, 2010; Fowles et al., 2011).

1.5 THEORETICAL FRAMEWORKS

The empowerment-based P4HP programme is grounded in three complementary theoretical frameworks: the wheel-shaped empowerment framework, the Behaviour Change Wheel (BCW), and the socioecological model. Each framework addresses different aspects of dietary behaviour change during pregnancy.

The wheel-shaped empowerment framework provides contextual relevance, drawing from research conducted among pregnant Dutch women. It offers practical guidance for HCPs in supporting pregnant women's nutritional choices (Super & Wagemakers, 2021). The BCW provides a systematic approach to understanding the factors influencing dietary choices, focusing on capability, opportunity, and motivation (Michie et al., 2011). Meanwhile, the socioecological model broadens the scope by examining multiple levels of influence, from individual factors to environmental constraints, thereby ensuring a comprehensive view of the complex determinants of diet quality (Beulen, Geelen, et al., 2020). These frameworks create an integrated theoretical foundation that views pregnant women as active agents within their broader social contexts. They also offer practical pathways for implementing dietary interventions in antenatal care settings.

EMPOWERMENT FRAMEWORK

An empowerment framework was developed by Super and Wagemakers (2021) based on their research amongst pregnant women with low SES in the Netherlands (**Figure 1.1**). The wheel-shaped empowerment framework shows the perspectives of pregnant women with low SES on food and eating in the inner circle, the opportunities for empowerment in the middle circle, and suggestions for HCPs to encourage pregnant women towards empowerment in the outer circle. The dotted lines in **Figure 1.1** indicate overlap and interaction between the different elements.

This empowerment framework by Super and Wagemakers (2021) was inspired by the Capability, Opportunity, and Motivation Behaviour (COM-B) model and BCW (Michie et al., 2011) (**Figure 1.2**). The BCW is an overarching model of behavioural change and features the COM-B model at its core. This model, also labelled as the source of behaviour, identifies three interacting conditions for behaviour change: capability (psychological knowledge and physical capacity), opportunity (external factors including physical resources and social support), and motivation (automatic habits/emotions and reflective planning processes). These three conditions interact to generate behaviour. The BCW extends beyond the COM-B model with two additional circles. The middle circle contains nine intervention functions that address capability, opportunity, or motivation deficits. The outer circle features seven policy categories that enable interventions. These components interact dynamically across all three circles.

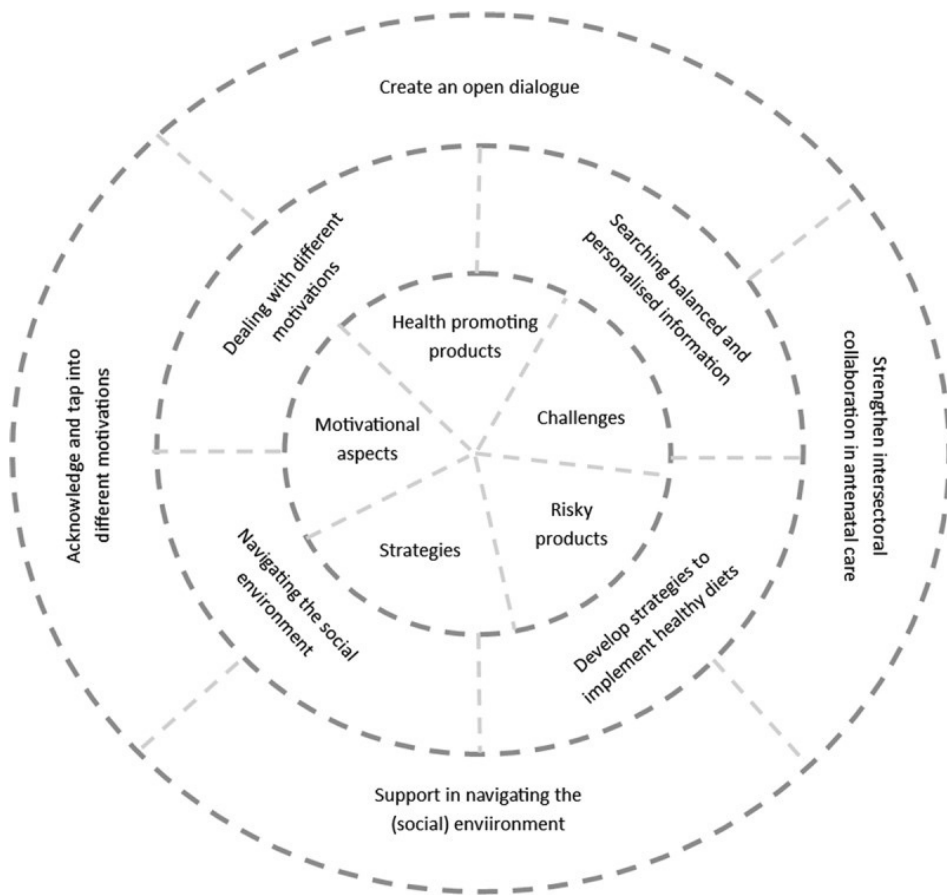


FIGURE 1.1: PERSPECTIVES OF LOW SES PREGNANT WOMEN ON FOOD AND EATING (INNER CIRCLE), OPPORTUNITIES FOR EMPOWERMENT (MIDDLE CIRCLE), AND SUGGESTIONS FOR EMPOWERMENT (OUTER CIRCLE) (SUPER & WAGEMAKERS, 2021).

SOCIO-ECOLOGICAL MODEL

The socio-ecological model offers a holistic framework that visualises how multiple levels of influence affect dietary intake (Bronfenbrenner, 1979; Fitzgerald & Spaccarotella, 2009; McLeroy et al., 1988). This model enables the categorisation of personal, cultural, and environmental factors that shape eating behaviours. **Figure 1.3** presents a socioecological model adapted by Beulen et al. (2020) to include factors influencing the diet quality of pregnant women.

The intrapersonal level encompasses individual characteristics, including psychosocial factors (knowledge, attitudes), biological factors (Body Mass Index), and behavioural preferences, including pregnancy-specific influences like food aversions. The

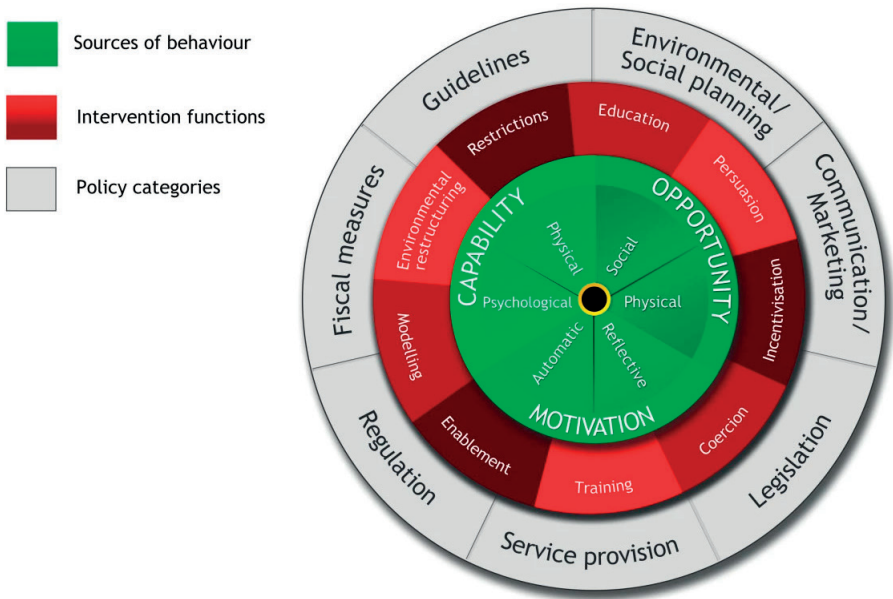


FIGURE 1.2: THE BEHAVIOUR CHANGE WHEEL (MICHIE ET AL. 2011)

interpersonal level involves the primary relationships surrounding an individual who can provide social support. The community/institutional level considers environmental factors, with socio-economic neighbourhood characteristics affecting food access and availability. Finally, the public policy level includes local and national policies that shape food access and availability.

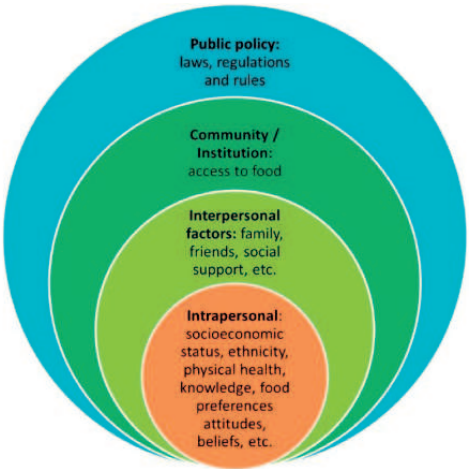


FIGURE 1.3: THE SOCIOECOLOGICAL MODEL, ADAPTED BY BEULEN ET AL. (2020) TO INCLUDE FACTORS INFLUENCING DIETARY INTAKE.

1.6 POWER 4 A HEALTHY PREGNANCY

A significant opportunity for improving the health of pregnant women, their babies and families is being missed. Therefore, this project aimed to improve the dietary intake of pregnant women by developing, implementing and evaluating a comprehensive strategy in close collaboration with pregnant women, their partners, midwives, and other professionals and experts.

The P4HP programme was developed through an iterative stakeholder collaboration process aimed at improving the diet quality of pregnant women through empowerment (Beulen, Geelen, et al., 2020; Van Lonkhuijzen et al., 2022). The programme's development involved extensive preliminary research and co-creation, including literature reviews, expert consultations, focus groups, and interviews with pregnant women from low socio-economic backgrounds, midwives, and dietitians. This was followed by pressure cooker sessions with stakeholders to ensure feasibility within Dutch prenatal care settings. The P4HP programme incorporates four additional consultations – three with midwives and one with a dietitian – facilitating in-depth nutritional discussions from an empowerment perspective (Van Lonkhuijzen et al., 2022). **Figure 1.4** presents a schematic overview of the P4HP programme, visualising three key elements: empowerment principles, implementation flexibility, and interprofessional collaboration.



FIGURE 1.4: OVERVIEW OF THE P4HP PROGRAMME

Central to the P4HP programme is its empowerment approach, shifting from traditional expert-driven care to facilitative partnerships where women analyse their situations and create solutions. Using Motivational Interviewing, HCPs recognise women as experts in their lives, enhancing motivation, self-efficacy, and personal control regarding healthy eating choices. Implementation flexibility is a key element. While the P4HP programme's core elements remain unchanged, its integration into existing care routines is adaptable by allowing HCPs to determine consultation timing that suits their practice routines. A visual conversation tool further supports this flexibility by enabling pregnant women to select which food groups to discuss, promoting commitment to personally meaningful dietary improvements. Finally, interprofessional collaboration between midwives and dietitians creates a comprehensive support system for pregnant women

where each professional contributes their unique expertise while maintaining a woman-centred approach. This holistic integration of empowerment, flexible implementation, and interprofessional care makes the P4HP programme uniquely positioned to achieve meaningful dietary improvements that could contribute to better health outcomes for mothers and future generations.

EXTENDING CARE BEYOND PREGNANCY

Although this thesis initially focused on pregnancy, it highlights the critical need for continuity of nutritional care into the postpartum period. The concept of a continuous care pathway emerged, acknowledging that nutritional needs do not end at delivery but evolve during the postpartum period. This period presents both challenges and opportunities for supporting women's dietary practices.

The principles that guide the P4HP programme – empowerment, interprofessional collaboration, and flexibility in implementation – remain highly relevant for postpartum nutritional support. The existing Dutch postpartum care structure offers potential entry points for integrating continued nutritional support. However, successful implementation would require adjustments to address the unique circumstances of the postpartum period. While this thesis primarily focuses on the development, implementation and evaluation of the P4HP programme, it also establishes a foundation for future research into providing seamless nutritional support throughout the entire perinatal period.

1.7 THIS THESIS

POSITIONING OF THIS THESIS

This thesis combines a biomedical and social-ecological perspective to better understand maternal nutrition during pregnancy. The biomedical perspective focuses on the physiological importance of the quality of the maternal diet, emphasising specific nutrient requirements and their impact on the health status of both the mother and foetus (Koletzko et al., 2019; Ramakrishnan et al., 2012). This approach has established strong links between maternal nutrition and various health outcomes, including gestational diabetes, pre-eclampsia, excessive gestational weight gain, and their long-term effects on foetal development and children's health (Langley-Evans et al., 2022). In contrast, the social-ecological perspective recognises that broader life circumstances shape dietary behaviours. It highlights the roles of social support, environmental factors, and individual empowerment in promoting dietary improvements during pregnancy (Super & Wagemakers, 2021). This perspective also recognises various barriers to healthy eating faced by pregnant women, particularly those from lower SES, including social, psychological, and environmental barriers (Grenier et al., 2021).

The integration of these perspectives offers a unique theoretical framework by which to consider maternal nutrition. While the biomedical perspective identifies what dietary changes are needed for optimal health outcomes, the social-ecological perspective identifies how these changes can be realistically implemented within women's complex lived experiences. This complementarity is particularly useful when studying empowerment-based interventions, as it allows us to connect physiological needs with the psychosocial processes that will enable women to meet those needs.

Methodologically, this thesis combines both the positivist and interpretivist paradigms. The positivist paradigm, typically associated with nutrition science, assumes that reality is objective and measurable. It aims to uncover universal laws through empirical observation and quantitative methods. This approach is important for understanding the concrete impacts of maternal nutrition on health outcomes and assessing interventions' effectiveness using standardised metrics. In contrast, the interpretivist paradigm recognises that reality is subjectively experienced and shaped through individual interpretation and social interaction. This perspective is essential for understanding how pregnant women experience dietary changes, interpret nutritional guidance, and engage with empowerment processes within their unique contexts.

With this integration of paradigms, this thesis addresses limitations inherent in either approach alone. Purely positivist approaches might detect statistical associations but cannot explain the mechanisms through which empowerment facilitates dietary changes. In contrast, interpretivist approaches can richly describe women's experiences and socially constructed aspects of dietary behaviours and empowerment, but are not likely to demonstrate a measurable impact on health. Our mixed-methods approach therefore employs quantitative methods to evaluate the measurable outcomes of the P4HP programme, while qualitative methods are used to explore the experiences of pregnant women, their partners, and HCPs. This work contributes to both nutrition science by incorporating dietary behaviour within social-ecological frameworks, and to social sciences by demonstrating how empowerment can achieve concrete health outcomes in antenatal care.

AIM AND SCOPE OF THIS THESIS

The overall aim of this thesis is to contribute to the improvement of dietary habits among pregnant and postpartum women. Initially, this work focused on evaluating the development, effectiveness and implementation of the empowerment-based P4HP programme, which aims to enhance diet quality in pregnant women through interprofessional collaboration between midwives and dietitians. However, as the research progressed, it became evident that adequate nutritional support extends beyond pregnancy, highlighting the need for a broader examination of the factors influencing dietary behaviour throughout the perinatal period. Thus, the central research objective of this thesis is to develop, implement, and evaluate an empowerment-based approach to improve diet quality among pregnant women, while also examining the factors needed to extend nutritional support across the entire perinatal continuum.

The central research question is: How can an empowerment-based approach improve diet quality among pregnant women, and what factors are essential for extending adequate nutritional support from pregnancy into the postpartum period?

The chapters examine these objectives from multiple angles:

- Testing the effectiveness of the P4HP programme on improving diet quality during pregnancy through a cluster randomised controlled trial (Chapters 2 and 3)
- Understanding pregnant women's experiences with and perceptions of the P4HP programme (Chapter 4)
- Evaluating HCPs' (midwives and dietitians) experiences with implementing the P4HP programme (Chapter 5)
- Documenting the development process of the P4HP programme (Chapter 6)
- Exploring additional factors that influence maternal dietary behaviour, specifically:
 - The role of partners in supporting pregnant women's dietary choices (Chapter 7)
 - Needs, current practices and opportunities in postpartum nutritional counselling among postpartum women, parents, and HCPs (Chapters 8 and 9)

These expanded avenues of inquiry, particularly the focus on partner support and postpartum nutrition, represent initial steps toward establishing a continuous care pathway from pregnancy through postpartum, addressing a significant gap in maternal nutritional support. This broader perspective acknowledges that effective dietary interventions must consider the pregnancy period itself as well as the transition to parenthood and the supporting role of the social environment.

This dissertation employs a mixed-methods research design, combining quantitative and qualitative approaches (**Table 1.1**). The main reason for using a mixed methods approach is that it provides a more comprehensive and holistic overview of diet quality during pregnancy (Creswell & Clark, 2017). Additionally, mixed methods provide more substantial evidence through the convergence of results, offering insights that may be overlooked when using only one approach. Thus, this design helps answer questions that cannot be fully addressed by either quantitative or qualitative methods alone.

OUTLINE OF THIS THESIS

Chapter 2 outlines the study protocol of the (quantitative) effect evaluation and the (quantitative and qualitative) process evaluations of the P4HP programme. **Chapter 3** describes the effect evaluation of the P4HP programme on diet quality, empowerment, sense of coherence (SOC), quality of life (QOL) and self-rated health (SRH) through a cluster randomised controlled trial (C-RCT). **Chapter 4** qualitatively examines the experiences of pregnant women who participated in the P4HP programme. **Chapter 5** combines quantitative and qualitative investigations to evaluate the implementation of the P4HP programme among midwives and dietitians. **Chapter 6** takes a reflective approach to describe the participatory developmental process of the P4HP programme. In **Chapter 7**, the partner's role in supporting the healthy diet of pregnant women is explored qualitatively through the perspectives of both pregnant women and their partners. **Chapter 8** examines current practices in postpartum nutritional counselling by HCPs using a qualitative investigation. **Chapter 9** describes preconditions for an empowerment strategy to improve diet quality among parents in the first year postpartum. Finally, **Chapter 10** synthesises findings from previous chapters, examining the P4HP programme through five lenses: effectiveness, empowerment theory, stakeholder collaboration, social contexts of dietary choices, and the future of health promotion in an era of data and personalisation. The chapter evaluates methodological considerations and provides evidence-based recommendations for Dutch antenatal care and policy to enhance nutritional support during pregnancy.

TABLE 1.1: OVERVIEW OF CHAPTERS, RESEARCH QUESTIONS, AND METHODS

Chapter	Research question	Methods
2	What is the effectiveness of the P4HP programme regarding diet quality, empowerment, SOC, QOL, and SRH, and how is the programme evaluated in terms of multidisciplinary collaboration, facilitators, and barriers?	Mixed methods: protocol design and methodological framework
3	What are the outcomes of participation in the P4HP programme, primarily in terms of diet quality and empowerment, and secondarily in terms of SRH, QOL, and SOC?	Quantitative: questionnaires
4	What are the reported changes in diet quality among pregnant women, the factors influencing these changes, and pregnant women's perceptions of the P4HP programme?	Qualitative: semi-structured interviews
5	How is the implementation of the P4HP programme evaluated by midwives and dietitians in terms of impact, interprofessional collaboration, facilitators and barriers?	Mixed methods: questionnaires, semi-structured (group) interviews
6	How was the P4HP programme, aiming to improve the diet quality of pregnant women, developed through participatory methods within the Dutch antenatal care system?	Qualitative: Documentation and reflection
7	What are the perspectives of Dutch pregnant women and their partners on the role of the partner in supporting the healthy diet of pregnant women?	Qualitative: semi-structured couple interviews
8	What are current nutritional counselling practices by HCPs for postpartum women, and what are HCPs' perspectives on digital nutritional counselling during this period?	Qualitative: semi-structured interviews
9	What are the preconditions for an empowerment strategy to improve diet quality among parents in the first year postpartum?	Qualitative: semi-structured interviews



Chapter 2

EVALUATING 'POWER 4 A HEALTHY PREGNANCY' (P4HP)

PROTOCOL FOR A CLUSTER RANDOMISED CONTROLLED TRIAL
AND PROCESS EVALUATION TO EMPOWER PREGNANT
WOMEN TOWARDS IMPROVED DIET QUALITY

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ABSTRACT

Background: In general during pregnancy, women are aware of the importance of good diet quality, interested in nutrition, and receptive to changing dietary intake. However, adherence to dietary guidelines is sub-optimal. A pregnant woman's first information source regarding nutrition information is her midwife. Healthy nutrition promotion by midwives may therefore be very promising, but midwives face multiple barriers in providing nutritional support. Empowering pregnant women to improve their diet quality is expected to improve their health. Therefore, an empowerment intervention has been developed to improve diet quality among pregnant women. The objective of this study is to evaluate the effectiveness and feasibility of Power 4 a Healthy Pregnancy (P4HP). P4HP aims to empower pregnant women to have a healthier diet quality.

Methods/design: This study applies a mixed methodology consisting of a non-blinded cluster randomised trial with an intervention (P4HP) group and a control group and a process evaluation. Midwifery practices, the clusters, will be randomly allocated to the intervention arm (n=7) and control arm (n=7). Participating women are placed in intervention or control conditions based on their midwifery practice. Each midwifery practice includes 25 pregnant women, making 350 participants in total. Health-related outcomes, diet quality, empowerment, Sense of Coherence, Quality of Life, and Self-Rated Health of participants will be assessed before (T0) and after (T1) the intervention. The process evaluation focuses on multidisciplinary collaboration, facilitators, and barriers, and consists of in-depth interviews with midwives, dietitians and pregnant women.

Discussion: This study is the first to evaluate an empowerment intervention to improve diet quality in this target population. This mixed method evaluation will contribute to knowledge about the effectiveness and feasibility regarding diet quality, empowerment, health-related outcomes, multidisciplinary collaboration, facilitators and barriers of the empowerment intervention P4HP. Results will help inform how to empower pregnant women to achieve improved diet quality by midwives and dietitians. If proven effective, P4HP has the potential to be implemented nationally and scaled up to a long-term trajectory from preconception to the postnatal phase.

Trial registration: The trial is prospectively registered at the Netherlands Trial Register (NL9551). Date registered: 19/05/2021.

2.1 BACKGROUND

A healthy diet is important for everyone, but crucial during pregnancy for the health of both mother and child (Harding, 2001; Henriksen, 2006; Lucas et al., 2014; Ramakrishnan et al., 2012; Stang & Huffman, 2016). During pregnancy, women are aware of the importance of a good diet quality and are interested in nutrition (Garnweidner et al., 2013; Szwajcer et al., 2005). However, adherence to dietary guidelines and recommendations is sub-optimal, especially among pregnant women with lower socioeconomic status (SES) (Baron et al., 2015; Geurts & Rossum, 2014; Malek et al., 2015), and specifically for the intake of fruit, vegetables, grains, folate, and iron (Hure et al., 2009; Mei et al., 2011; Pinto et al., 2009; Rifas-Shiman et al., 2009; Watts et al., 2007). Poor diet quality by the mother is associated with adverse health outcomes, including increased risk of pre-eclampsia, gestational diabetes, and excessive gestational weight gain. For the unborn, a poor diet of the mother is related to adverse birth outcomes, including premature birth and low birth weight, as well as disadvantageous health outcomes later in life, such as the increased risk of developing chronic diseases (Harding, 2001; Henriksen, 2006; Ramakrishnan et al., 2012). However, due to several challenges, such as nausea, cravings, and ingrained habits, pregnant women experience difficulties with the implementation of dietary changes and sustaining these changes during their pregnancy (Blumfield et al., 2012; Malek et al., 2015). On top of that, the diet quality of pregnant women is challenged by aspects such as the costs of living and their physical and social environments.

Pregnancy is often regarded as a critical transition, a teachable moment, in which women are more receptive to changing dietary patterns than in other phases in life (Edvardsson et al., 2011; Garnweidner et al., 2013; Olson, 2005; Stothard et al., 2009; Szwajcer et al., 2005). Pregnancy might increase awareness regarding diet since women generally feel that one of the few things to positively impact the health of their child is to make dietary improvements (Szwajcer et al., 2007). A pregnant woman's first, most important, and most trusted information source regarding nutrition information is their midwife (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; Bookari et al., 2017; Garnweidner et al., 2013; Lindqvist et al., 2017; Szwajcer et al., 2005; WHO, 2016). Also, midwives feel responsible to inform pregnant women about a healthy diet (Beulen et al., 2021). Compared to other countries, midwives in the Netherlands play a relatively large and central role in maternity care. Healthy nutrition promotion by midwives is therefore promising to make use of this window of opportunity where women are increasingly aware of their behaviours for their health and their child's health (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; Lindqvist et al., 2017; Szwajcer et al., 2012). However, although midwives feel the responsibility to provide nutritional advice, they do not consider themselves nutritional experts and encounter structural

barriers in providing nutrition communication (Arrish et al., 2017; Beulen et al., 2021; Lucas et al., 2014; McCann et al., 2018; Schmied et al., 2011). Some of the main barriers for midwives are time constraints and unsupportive health systems (e.g. a lack of cooperation with other health professionals) (Aquino et al., 2016; Arrish et al., 2017; Lucas et al., 2014; Psaila et al., 2014; Watson et al., 2015), as well as limited relevant and reliable resources and training (Arrish et al., 2014, 2016, 2017; Lucas et al., 2014; McCann et al., 2018). As a result, nutrition communication in antenatal care generally remains suboptimal. Currently, only Dutch women with pregnancy complications, overweight/obesity, or excessive gestational weight gain, or those who asked for it themselves receive comprehensive guidance regarding their nutrition during pregnancy (Baron, Martin, et al., 2017; Beulen et al., 2021; Szwajcer et al., 2009).

The modern concept of empowerment is increasingly defined as strengthening the capabilities and the self-reliance of individuals (Driessens et al., 2010). We use Aubel's definition, which describes empowerment as 'the ability of individuals or groups to improve capacities, to critically analyse situations and to take actions to improve those situations' (Aubel, 2001). This definition applies bottom-up thinking to drive behaviour change (Heyden et al., 2017; Njøs & Fosse, 2018; Super & Wagemakers, 2021), requiring an environment in which pregnant women can engage in open communication (Heyden et al., 2017). The process of empowering pregnant women is expected to improve their health, as they are supported to make healthier choices, for example in terms of nutrition (Garnweidner et al., 2013; Lindqvist et al., 2017). This can therefore result in improved child health and provide children with a healthy and successful start to life (Henriksen, 2006; Ramakrishnan et al., 2012).

P4HP has been developed in the past years together with stakeholders, aiming to empower pregnant women to have a healthier diet quality (Beulen, Geelen, et al., 2020; Beulen, Super, et al., 2020; Super et al., 2019; Super & Wagemakers, 2021). This intervention may contribute to enduring newborns with a healthy, successful start of life (Henriksen, 2006; Ramakrishnan et al., 2012) and has the potential to improve health across generations. P4HP uses a women-centred empowerment approach, to prioritise the woman's individual needs, as defined by the woman herself, assigning to the woman's choice, control, and continuity of care. P4HP allows women to be empowered, gaining control over their lives and learning how to achieve goals that are meaningful to them. Individuals are most likely to change their behaviour to make healthier choices when they are educated and motivated to do so, in addition to environments and policies supporting these decisions (Sallis & Owen, 2015).

A similar intervention in which empowerment and diet quality among pregnant women is central has not been implemented before to our best knowledge. The research will

contribute to theoretical development by providing practice-based evidence (Cyril et al., 2016; Vaandrager et al., 2010). This mixed methods study aims to 1) evaluate the effectiveness of P4HP regarding diet quality, empowerment, Sense of Coherence (SOC), Quality of Life (QOL), and Self-Rated Health (SRH) using a cluster randomised controlled trial (C-RCT), and 2) evaluate P4HP in terms of multidisciplinary collaboration, facilitators and barriers using a process evaluation. This way, as we retrieve both information about what is needed to achieve an effect and about what is needed in the implementation and in the multisectoral collaboration, we gain insight in both the effectiveness as well as the feasibility of P4HP.

Research in the area of empowerment towards dietary intake in pregnancy is sparse (Bookari et al., 2017; Brandstetter et al., 2015). Still, empowerment has been linked to diet quality, although mostly in global south (Kruse, 2019; Misgina et al., 2021; Onah et al., 2021; Sraboni & Quisumbing, 2018). Additional to empowerment and diet quality, health outcomes are included, as empowerment has been previously linked to the concepts QOL (Bravo et al., 2015; Moattari et al., 2012), SOC (Koelen & Lindström, 2005; Super et al., 2016), and SRH (Kim et al., 2012; Rohrer et al., 2008). Also diet quality has been linked to the concepts QOL (McNaughton et al., 2012; Milte et al., 2015), SOC (Kye et al., 2012; Lindmark et al., 2005), and SRH (Collins et al., 2008; Goodwin et al., 2006). We hypothesise that empowerment, improved diet quality, and the health outcomes QOL, SOC and SRH will have a mutually reinforcing, invigorative effect on each other (**Figure 2.1**).

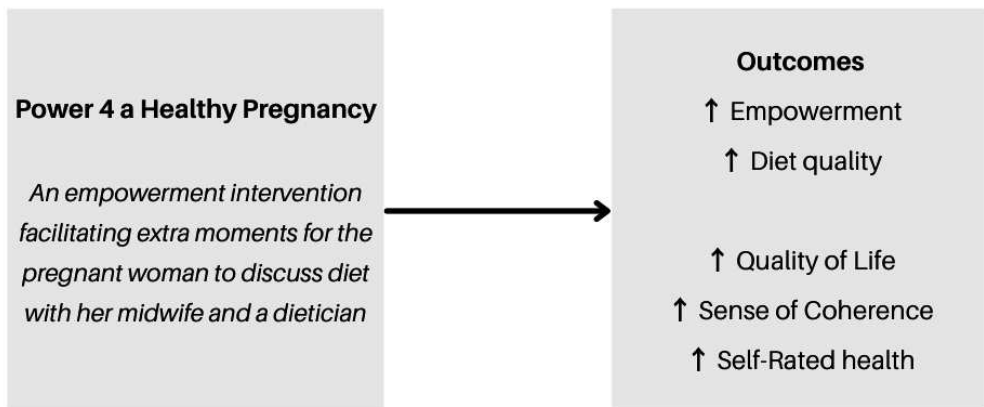


FIGURE 2.1: OVERVIEW OF HYPOTHESIS P4HP

2.2 METHODS

STUDY DESIGN

This mixed methods study consists of a non-blinded C-RCT with an intervention (P4HP) group and a control group and a process evaluation. A qualitative process evaluation will take place to evaluate P4HP by midwives and dietitians in terms of multidisciplinary collaboration, facilitators, and barriers.

A pilot study has launched on October 1st, 2021, with the aim to reach a total of 10 participants from two midwifery practices within 2 months. In this pilot study we pre-test the questionnaires, the perceptions of the P4HP intervention, and the practical and technical matters regarding implementation, including the organisation of multidisciplinary collaboration. Any suggestions by the midwives, dietitians, and pregnant women will be duly accommodated to improve the feasibility.

NON-BLINDED C-RCT

The non-blinded C-RCT will evaluate the effectiveness of P4HP on pregnant women's empowerment, diet quality, and health outcomes between intervention and control practices. Figure 2.2 details the flow of participants from recruitment of midwifery practices until the last follow-up contact for intervention and control participants. The clusters are midwifery practices in the Netherlands and the participants are Dutch-speaking pregnant women visiting the practice. Cluster randomisation is applied to eliminate the risk of cross-contamination between the two study arms. Thus, whether pregnant women are placed in the intervention or the control group is based on whether receiving care from intervention or control midwifery practices. Due to the nature of the intervention, it is not possible to blind the professionals, participants, or investigators to the study conditions. This protocol has been written according to the recommendations of the Standard Protocol Items Recommendations for Interventional Trials (SPIRIT) 2013 statement (Chan, Tetzlaff, Altman, et al., 2013; Chan, Tetzlaff, Gøtzsche, et al., 2013). SPIRIT guides key content to facilitate the drafting of high-quality protocols, including recommendations for intervention trials.

CLUSTER AND PARTICIPANT RECRUITMENT

Midwifery practices in the Netherlands will be recruited by using existing connections, snowballing, social media, and presentations of the study at local collaborations of midwifery practices. Midwifery practices are randomised as clusters to either an intervention arm or standard birth care. Clusters will be randomised by a researcher, who is unfamiliar with the midwifery practices, using a randomisation scheme in Excel.

Eligible pregnant women will be recruited in randomised midwifery practices (clusters)

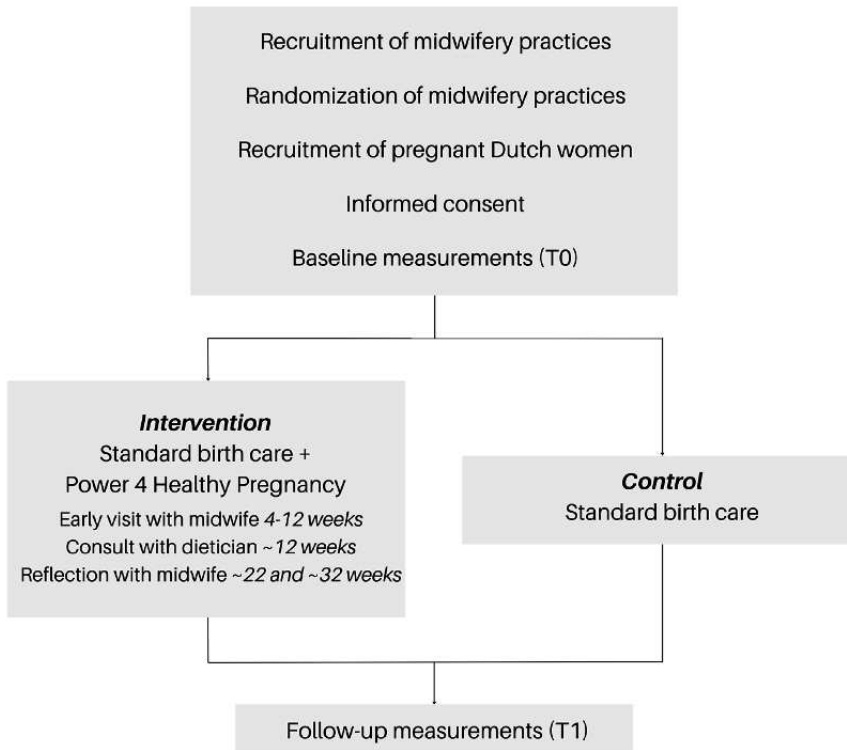


FIGURE 2.2: FLOW DIAGRAM OF THE PARTICIPANTS THROUGH THE TRIAL

in the Netherlands using a purposive sampling technique. Midwives will be informed by the research team about the in- and exclusion criteria. Midwives will explore whether or not the pregnant women meet the inclusion criteria and explain to them the purpose of the study. The women will be invited to participate voluntarily. To be eligible to participate in this study, a participant must meet all of the following criteria: being in the first trimester of pregnancy; >18 years of age; understanding and speaking Dutch; consuming a Dutch diet pattern i.e. a diet with a maximum of one hot meal per day. A potential participant who meets any of the following criteria will be excluded from participation: not willing to provide informed consent; having a severe chronic illness/condition (for example cancer); having conditions that may affect diet quality. The recruitment of participants will begin on 01-01-2022 and will end when all 14 midwifery practices have met their target of 25 women. Alternatively, the recruitment will end on 31-12-2022.

SAMPLE SIZE ESTIMATION

The sample size estimation is based on the design of a C-RCT (Hemming et al., 2017) using the Group-or Cluster-Randomised Trials sample size calculator from the National

Institutes of Health (*Research Methods Resources*, n.d.), where each cluster represents a midwifery practice. The results indicate that to detect an effect size of 0.4 (small to medium) (Cohen, 1988) with a power of 80%, an alpha of 0.05, and an intra-cluster correlation coefficient of 0.02, each arm should include 7 clusters of 25 participants each. The assumption of an intra-cluster correlation coefficient of 0.02 is based on our experience with the SLIMMER project, a cluster randomised trial of a combined lifestyle intervention including behaviour change in diet and physical activity on overweight and risk of diabetes (Duijzer et al., 2017). We strive to keep the number of participating pregnant women per cluster as similar as possible. Based on the sensitivity analysis for this sample size estimation (*Research Methods Resources*, n.d.), we estimate that 25 participants from 7 intervention and 7 control clusters – leading to 350 participants in total – will be sufficient to detect the relevant difference between groups. The Netherlands had 168.066 births in the year 2020 (Statistiek, n.d.). 350 participants represent <0.25% of pregnancies in the Netherlands, and therefore expected to be achievable.

DATA COLLECTION AND ASSESSMENTS

At enrolment, participants will give their informed consent through consent forms. Subsequently, participants will be provided with two online quantitative questionnaires to fill out, utilising baseline data for the study (T0). Upon completion of P4HP, participants are provided the same two online quantitative questionnaires (minus sociodemographic data) to respond to the post-intervention assessment (T1) (**Figure 2.3**). The first questionnaire assesses diet quality (Looman et al., 2017). The term diet quality has been used in recent decades to evaluate the dietary habits or patterns of a population and the efficacy of dietary interventions (Alkerwi, 2014; Drewnowski et al., 1996; Patterson et al., 1994). Diet quality is a suitable term to present multiple food components, assessed using an index to evaluate the extent of adherence to dietary guidelines. The second questionnaire includes all other assessments and is distributed using Qualtrics. Access to all data collection tools and databases is strictly limited and regulated through personal user profiles. Both platforms are password-protected and all data will be regularly backed up into a password-protected database.

Sociodemographic data: Questions to collect name, year of birth, phone number, email, postal code digits, living situation, ethnicity, educational level, and personal and household income.

BMI: Two questions to collect height and body weight.

Diet quality: We derive scores for diet quality using Eetscore (Rijk et al., 2021). Eetscore is a validated web-based screening tool to determine the diet quality of Dutch adults and suitable for assessing change in diet quality over time. Eetscore consists of a short

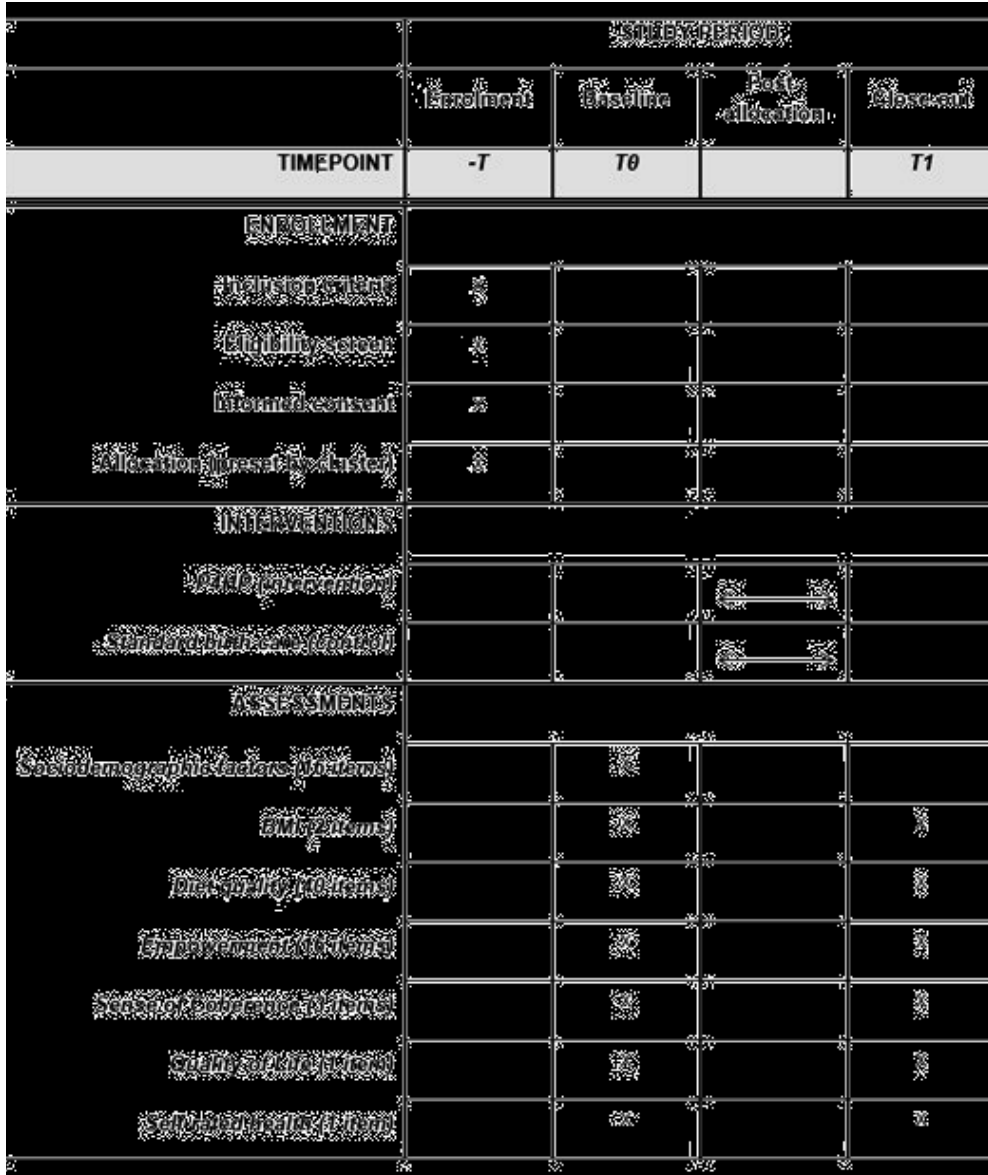


FIGURE 2.3: P4HP C-CRT SPIRIT DIAGRAM

food frequency questionnaire in an accessible writing style that is scored with the Dutch Healthy Diet index 2015 (DHD2015-index) to assess adherence to the Dutch food based dietary guidelines of 2015 of the Dutch health Council (Looman et al., 2017). The DHD2015-index has been validated with 24h dietary recall and FFQ data. In addition, to the DHD2015-index, a 16th component for unhealthy choices has been added. The questionnaire to determine this diet quality score consists of 40 questions

with sub-questions inquiring about the consumption of 54 foods or food groups. Based on the answers a total score and 16 sub scores will be calculated. Sub scores of Eetscore are available for 1) vegetables, 2) fruit, 3) whole grain products, 4) legumes, 5) nuts, 6) dairy, 7) fish, 8) tea, 9) fats and oils, 10) coffee, 11) red meat, 12) processed meat, 13) sugar-containing beverages, 14) alcohol, 15) sodium and 16) unhealthy choices. Each component will be scored on a scale ranging from 0 (non-adherence) to 10 (complete adherence), providing a total score between 0 and 160. For the calculation of the scores, specific cut-off and threshold values are used. Since Eetscore is developed for the general Dutch adult population, it has been adapted to fit the requirements of pregnant women. The (sub)scores were adapted based on the dietary recommendations for pregnant women provided by the Dutch Health Council and the Netherlands Nutrition Centre (Health Council of the Netherlands, 2021). We use the web-based version of Eetscore which can be filled out in about 10-15 minutes.

Empowerment: Empowerment will be assessed using the Pregnancy-Related Empowerment Scale (PRES). This is a valid and reliable assessment containing 16 questions on women's health-related empowerment during pregnancy (Klima et al., 2015).

SOC: We derive SOC scores from the three-item SOC questionnaire (SOC-3) (Eriksson, 2005; Lundberg & Peck, 1995). This validated questionnaire includes three questions; all corresponding to the three components of SOC: comprehensibility ("Do you usually feel that the things that happen to you in your daily life are hard to understand?"), manageability ("Do you usually see solutions to problems and difficulties that other people find hopeless?"), and meaningfulness ("Do you usually feel that your daily life is a source of personal satisfaction?") (Eriksson, 2005; G  n  reux et al., 2020; Lundberg & Peck, 1995; Olsson et al., 2009). Participants can indicate their answer as 1 (yes, usually), 2 (yes, sometimes), or 3 (no). The sum of these three items (after reverse coding of the comprehensibility item) reflects the total SOC, with higher scores indicating a weaker SOC. Participants are divided into three SOC groups: weak (scores 6–9), intermediate (scores 4–5), and strong (score 3) - in line with previous studies (Lindfors et al., 2005; Lundberg & Peck, 1995; Super et al., 2014). We use a Dutch version of the SOC-3, a short version of the original to alternatively measure change, as previously used by Herens (Herens et al., 2016; Super et al., 2014; Thompson et al., 2021). SOC can be influenced by interventions and has been previously linked to the concept of empowerment (Koelen & Lindstr  m, 2005; Super et al., 2016).

QOL: We derive a score for global QOL using a Visual Analogue Scale (VAS): a horizontal line of 100 mm, with stops ("anchors") at both extremes – 0 (worst imaginable QOL) to 100 (perfect QOL) – representing the limits of self-rated QOL. A QOL VAS is a

frequently used single-item technique with good to excellent levels of reliability, validity, and sensitivity (Bowling, 2005; De Boer et al., 2004; Fayers & Hand, 2002).

SRH: We derive a score for SRH using a General Self-Rated Health (GSRH) question. Asking people to rate their health in surveys provides an easily assessed, common indicator of health (Daniilidou et al., 2010; DeSalvo et al., 2006, 2009; FORUM, 2020; Schnittker & Bacak, 2014). Respondents are asked to rate their health, in general, as 'excellent', 'very good', 'good', 'fair' or 'poor'.

PROCESS EVALUATION

To perform a process evaluation, P4HP will be evaluated in terms of multidisciplinary collaboration, facilitators, and barriers by in-depth interviews with a purposeful sample of midwives, dietitians and pregnant women involved in the C-RCT. Semi-structured interview guides will be prepared for each of the interviews with midwives, dietitians, and pregnant women. 10-15 interviews will be performed with each of the three groups, depending on data saturation, and performed at T1.

INTERVENTION

P4HP is a non-invasive empowerment intervention and consists of four extra moments for pregnant women to discuss nutrition with their midwife and a dietitian. P4HP distinguishes itself from standard birth care by its empowering approach towards improving diet quality during pregnancy. The intervention is free of charge for the women and takes place in an individual or group setting (via CenteringPregnancy). P4HP is designed to be flexible, meaning that the professional has the freedom to adapt to what the individual or group needs at each session. This research is in line with current Dutch policy regarding empowerment, dietary guidelines, and prevention (Boumans, 2012; Ministerie van Sociale Zaken en Werkgelegenheid, 2018; Ministerie van Volksgezondheid, Welzijn en Sport, 2018; Voedingscentrum, n.d.-a).

Table 2.1 provides an overview of the P4HP-elements. For each element of the intervention, it explains the goal(s), the activity, the estimated time that is needed for the activity, and the tools as well as who guides the activity. The exact time investment per session topic will be discussed with and adapted to the possibilities of the midwives and dietitians.

The financial compensation for the invested time by midwives and dietitians will be reimbursed. Participating women will not have additional costs as compared to standard birth care.

TABLE 2.1: OVERVIEW OF THE P4HP-INTERVENTION

Session	Time	Goal(s)	Activities	Tool
1. Early nutritional information with midwife (4-10 weeks of participants' pregnancy)				
Individual setting	15 min	<ul style="list-style-type: none"> - Gain insight into perspectives of the women towards nutrition and create a sense of urgency for healthy nutrition during pregnancy - Identify aspects that go well regarding nutrition and define at least one achievable step the woman is willing to work on - Create a positive attitude towards nutritional changes - Understand the complexity of each woman's situation regarding healthy nutrition 	First interview on nutrition	Visual aid to guide the interview and write down action points Motivational Interviewing
2. Appointment with dietitian (~12 weeks of participants' pregnancy)				
A) Individual setting	30-45 min	<ul style="list-style-type: none"> - Support women in developing strategies to cope with individual challenges - Provide more in-depth information 	Discuss challenges in healthy nutrition based on the woman's individual needs	Visual aid to guide the interview and write down action points
B) Group setting	60 min	<ul style="list-style-type: none"> - Support women in developing strategies to cope with individual challenges - Provide more in-depth information - Peer support and learn from each other's questions and experiences 	Workshop with group discussions on challenges in healthy nutrition based on the women's individual needs Use each other's experiences to find individual coping mechanisms	Visual aid to guide the interview and write down action points

3. Reflection moments with midwife (~22 and ~32 weeks of participants' pregnancy)

A) Individual setting	15 min	- Increase awareness of the connection between the women's actions and results on diet quality	Facilitate women's reflection on their nutrition and the efforts they made in the last weeks
		- Increase abilities to identify actionable and achievable goals that lead to improved diet quality	Identify next steps for improvement, if achievable at that moment
B) Group setting	30 min	- Increase awareness of the connection between the women's actions and results on healthy nutrition	Facilitate women's reflection on their nutrition and the efforts they made in the last weeks
		- Increase abilities to identify actionable and achievable goals that lead to improved diet quality	Identify next steps for improvement, if achievable at that moment
		- Peer support and learn from each other's questions and experiences	moment

CONTROL

Midwifery practices in control clusters will provide participating women with standard birth care (according to the present Dutch birth care standards (Expertgroep Zorgstandaard Integrale Geboortezorg, 2016)) and the usual information on nutrition during pregnancy. There is no standard protocol for nutrition communication in antenatal care, so the amount of time and content can vary between the control practices. It is common practice to dedicate a small amount of time (2-10 minutes) to the discussion of nutrition at the first consultation, focusing on foods that cannot be safely consumed during pregnancy. In standard birth care, pregnant women may be referred to organisations such as the Netherlands Nutrition Centre for questions, nutritional guidelines, or advice. Frequently used tools such as the app ZwangerHap (*Zwangerschap App: ZwangerHap | Voedingscentrum*, n.d.) are likely used by pregnant women in the control group. In addition, the newest dietary guidelines for pregnant women of the Dutch Health Council are freely available for health professionals and pregnant women. Being part of the control group in no way limits the use of such nutritional resources, as they are part of standard birth care. Outcome measures will be obtained in the same way for participants in the control clusters as for those in

intervention clusters at baseline (T0) and follow-up (T1).

ETHICAL CONSIDERATION

Ethics approval was given by Medical Research Ethics Committee Utrecht, the Netherlands on September 21st 2021. The committee thereby declares that the proposal satisfactorily deals with ethical issues and that it complies with the Netherlands Code of Conduct for Scientific Practice. Because of negligible risk for participants, the MREC Utrecht has granted this study exemption from the obligation to the insurance that covers damage caused by the research through injury of the participant. Therefore, adverse events are currently not foreseen, due to the nature of the study and intervention. Informed consent will be obtained from each participant, after the purpose and possible consequences of the study have been explained. This study will be conducted according to the principles of the Declaration of Helsinki (October 2013) and according to the Medical Research Involving Human Subjects Act (WMO).

Participation in the study is voluntary and participants can leave the study at any time for any reason if they wish to do so without any consequences. They are asked to inform either the principal investigator or intervention deliverer (midwife or dietitian) about their decision. Participants are not obliged to inform the researchers about their reason to withdraw. The investigator can decide to withdraw a participant from the study for urgent medical reasons, such as having a miscarriage or a pregnancy with extreme complications. The reason for withdrawal reason will be kept for the record for further study. Since P4HP is possibly delivered in a group format, there will be no replacement of individual participants after withdrawal.

DATA ANALYSES

QUANTITATIVE ANALYSES C-RCT

Statistical analyses will be carried out using IBM SPSS Version 25 (Statistical Package for Social Sciences). Data cleaning will be performed before the final review to check for missing data or outliers. We expect data missing will be at random, and if so, all available data from T0 and T1 will be used to conduct the analyses.

All data will be quantitatively presented in tables (**Tables 2.2 and 2.3**). BMI, the DHD2015-index, PRES score, SoC-3 score, QOL VAS score, and GSRH-score will be presented as ordinal data. Ethnicity, education, and living situation will be presented as nominal data. All data will be entered and verified, and scores will be calculated for multiple-item instruments (i.e. DHD2015-index, PRES, SoC-3). Descriptive statistics will be performed to tabulate mean (or median) values of all study characteristics and baseline values of the independent variables. Chi-square (for categorical variables) and Student's t-tests (for continuous variables) will be used to compare the descriptive

statistics between study groups and to identify potential covariates. The number of participants, as well as means (standard deviations, SDs), median or % (numbers of patients), will be tabulated where appropriate.

TABLE 2.2: BASELINE CHARACTERISTICS FOR INTERVENTION AND CONTROL GROUP

	Intervention group (P4HP)	Control group (standard birth care)	Difference in means (95% CI)	P-value
	Mean (SD)	Mean (SD)		
<i>Age</i>				
	% (n)	% (n)		
<i>Ethnicity (% native Dutch)</i>				
<i>Education (low, medium, high)</i>				
<i>Living situation (alone, with a partner, with children, with partner and children)</i>				
	Mean (SD)	Mean (SD)		
<i>BMI</i>				
<i>Diet quality (DHD2015-index)</i>				
<i>Empowerment (PRES)</i>				
<i>Sense of Coherence (SOC-3)</i>				
<i>Quality of Life (QOL VAS)</i>				
<i>Self-Rated Health (GSRH)</i>				

Linear mixed models will be used to analyse the data. Using linear mixed models allows for the analysis of different sources of variation in data and for unequal variances and correlations. This flexible method is suitable for analysis of the clustered data as it allows to calculate the treatment effect. When there are multiple levels, such as pregnant women seen by the same midwifery practice, the variability in the outcome can be thought of as either within-group or between-group. Pregnant women-level observations are not independent, as within a midwifery practice pregnant women and their guidance are more similar. Units samples at the highest level (in our research, midwifery practices) are regarded as independent. With this method also confounders can be taken into account (Poelman, n.d.). After performing the linear mixed models analysis, the final results will be presented in **Table 2.3**. This table will display means and standard errors, the between-group differences, and the p-values for the treatment effect for all primary and secondary outcomes.

All primary and secondary outcomes will be tested via linear mixed models. Other subgroup analyses include age, ethnicity, individual or group (CenteringPregnancy) consultation, educational level, living situation, working situation, and income level. These variables will be checked if they differ across the groups using an independent Student’s t-test when continuous and normally distributed. If skewed, a Wilcoxon signed-rank test will be done. Variables that are not continuous, will be checked for differences between groups using a chi-square test. Two-sided p values <0.05 will be regarded as statistically significant.

TABLE 2.3: BASELINE, POST-INTERVENTION, AND CHANGE SCORES FOR INTERVENTION AND CONTROL GROUP

	T0 (<i>M, SD</i>)	T1 (<i>M, SD</i>)	Change T1 (<i>change ±SE</i>)	Effect estimate (<i>95% CI</i>)	Group differences (<i>P-value</i>)
BMI					
<i>(kg/m2)</i>					
Intervention (n=)					
Control (n=)					
Effect size					
Diet quality (<i>DHD2015-index</i>)					
Intervention (n=)					
Control (n=)					
Effect size					
Empowerment (<i>PRES</i>)					
Intervention (n=)					
Control (n=)					
Effect size					
Sense of Coherence (<i>SOC-3</i>)					
Intervention (n=)					
Control (n=)					
Effect size					
Quality of Life (<i>QOL VAS</i>)					
Intervention (n=)					
Control (n=)					
Effect size					
Self-Rated Health (<i>GSRH</i>)					
Intervention (n=)					
Control (n=)					
Effect size					

QUALITATIVE ANALYSES PROCESS EVALUATION

Stakeholder interviews will be recorded, transcribed verbatim, and analysed in Atlas.ti using inductive coding to derive themes, theories, or concepts from the raw data and to reveal underlying structures of experiences or processes (Thomas, 2006). The coding process will be done by at least two researchers to increase the validity of the process.

2.3 DISCUSSION

This paper describes the study protocol for a mixed methods study consisting of a C-RCT with an intervention group and a control group and a process evaluation. The study protocol includes the evaluation of P4HP, an empowerment intervention to improve diet quality among pregnant women. To our knowledge, this is the first C-RCT that evaluates the effectiveness of an empowerment intervention to improve diet quality in The Netherlands. Research in this field is needed because there is limited evidence of effective empowerment interventions regarding diet quality during pregnancy. To ensure that P4HP fits into standard birth care, various stakeholders have been involved in all steps of the development process. Our study will provide important and unique information on how to empower pregnant women to achieve improved diet quality by midwives and dietitians. Having both a quantitative and qualitative evaluation of P4HP will create a comprehensive overview of both the impact of P4HP and how best to implement it more broadly in practice.

P4HP will be assessed on diet quality, empowerment, SOC, QOL, and SRH. Although these assessments were selected intentionally based on previous research, the intervention may still produce an effect that is not directly assessed by our quantitative assessments. The process evaluation is therefore added to capture these indirect effects using semi-structured interviews. Innovative is that outcome measures include empowerment and SOC, something not common in C-RCT studies. Previous studies found evidence that SOC significantly changed and that those with a weaker SOC were more likely to have a stronger SOC after the intervention that included experimental learning (Hochwälder, 2019; Thompson et al., 2021), as these groups have most to gain. In case we find change in SOC, it indicates that participants of P4HP benefit from the intervention; providing a more complete picture of the interventions' successes. Two limiting factors of using Eetscore to assess diet quality are that it is only available in Dutch and oriented to a Dutch dietary pattern. Consequently, this unfortunately limits women who do not speak Dutch and with other diet patterns from participating.

Materials and language used in P4HP are designed to be suitable for low SES pregnant women – the group who will mostly benefit from this intervention because of a general

sub-optimal adherence to dietary guidelines (Baron et al., 2015; Geurts & Rossum, 2014; Malek et al., 2015). We assume P4HP thus aligns with women of all SES groups. As it is not ethical to discriminate the inclusion of participants on their SES-status, all SES-groups visiting participating midwifery practices will be included in this study. In the results we will report on differences in outcomes between SES groups.

This study will make a significant and to our knowledge unique scientific and socially relevant contribution about using an empowerment intervention to improve the diet quality of pregnant women in the Netherlands. If P4HP improves pregnant women's diet quality, empowerment and other health-related outcomes, the impact may have health, social, and economic benefits. We anticipate that the study outcomes have the potential to change the way nutrition is addressed during pregnancy. The findings will directly benefit pregnant women and their children, as well as inform academics and others who strive to produce interventions that can be effectively implemented in routine care using multisectoral collaboration. If P4HP proves to be an effective and feasible intervention, further research will be done on the extension towards the preconception and postpartum phase.

Ethics approval and consent to participate: This project has been approved by the Medical Research Ethics Committee Utrecht, code 21/526D, dossier NL78194.041.21. All participating pregnant women will be asked to provide their written informed consent.

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Chapter 3

AN EMPOWERMENT PROGRAMME TO IMPROVE DIET QUALITY DURING PREGNANCY

THE POWER 4 A HEALTHY PREGNANCY CLUSTER RANDOMISED CONTROLLED TRIAL

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ABSTRACT

Background: A healthy diet during pregnancy is vital for the well-being of both mothers and babies. However, navigating dietary choices amidst the unique psychological and physiological changes of pregnancy can be challenging. Empowerment, defined as the ability to improve capacities, critically analyse situations, and take actions to improve them, can support pregnant women to make healthier choices. This intervention study assessed the effects of the 'Power 4 a Healthy Pregnancy' (P4HP) programme on diet quality and empowerment.

Methods: In a nonblinded, two-arm, parallel cluster randomised controlled trial, the P4HP programme was implemented in 16 randomly allocated Dutch midwifery practices, recruiting 342 participants. Participants were assigned to either the intervention (n=186) or the control group (n=156). The P4HP programme offered four additional consultations during pregnancy to discuss nutrition with both a midwife and a dietitian, using an empowerment approach. The effectiveness of the P4HP programme was evaluated using pre- and post-intervention questionnaires assessing diet quality, empowerment, quality of life, sense of coherence, and self-rated health. The data were analysed using linear mixed models with an intention-to-treat approach.

Results: The P4HP programme was conducted from approximately week 11 to week 34 of pregnancy. The total diet quality score significantly improved during pregnancy in the intervention group compared to the control group (4.28; 95% CI: 1.00 to 7.56; $p = 0.011$), particularly driven by improvements in the scores for vitamin D, iodine, and fish. Although other components, including fruit, whole-grain foods, nuts, dairy foods, iodine, and fish showed greater average increases in diet quality scores within the intervention group, these differences were not significant. Women across all empowerment levels expressed uncertainty regarding their weight gain during pregnancy.

Conclusion: The P4HP programme positively influenced the dietary habits of pregnant women through empowerment. The observed improvement in diet quality underscores the potential of the P4HP programme as an effective intervention during pregnancy. This study lays the foundation for future empowerment-based interventions in maternal health contexts.

Trial registration: International Clinical Trial Registry Platform NL-OMON23191, date of registration: 19/05/2021.

3.1 INTRODUCTION

Maintaining a nutrient-rich diet during pregnancy is essential because of the health benefits to both expectant mothers and their unborn children. A healthy diet is universally pivotal but is particularly important during the gestational period (Jouanne et al., 2021; Raghavan et al., 2019). A set of specific dietary guidelines has been established for pregnant women by the Health Council of the Netherlands (Health Council of the Netherlands, 2021). These guidelines aim to support the optimal development of the unborn baby. They recommend appropriate intake levels of essential nutrients, including vitamin D, folic acid, iodine, iron, and calcium. Additionally, the guidelines caution against consuming unsafe food groups, such as alcohol and liver products (Health Council of the Netherlands, 2021). Such guidelines not only serve as a valuable resource for expectant mothers but also highlight the broader societal recognition of the critical role that maternal diet plays in the well-being of both present and future generations (Abu-Saad & Fraser, 2010; Blumfield et al., 2013; Stang & Huffman, 2016). A suboptimal maternal diet not only correlates with adverse birth outcomes, such as premature birth and low birth weight, but also lays the foundation for unfavourable long-term health outcomes, including increased susceptibility to chronic diseases and obesity (Abu-Saad & Fraser, 2010; Ramakrishnan et al., 2012).

Pregnancy, especially in nulliparous women, represents a unique opportunity during which individuals exhibit heightened receptivity to dietary improvements (Arabin & Baschat, 2017; Hillier & Olander, 2017; Shapira, 2008; Szwajcer et al., 2005; Uzan et al., 2024). This critical transition period elevates nutritional awareness, creating a greater willingness among women to enhance their diet quality, motivated by the belief that it can positively influence their unborn babies' well-being (Szwajcer et al., 2005; Szwajcer et al., 2007; Uzan et al., 2024). However, pregnancy poses challenges for women in terms of implementing and sustaining dietary changes (R. E. Walker et al., 2020). Factors such as nausea, cravings, and established habits, as well as external challenges related to living costs and surroundings, contribute to this. Therefore, despite their motivation to enhance diet quality, pregnant women, especially those with low socioeconomic status, struggle to adhere to dietary recommendations (Baron et al., 2015; Blumfield et al., 2013; ter Borg et al., 2023). A recent systematic review of food and nutrient intake among Dutch pregnant women revealed suboptimal intakes of fruits, vegetables, and fish while exceeding the recommendations for alcohol, sugary drinks, and salt (ter Borg et al., 2023). Interestingly, the intake of other food groups or nutrients, such as protein and vitamin A, was found to be adequate (ter Borg et al., 2023).

Midwives serve as primary healthcare providers for pregnant women in the Netherlands, playing a crucial role that includes providing essential nutrition information and guidance during pregnancy (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; Meulenbroeks et al., 2021). This central role offers a valuable opportunity for promoting a healthy diet during pregnancy (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; Super et al., 2021). However, despite their responsibility to provide nutritional advice, midwives encounter structural barriers, such as time constraints, unsupportive health systems, and limited resources and training. These challenges contribute to suboptimal nutritional communication during antenatal care (Arrish et al., 2014, 2017; Beulen et al., 2021; Olloqui-Mundet et al., 2023; Szwajcer, Hiddink, Koelen, et al., 2008).

Currently, only specific groups of Dutch women with pregnancy complications or weight-related concerns receive comprehensive nutritional guidance during pregnancy (Baron, Martin, et al., 2017; Beulen et al., 2021; Szwajcer, Hiddink, Koelen, et al., 2008). There is a strong need to strengthen the collaboration between dietitians and midwives, ensuring that nutrition becomes a routine and standard part of antenatal care (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; Super et al., 2021). The empowerment model suggests that by enhancing individuals' self-efficacy and decision-making skills, they are better equipped to adopt and sustain positive health behaviours (Nieuwenhuijze & Leahy-Warren, 2019). Although the use of empowerment in nutrition-related programmes remains limited, it holds promise for health improvement (Berretta et al., 2023; Brandstetter et al., 2015; Cyril et al., 2016; Lindacher et al., 2018; Zinsser et al., 2020). Given these findings, integrating empowerment-based nutritional support could be valuable in promoting optimal maternal and foetal health among expectant Dutch mothers.

To address the lack of nutritional guidance, we developed the 'Power 4 a Healthy Pregnancy' (P4HP) programme aimed at improving prenatal diet quality, ultimately promoting healthier newborns and better health across generations. The P4HP programme was developed through preliminary research conducted by our team, including literature reviews, qualitative and quantitative studies (Beulen, Geelen, et al., 2020; Beulen, Super, et al., 2020; Beulen et al., 2021; Super et al., 2021; Super & Wagemakers, 2021; Van Lonkhuijzen et al., 2022), and a participatory co-design process with stakeholders (publication forthcoming). This thorough development phase ensured the programme met needs while remaining feasible within Dutch prenatal care settings. Motivational Interviewing (MI), a client-centred counselling approach, is used by participating dietitians and midwives during consultations. MI has shown promise across various health domains by recognising individuals as experts in their own lives, emphasising autonomy, and supporting personal choice in behaviour change (Martins & McNeil, 2009; Miller & Rollnick, 2012).

The objective of this study was to provide insight into the quantitative effectiveness of additional consultations within the P4HP programme, primarily on diet quality and empowerment, and secondarily on self-rated health (SRH), quality of life (QOL), and sense of coherence (SOC). As stated in the study protocol, we hypothesise that participation in the P4HP programme, in comparison to receiving standard prenatal care alone, would result in increased diet quality and empowerment scores among pregnant women (Van Lonkhuijzen et al., 2022). By conducting this research, we aimed to contribute to the understanding of how empowerment-focused programmes can positively impact the diet quality and overall well-being of pregnant women, thereby influencing maternal health and pregnancy outcomes.

3.2 MATERIALS AND METHODS

STUDY DESIGN

The study design comprised a two-arm, non-blinded, parallel cluster randomised controlled trial (C-RCT) with a 1:1 allocation ratio. It was conducted across 16 midwifery practices in the Netherlands, from January 2022 to April 2023 (Van Lonkhuijzen et al., 2022). Data were collected at two timepoints (T): baseline in early pregnancy (T0) and post-intervention in the third trimester (T1). Midwifery practices recruited pregnant women to participate in this study. During the study period, all the participants received standard prenatal care. Additionally, participants in the intervention group followed the P4HP programme along with standard prenatal care.

Before the start of the P4HP C-RCT study, a pilot study was conducted in two midwifery practices from October 2021 to January 2022. During this phase, practices 1 and 2 enrolled eight pregnant women (see **Annex 3.1** for characteristics of midwifery practices). We pretested the questionnaires, explored perceptions of the P4HP programme among pregnant women, midwives, and dietitians, and evaluated the practical and technical aspects of the implementation of the P4HP programme. The pilot phase progressed smoothly without significant issues, and no major modifications to the P4HP programme were deemed necessary. Consequently, we decided to include the participants and their data from the pilot phase in the C-RCT.

The CONSORT guidelines for cluster trials have been consulted (Campbell et al., 2012). The Medical Research Ethics Committee Utrecht (NedMec) approved this study on 21 September 2021 (protocol number 21-526/D). This study was registered in the WHO International Clinical Trial Registry Platform, before conducting the recruitment, on May 19th 2021 (NL-OMON23191) (Central Committee on Research Involving Human Subjects, n.d.; *Power 4 a Healthy Pregnancy-Intervention (Registration*

ID: NL-OMON23191), 2021).

RECRUITMENT OF MIDWIFERY PRACTICES

Midwifery practices were recruited through Obstetric Collaborative Networks. These regional networks bring together various organisations involved in obstetric care, maternity care, and birth care to collaboratively establish pregnancy and birth care policies. We engaged local Solid Start (Kansrijke Start) coalitions as well as municipalities. These coalitions are Dutch government-initiated networks that promote collaboration between medical and social care professionals to ensure the best possible start in life for children. We employed snowball sampling for recruitment. We recruited midwifery practices from various regions across the Netherlands to enhance the applicability of this study to a broader population. An overview of the characteristics of participating midwifery practices is available in **Annex 3.1**.

We chose cluster randomisation for three key reasons. First, it prevented potential contamination between intervention and control groups within practices. Second, the P4HP programme required practice-level implementation of new workflows and collaborative relationships between midwives and dietitians. Third, the intervention's effectiveness depended on practice-wide organisational factors, making the practice the natural unit of randomisation (**Figure 3.1**). Of the two midwifery practices involved in the pilot study, only Practice 1 decided to continue its participation in the RCT. Based on their experience with implementing the P4HP programme during the pilot, we directly assigned Practice 1 to the intervention group. The subsequent 13 recruited practices (No. 3-15) were randomly allocated to either the intervention group (the P4HP programme in addition to usual prenatal care) or the control group (usual prenatal care). The randomisation was performed by a computer-generated randomisation scheme in Excel. Two additional midwifery practices (No. 16 and 17) were directly allocated to the intervention group, for several reasons. First, we reached our initial goal of 14 clusters (7 intervention and 7 control) (Van Lonkhuijzen et al., 2022). Second, there was a notable imbalance in the participant recruitment distribution, resulting in a significantly larger control group. Third, practice no. 17 specifically requested participation in the intervention group to learn how to integrate nutrition into their practices, especially because of the high prevalence of overweight among their population. Unfortunately, one control midwifery practice (No. 15) discontinued study participation before participant recruitment started because of internal issues within the midwifery practice.

Midwifery practices with an existing collaboration with a dietitian were recruited together to participate in the P4HP programme (n=2). For midwifery practices lacking current collaboration, we recruited dietitian practices within their region to participate in the P4HP programme. Subsequently, we facilitated introductory meetings

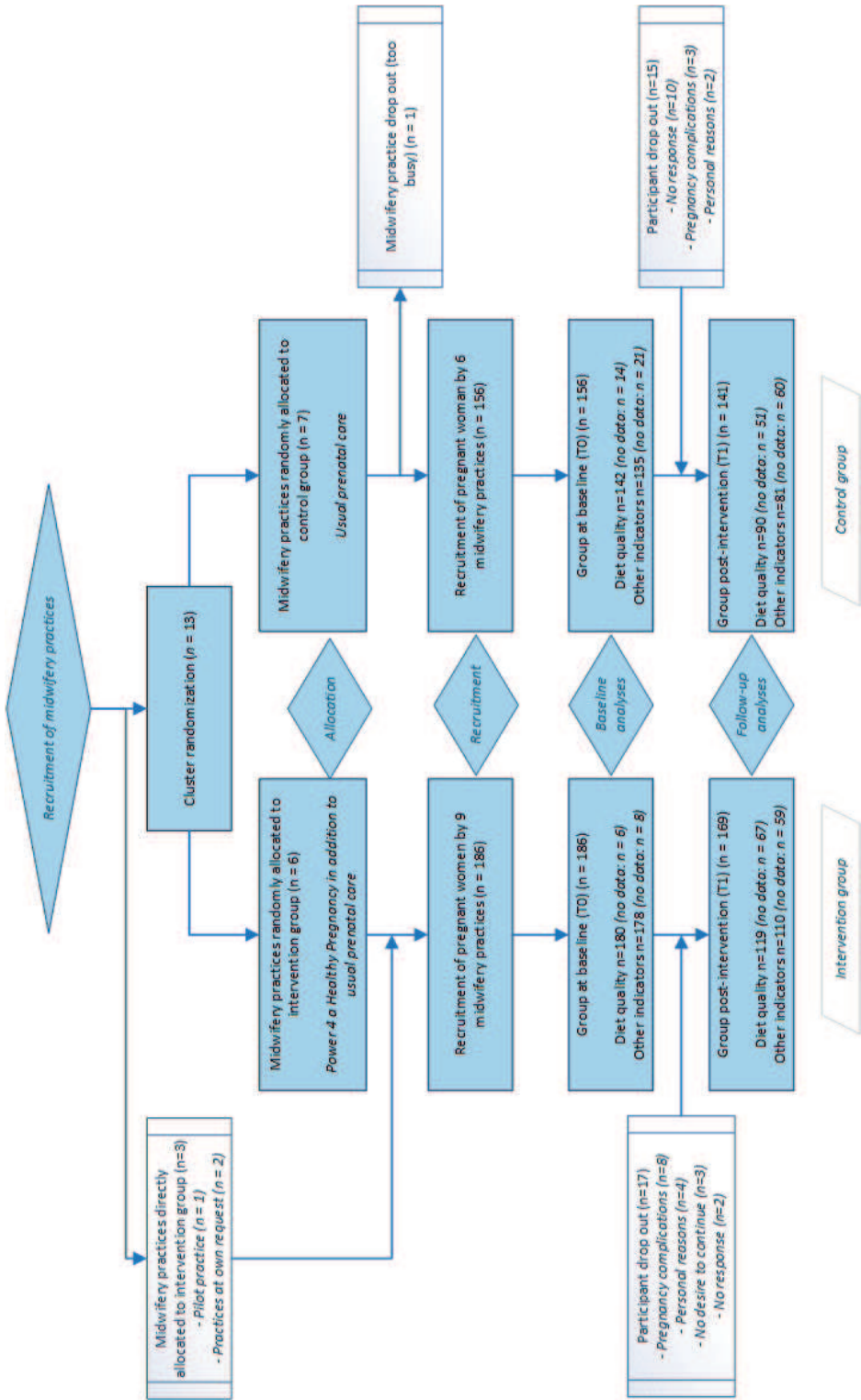


FIGURE 3.1: FLOWCHART ILLUSTRATING PARTICIPANT RECRUITMENT AND RETAINMENT , PARTICIPATION AND DROP-OUT RATES IN BOTH THE INTERVENTION AND CONTROL GROUPS OF THE P4HP STUDY

between the dietitians and the eight midwifery practices in the intervention group. Approximately 40 midwives and 20 dietitians participated in the implementation of the P4HP programme. On average, approximately 21 pregnant women (median: 26) were recruited from each midwifery practice, ranging from 3 to 32 (see **Annex 3.1** for characteristics of midwifery practices). Midwifery practices yielded complete datasets, containing four completed questionnaires (two at T0 and two at T1) for an average of approximately 12 pregnant women (median: 14). The percentage of complete datasets per midwifery practice ranged from 11% (1 of 9 women) to 86% (12 of 14 women).

PARTICIPANT RECRUITMENT

Eligible pregnant women were recruited using purposive sampling. During the predetermined inclusion period (January–October 2022), pregnant women attending any of the randomised participating midwifery practices were invited by their midwives to participate in the study. A total of 342 women were enrolled in the study; 186 were allocated to the intervention group and 156 to the control group (**Figure 3.1**).

INCLUSION AND EXCLUSION CRITERIA

To qualify, participants had to meet the following inclusion criteria: being in the first trimester of pregnancy, >18 years of age, proficient in the Dutch language, and adhering to a Dutch diet pattern (characterised by a maximum of one hot meal per day). The exclusion criteria were: unwillingness to provide informed consent, severe chronic illnesses (e.g. cancer), and conditions potentially affecting diet quality. Eligible candidates were informed of the study by their midwives, and written informed consent was obtained before inclusion. Women residing across a large part of the Netherlands had the opportunity to enrol via their midwifery practice.

THE P4HP PROGRAMME

The P4HP programme was developed through an iterative process involving multiple stakeholders, e.g. midwives, dietitians, and pregnant women, who participated in expert meetings and stakeholder sessions to co-design the intervention, building on findings from our team's preliminary studies (Beulen, Geelen, et al., 2020; Beulen, Super, et al., 2020; Beulen et al., 2021; Super et al., 2021; Super & Wagemakers, 2021; Van Lonkhuijzen et al., 2022). This participatory approach helped ensure the programme's practical feasibility and alignment with stakeholder needs. The subsequent pilot study in two midwifery practices allowed for final refinements based on implementation experience and stakeholder feedback before the main trial.

The P4HP programme distinguishes itself from conventional birth care by its non-invasive empowering approach, prioritising the improvement of diet quality during pregnancy. The P4HP programme consists of four additional opportunities during

pregnancy for women to engage in discussions about nutrition: three consultations with their midwives, and one consultation with a dietitian. A summarised overview of the goals and activities of each consultation is presented in **Table 3.1**. The midwives and dietitians received comprehensive support to implement the P4HP programme. Professionals participated in multiple meetings with the research team, covering the detailed implementation of the P4HP programme in their practices. In addition, the detailed manual served as a comprehensive guide to support the delivery of the P4HP consultations (see **Supplementary material 1** for the guide). By providing thorough preparation and ongoing support, we ensured the midwives and dietitians felt equipped to competently deliver the P4HP programme as intended. In addition, we assessed the process of implementing the P4HP programme and gathered feedback from the providers through a comprehensive process evaluation (Van Lonkhuijzen et al., n.d.).

The P4HP programme employs an empowering approach that prioritises individual needs, choices, and control. This approach allows midwives and dietitians to collaborate with pregnant women to identify the most effective strategies to their unique situations. As described by Tengland, empowerment is a process that offers individuals greater control over specific circumstances, thereby increasing their self-efficacy for those circumstances and tasks (Tengland, 2008).

During P4HP consultations, healthcare professionals employ MI; a woman-centred and time-limited psychosocial intervention designed to identify and resolve behaviour disparities while increasing motivation for change (Miller & Rollnick, 2012). Through open-ended questioning, MI empowers individuals by exploring their perceptions of change, including its meaning, importance and their capacity to achieve it (McCarley, 2009; Miller & Rollnick, 2012). Research has demonstrated that MI is promising and can be more effective than standard education alone in improving pregnancy-related health behaviours, including fruit and vegetable consumption (Martins & McNeil, 2009; VanWormer & Boucher, 2004). For instance, a MI intervention with at-risk South African women led to significant reductions in alcohol-exposed pregnancy risk at both 3 and 12 months post-intervention (Rendall-Mkosi et al., 2013). In pregnancy care, MI is frequently used to influence gestational weight gain (Ásbjörnsdóttir et al., 2019; Jevitt & Ketchum, 2024; Nightingale et al., 2023; Simmons et al., 2016). The approach is closely associated with empowerment principles, as both are rooted in self-determination theory, which suggests that individuals naturally strive to improve their wellbeing when they internalise the need for change (Markland et al., 2005). While the combination of MI and empowerment approaches shows particular promise for supporting positive health behaviour changes, their joint application to prenatal nutrition remains understudied.

TABLE 3.1: SUMMARISED OVERVIEW OF THE GOALS AND ACTIVITIES IN THE FOUR CONSULTATIONS OF THE P4HP PROGRAMME, CONDUCTED BETWEEN BASELINE (T0) AND POST-INTERVENTION (T1)

Time	Goal(s)	Activities
1. Early nutritional information with the midwife (4-10 weeks of participants' pregnancy)		
10-15 min	<ul style="list-style-type: none"> - Gain insight into the perspectives of the women towards nutrition and create a sense of urgency for healthy nutrition during pregnancy - Identify aspects that go well regarding nutrition and define at least one achievable step the woman is willing to work on - Create a positive attitude towards nutritional changes - Understand the complexity of each woman's situation regarding healthy nutrition 	<ul style="list-style-type: none"> First exploratory consultation on nutrition. Optional use of visual aids to guide the consultation and write down action points.
2. Appointment with the dietitian (~ 12 weeks of participants' pregnancy)		
30-45 min	<ul style="list-style-type: none"> - Support women in developing strategies to cope with individual challenges - Provide more in-depth nutritional information 	<ul style="list-style-type: none"> Discuss challenges in healthy nutrition in-depth based on the women's individual needs. Optional use of visual aids to guide the consultation and write down action points.
3. Two reflection moments with the midwife (~ 22 and ~ 32 weeks of participants' pregnancy)		
2x10-15 min	<ul style="list-style-type: none"> - Raise awareness of the link between women's actions and diet quality outcomes - Enhance the ability to set actionable and achievable goals that contribute to improved diet quality 	<ul style="list-style-type: none"> Facilitate women's reflection on their diet and their efforts during the previous weeks. Identify the next steps for improvement, if achievable.

The P4HP programme combines the strengths of midwives and dietitians. The midwife, a highly trusted source of information for pregnant women, conducted three of the four P4HP consultations. Skilled in MI, the midwife reflected on nutrition together with the pregnant woman and helped to set and review goals. The dietitian, built on the midwife's foundation, provided personalised nutritional guidance. Written consultation reports were exchanged between midwives and dietitians, allowing them to follow up on each other's consultations and ensure continuity of care. Emphasis was placed on repeated counselling and collaboration between midwives and dietitians to enhance the effectiveness of the programme (Beulen, Geelen, et al., 2020; Beulen, Super, et al., 2020; Super et al., 2019; Super & Wagemakers, 2021; Van Lonkhuijzen et al., 2022).

This way, enhancing the motivation of pregnant women and making behaviour changes became a shared endeavour rather than an individual responsibility (Miller & Rollnick, 2012; Rollnick et al., 1999).

Both midwives and dietitians had the option to use a visual conversation tool to guide the consultations and document action points together with pregnant women (see **Supplementary material 1** for the P4HP guide). Participating women received a magnet with the logo of the P4HP programme to have the option to stick their visual conversation tool on, for example, their fridge to have their goals in sight and to be reminded of them throughout the day.

Flexibility in implementing the P4HP programme was important for two main reasons: 1) to smoothly integrate the programme into the dynamic and varying daily procedures of the midwifery practice and 2) to provide freedom for professionals to tailor each consultation to the individual needs of the pregnant woman. Consequently, in two midwifery practices (No. 1 (post-pilot) and 16) dietitians conducted the first two P4HP consultations following explicit requests from the midwives. The early pregnancy period was intensive for midwives, making it inconvenient for them to accommodate the first P4HP consultation within their routines. Additionally, dietitians expressed a preference for multiple consultations with pregnant women.

Midwives and dietitians were fully reimbursed for the time invested, while participating women had no additional costs compared with standard birth care. Initially, the P4HP programme was planned to be implemented in either individual or group settings; however, due to the COVID-19 pandemic, group consultations via CenteringPregnancy were disrupted. Therefore, it was decided to conduct the P4HP programme exclusively on an individual basis.

DATA COLLECTION

Data collection began when participants provided written informed consent. Two questionnaires were developed for this study; an adapted version of the Eetscore questionnaire and a questionnaire on sociodemographics, empowerment, and health (see **Annex 3.2** for the questionnaires). The Eetscore questionnaire, which is scored using the Dutch Healthy Diet index for pregnant women (DHD-P), is a web-based screening tool designed to assess diet quality. It typically takes 10-15 minutes to complete (*Eetscore*, n.d.; Lee et al., 2016; Looman et al., 2017; Rijk et al., 2021). The DHD-P was designed to align with the dietary recommendations for pregnant women set by The Health Council of the Netherlands (HCN) and the Netherlands Nutrition Centre, making it particularly suitable for our study population and research aim (Faessen et al., 2024; Health Council of the Netherlands, 2021; Van Lonkhuijzen et al., 2022). The DHD-P

evaluates 21 food and nutrient components through 48 questions with sub-questions (Faessen et al., 2024). Each component was scored on a scale of 0 (non-adherence) to 10 (complete adherence), resulting in a maximum of 210 points. However, because supplementation with folic acid is not recommended in the final stage of pregnancy, we excluded the folic acid component, resulting in a maximum total diet quality score of 200. The scoring has been described in detail elsewhere (Faessen et al., 2024) and is summarised in **Table 3.2** including the cut-off and threshold values.

The questionnaire on sociodemographics, empowerment, and health was administered using the Qualtrics platform. Sociodemographic data, including age, living situation, ethnicity, educational level, personal and household income, and body weight and height, were collected. The subsequent section of the questionnaire consisted of the Pregnancy-Related Empowerment Scale (PRES), a tool used to assess the level of empowerment during pregnancy (Klima et al., 2015). This scale is rooted in the concept of health-related empowerment and contains 16 questions on women's health-related empowerment during pregnancy divided into four subscales: provider connectedness, skilful decision-making, peer connectedness, and gaining voice (Klima et al., 2015). Pregnant women's level of empowerment increases as the scale score increases, with 16 being the lowest possible score and 64 being the highest. Additionally, the health outcomes of SRH, QOL, and SOC were assessed. Participants rated their SRH on a five-point scale, ranging from 'excellent' to 'poor'. QOL was evaluated using the global QOL scale, with respondents rating their satisfaction on a visual analogue scale ranging from 0 (worst) to 100 (best) (De Boer et al., 2004). SOC was assessed using the three-item SOC questionnaire (SOC-3), which assesses the comprehensibility, manageability, and meaningfulness of daily life experiences (Lundberg & Peck, 1995). Participants responded to each item as "usually", "sometimes", or "no".

On average, the questionnaires at T0 were completed at approximately week 11 of pregnancy (range 5-21 weeks of pregnancy), and at T1, they were completed at approximately 34 weeks of pregnancy (range 30-39 weeks of pregnancy). Both the control and intervention groups were asked to complete the Eetscore questionnaire to collect information about diet quality along with a questionnaire on sociodemographic information, empowerment, and health (Van Lonkhuijzen et al., 2022). Participants were first e-mailed a request to complete the questionnaires. In the case of non-completion, participants were repeatedly reminded to complete the questionnaires via e-mail and phone. When we failed to contact the pregnant woman for multiple weeks, we contacted her midwifery practice to check her situation.

POWER CALCULATION

A total sample size of 350 participants was required to detect a small to medium effect

TABLE 3.2: CUT-OFF AND THRESHOLD VALUES FOR DIET QUALITY SCORES

Component*	Dutch dietary guidelines	Minimum score (= 0 points)	Maximum score (= 10 points)
1 Vegetables	At least 200 grams per day	No intake	200 grams or more per day
2 Fruit	At least 200 grams per day	No intake	200 grams or more per day
3 Whole-grain products (<i>Both components contribute 50% of the score</i>)	At least 90 grams of whole grain	No intake	90 grams or more whole grains per day
4 Legumes	Replace refined cereals with wholegrain products	No intake of whole grains OR ratio of wholegrain/refined products ≤ 0.7	No refined products OR ratio of wholegrain/refined products ≥ 1
5 Nuts	Eat legumes weekly	No intake	10 grams or more per day
6 Dairy products	At least 15 grams of unsalted nuts per day	No intake	15 grams or more per day
	Consume about 3 to 4 portions of dairy per day (450-600 grams) including milk and yoghurt, with a maximum of 40 g of cheese	No intake OR >750 grams per day	450-600 grams per day
7 Fish (<i>50% score based on fatty fish once a week and 50% of the score is based on lean fish once a week.</i>)	Twice a week fish, of which one time a week fatty fish and one time a week lean fish. Avoid fish that are not advised for pregnant women	No intake	30 grams or more per day
8 Caffeine	No more than 200 mg of caffeine (calculated from coffee and tea consumption)	More than 200 mg of caffeine per day	Less than 200 mg caffeine per day
9 Fat and oils	Replace butter, hard margarines and cooking fats by soft margarines, liquid cooking fats and vegetable oils.	No consumption of soft margarines, liquid cooking fats and vegetable oils OR ratio of liquid cooking fats to solid cooking fats ≤ 0.6	No consumption of butter, hard margarines and cooking fats OR Ratio of liquid cooking fats to solid cooking fats ≥ 1.3
10 Coffee	Replace unfiltered coffee by filtered coffee	Any consumption of unfiltered coffee	Consumption of only filtered coffee OR no coffee consumption
11 Red meat	Minimise consumption, maximum of 300 grams per week	100 grams or more per day	45 grams or less per day
12 Processed meat	Minimise consumption, maximum of 200 grams per week	50 grams or more per day	No intake
13 Sugar-containing beverages	Minimise consumption	1 glass (250 grams) or more per day	No intake

14	Alcohol	No consumption	Any amount of consumption	No intake
15	Salt**	Limit consumption to 6 g/day (2.4 g/day of sodium)	3042 mg or more per day	Less than 2028 mg per day
16	Unhealthy choices	Limit consumption of unhealthy day and week choices to ≤3 week choices per week	More than seven choices per week	Three or less choices per week
17	Vitamin D	10 micrograms per day supplementation	No supplementation OR 100 mcg or more per day	10 micrograms per day
18	Vitamin A	750 mcg RAE per day and not more than 3000 mcg RAE per day.	0 mcg RAE OR 3000 mcg RAE or more per day	750 mcg RAE per day
19	Soy	Limit soy consumption to no more than 4 portions of soy milk/yoghurt per day and no more than 2 portions of soy products (tempeh, tofu, etc.) per week. Unless you do not consume soy milk/yoghurt, then there is no limitation on soy products such as tempeh and tofu.	More than 4 portions per day of soy milk/yoghurt and/or more than 2 portions per week of soy products (if any soy milk/yoghurt is consumed)	Consumption below 4 portions per week of soy milk/yoghurt and below 2 portions of soy products per week (if any soy milk/yoghurt is consumed)
20	Iodine	Consume sufficient products containing iodine to obtain 200 mcg per day	No consumption of fish, dairy and bread	2 times a week fish, 3–4 portions dairy and 5 slices of bread per day

* As supplementation of folic acid is not recommended in the final stage of pregnancy, we excluded the folic acid component from our analyses resulting in a maximum total diet quality score of 200

** All Etscore items together do not cover the entire daily diet. Therefore, it is necessary to apply a correction for the cut-off values of sodium. To establish the cut-off values, the Health Council recommendation (maximum 6 g salt = 2400 mg sodium) was multiplied by the MOM1 value for sodium (84.51%): $2400 \text{ mg} * 0.8451 = 2028 \text{ mg}$. To arrive at the upper limit, a maximum of 9 g of salt (= 3600 mg of sodium) per day was assumed to be multiplied by the MOM1 value for sodium, amounting to 3042 mg.

size of 0.4 (Cohen, 1988) with a power of 80%, an alpha level of 0.05, and an assumed intra-cluster correlation coefficient of 2%. Both the intervention and control arms were intended to comprise 7 clusters of 25 participants each. Ultimately, a slightly smaller number of 342 participants were enrolled in the study, but this discrepancy was compensated for by including more midwifery practices (clusters) than originally planned, thereby enhancing the statistical power (Van Lonkhuijzen et al., 2022). A total of 32 participants dropped out of the study: 15 from the control group and 17 from the intervention group, resulting in a dropout rate of 9.4% (**Figure 3.1**). Follow-up measurements on diet quality were available for 209 participants (61.1% of initially recruited participants), 119 in the intervention, and 90 in the control practices.

DATA ANALYSIS

Descriptive data analyses were performed using SPSS Statistics (version 28.0) and are presented (as mean \pm SD or n (%)) for the intervention and control groups separately. Independent t-tests (continuous variables) and independent Chi-square Test of Independence (categorical variables) were used to compare the descriptive characteristics between the study groups. In addition, we stratified the population into two groups of lower and higher-than-average diet quality at T1. We assessed the differences for these groups for all DHD-P subscores to identify which diet quality components contribute most to the differences in diet quality between groups with below and above-average total diet quality scores at T1 (**Annex 3.3**).

The effects of the intervention on endline values of primary and secondary outcomes were analysed using Stata release 18 (Statacorp, 2023). Mixed Models with intervention vs. control as fixed effect, midwifery practice (cluster) as a random factor (Hilbert et al., 2019) and baseline values (T0) as covariates, as recommended (Vickers & Altman, 2001), and robust variance estimators were used. We analysed the data according to the intention-to-treat principle (Brody, 2016). Additionally, a Last Observation Carried Forward (LOCF) analysis was executed for total diet quality to account for dropout rates, ensuring the inclusion of all participants in the analysis, and providing a more precise effect estimate. Missing data at T1 were imputed using each participant's T0 data. All models were adjusted for BMI and household income. Normally distributed outcome variables such as DHD-P total score were analysed using the Stata procedure 'mixed', DHD-P subscores with the procedure 'metobit' (mixed tobit regression with lower limit 0 and upper limit 10), and DHD-P subscores with categorical distributions, PRES, SOC, and SRH were analysed with the procedure 'meologit' (mixed ordinal regression). P values <0.05 were considered to indicate statistical significance.

3.3 RESULTS

DESCRIPTIVE CHARACTERISTICS

On average, the 342 participants were 31 years old (**Table 3.3**). Nearly half of the women experienced their first pregnancy. Most women were Dutch, highly educated, and employed during pregnancy, with no differences between the intervention and control groups. Yet, women in the intervention group had a significantly higher BMI (25.9 ± 5.6 vs. 24.7 ± 4.7 kg/m², $P < 0.05$) and household income (32% vs. 17% reporting $\geq \text{€ } 5,001,-$) compared to the control group. Baseline scores of the two primary outcomes, diet quality and empowerment, were comparable between the two groups.

TABLE 3.3: DESCRIPTIVE CHARACTERISTICS OF THE 342 P4HP C-RCT-STUDY PARTICIPANTS AT BASELINE

		Intervention	Control	P value
Age (y) (mean \pm SD) ($n=287$)		31.0 \pm 4.3	31.3 \pm 3.9	.50
BMI (kg/m²) (mean \pm SD) ($n=282$)		25.9 \pm 5.6	24.7 \pm 4.7	<.05
BMI groups (kg/m²)	<18.5	3 (1.9)	4 (3.2)	.17
(n (%)) ($n=282$)	18.5-25	80 (51.0)	75 (60.0)	
	25-30	44 (28.0)	33 (26.4)	
	30+	30 (19.1)	13 (10.4)	
Parity (n (%))	Primiparous	87 (50.0)	58 (42.0)	.16
($n=312$)	Multiparous	87 (50.0)	80 (58.0)	
Migration background (n (%)) (<i>woman and/or at least one of parents born outside of the Netherlands</i>) ($n=317$)		27 (15.2)	18 (12.9)	.57
Paid employment during pregnancy (n (%)) ($n=314$)		167 (93.8)	122 (89.7)	.18
Education (n (%))	Secondary education	10 (5.6)	2 (1.5)	.19
($n=314$)	Secondary vocational education	56 (31.5)	46 (33.8)	
	Higher professional education	67 (37.6)	59 (43.4)	
	University education	45 (25.3)	29 (21.3)	
Monthly net household income (n (%)) ($n=314$)	€ 0.- to € 2,500,-	12 (6.7)	11 (8.1)	.03
	€ 2,501,- to € 5,000,-	89 (50.0)	82 (60.3)	
	€ 5,001,- and more	57 (32.0)	23 (16.9)	
	I do not know/I do not want to answer this question	20 (11.2)	20 (14.7)	
Total diet quality score (mean \pm SD) ($n=322$)		134.9 \pm 17.1	135.9 \pm 17.3	.60
Total empowerment score ($n=313$)		58.0 \pm 5.7	58.7 \pm 3.8	.22

DIET QUALITY

Figure 3.2 presents the intervention effects on diet quality, with both groups showing improvements from the first to third trimesters. This increase was significantly higher

in the intervention group than in the control group (4.28; 95% CI: 1.00 to 7.56; $p = 0.011$). Applying the LOCF method, to handle missing data, did not substantially alter the results, but did provide a more precise estimate, showing a slightly lower group-difference (2.75; 95% CI: 0.76 to 4.72; $p = 0.007$).

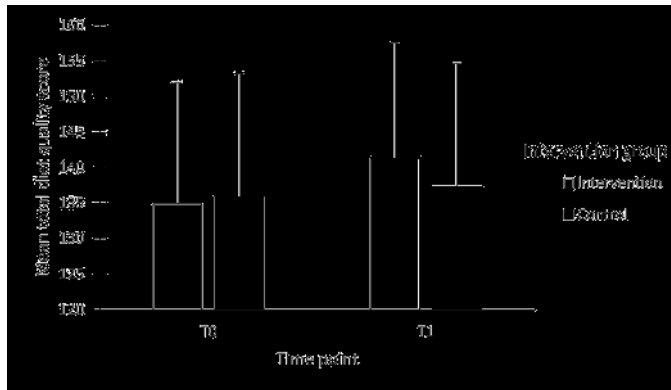


FIGURE 3.2: THE AVERAGE OF TOTAL DIET QUALITY SCORES OF 342 PREGNANT WOMEN AT BASELINE (T0; ON AVERAGE 11 WEEKS OF PREGNANCY) AND POST-INTERVENTION (T1; ON AVERAGE 34 WEEKS OF PREGNANCY) IMPLEMENTING THE P4HP PROGRAMME.

Based on the DHD-P subscores of the total diet quality score, the effect found for the total diet score was particularly driven by a higher intake of fish (0.55, 95% CI: 0.07 to 1.03, $p = .025$), and iodine (0.40, 95% CI: 0.20 to 0.61; $p < .0001$), and smaller decrease in vitamin D intake (0.48; 95% CI: 0.02 to 0.95; $p = .043$) in the intervention compared to the control group. Although components such as fruit, whole-grain products, nuts, dairy products, processed meat, and sugar-containing beverages showed greater average increases in diet quality scores in the intervention group than in the control group, the differences were not statistically significant on a stand-alone basis (**Table 3.4**). Nevertheless, stratifying the total population into two subsets, those with under and above-average total diet quality scores at T1, showed the potential to improve the diet quality of nuts (3.9), legumes (3.8), vegetables (2.7), fruit, (2.0), fat and oils (2.0), and processed meat (2.0). Large differences between the subsets demonstrate the potential to improve the diet quality in this population (**Annex 3.3**).

Two midwifery practices in the intervention group accounted for a large increase in diet quality (**Annex 3.1**), as the diet quality score of women in practice no. 11 increased on average by 12.0 points and of women from practice no. 16 on average by 11.2 points. The range of change in the average total diet quality score among the participating women was -11.3 to 14.0 for intervention practices and -5.2 to 8.4 for control practices.

TABLE 3.4: TOTAL DIET QUALITY SCORE AND 20 COMPONENTS SCORES FOR 342 PREGNANT WOMEN, BEFORE AND AFTER THE POWER 4 A HEALTHY PREGNANCY PROGRAM

DHD Components	Time	Intervention		Control		Difference between groups	
		(Mean (SD)	Median [IQR 25, 75]	Mean (SD)	Median [IQR 25, 75]	Estimate (95% CI)	P
Total score* (range 0-200)	T0	134.9 (17.1)	135.0 [121.3, 146.0]	135.9 (17.3)	135.0 [125.0, 146.3]	4.28 (1.00 to 7.56)	.011
	T1	141.3 (16.3)	141.0 [131.0, 153.0]	137.4 (17.3)	145.5 [127.5, 153.0]		
1 Vegetables	T0	6.4 (2.9)	6.7 [4.2, 9.4]	6.3 (3.1)	6.3 [4.3, 9.7]	0.13 (-0.80 to 1.07)	.779
	T1	6.5 (2.8)	6.8 [4.2, 9.1]	6.1 (3.2)	6.4 [3.5, 9.7]		
2 Fruit	T0	7.6 (2.5)	8.8 [6.9, 10.0]	7.8 (2.5)	8.8 [6.9, 10.0]	0.30 (-0.75 to 1.34)	.578
	T1	8.1 (2.4)	8.8 [6.9, 10.0]	7.7 (2.5)	8.8 [6.9, 8.8]		
3 Whole-grain products	T0	7.1 (2.8)	7.2 [5.1, 10.0]	7.1 (2.7)	6.9 [5.5, 10.0]	0.47 (-0.36 to 1.30)	.264
	T1	7.6 (2.6)	7.8 [6.0, 10.0]	7.6 (2.4)	7.9 [5.8, 10.0]		
Gram	T0	4.5 (1.1)	5.0 [5.0, 5.0]	4.6 (1.0)	5.0 [5.0, 5.0]		
	T1	4.6 (1.0)	5.0 [5.0, 5.0]	4.8 (0.8)	5.0 [5.0, 5.0]		
Ratio	T0	2.6 (2.1)	2.3 [0.5, 5.0]	2.6 (2.1)	2.0 [0.5, 5.0]		
	T1	3.0 (2.0)	3.1 [1.0, 5.0]	2.8 (2.0)	2.9 [0.9, 5.0]		
4 Legumes	T0	5.3 (4.5)	6.5 [0.0, 10.0]	5.5 (4.4)	6.5 [0.0, 10.0]	1.23 (-1.73 to 4.18)	.416
	T1	6.2 (4.3)	8.7 [1.1, 10.0]	6.5 (4.2)	8.7 [2.2, 10.0]		
5 Nuts	T0	4.1 (3.5)	2.9 [1.0, 6.8]	3.7 (3.4)	2.9 [1.0, 5.8]	1.01 (-0.35 to 2.38)	.146
	T1	4.8 (3.7)	2.9 [1.0, 8.7]	4.0 (3.7)	2.9 [1.0, 6.8]		
6 Dairy products	T0	4.1 (2.8)	3.5 [1.7, 6.1]	4.4 (3.0)	3.9 [1.6, 6.5]	0.58 (-0.13 to 1.28)	.108
	T1	5.1 (2.8)	4.4 [3.2, 7.0]	4.6 (2.7)	4.0 [2.5, 6.8]		
7 Fish	T0	4.0 (2.80)	3.9 [2.0, 5.7]	3.7 (3.1)	3.1 [1.3, 5.6]	0.55 (0.07 to 1.03)	.025
	T1	4.6 (2.86)	4.9 [2.0, 6.8]	3.8 (2.9)	3.2 [1.3, 5.4]		
Lean	T0	2.2 (1.68)	1.4 [0.7, 2.9]	2.0 (1.8)	1.4 [0.7, 4.0]		
	T1	2.5 (1.73)	2.9 [1.1, 4.3]	2.1 (1.6)	1.4 [0.7, 2.9]		
Fatty	T0	1.9 (1.7)	1.3 [0.6, 3.8]	1.7 (1.7)	1.3 [0.0, 2.5]		
	T1	2.1 (1.7)	1.3 [0.6, 3.8]	1.7 (1.6)	1.3 [0.0, 2.5]		

8 Caffeine	T0	7.7 (4.2)	10.0 [10.0, 10.0]	8.4 (3.7)	10.0 [10.0, 10.0]	-0.24 (-0.69 to 0.21)	.305
	T1	7.4 (4.4)	10.0 [0.0, 10.0]	8.6 (3.5)	10.0 [10.0, 10.0]		
9 Fat and oils	T0	6.4 (4.5)	10.0 [0.4, 10.0]	6.5 (4.4)	10.0 [1.2, 10.0]	-0.32 (-3.13 to 2.48)	.820
	T1	6.3 (4.6)	10.0 [0.3, 10.0]	6.7 (4.4)	10.0 [1.1, 10.0]		
10 Coffee	T0	8.1 (2.5)	10.0 [5.0, 10.0]	8.4 (2.6)	10.0 [5.0, 10.0]	-0.15 (-0.61 to 0.32)	.530
	T1	7.9 (2.6)	10.0 [5.0, 10.0]	8.2 (2.5)	10.0 [5.0, 10.0]		
11 Red meat	T0	9.5 (1.7)	10.0 [10.0, 10.0]	9.9 (0.5)	10.0 [10.0, 10.0]	0.24 (-1.44 to 1.92)	.783
	T1	9.8 (1.1)	10.0 [10.0, 10.0]	9.9 (0.6)	10.0 [10.0, 10.0]		
12 Processed meat	T0	5.4 (3.4)	5.5 [3.1, 8.3]	5.4 (3.5)	5.5 [2.9, 8.5]	-0.02 (-1.03 to 0.99)	.964
	T1	6.0 (3.3)	7.1 [4.1, 8.5]	5.6 (3.4)	6.4 [2.5, 8.5]		
13 Sugar-containing beverages	T0	6.9 (3.5)	8.3 [4.0, 10.0]	6.3 (3.6)	7.8 [3.4, 9.5]	-0.26 (-0.75 to 0.24)	.305
	T1	7.5 (3.1)	9.1 [5.7, 10.0]	6.8 (3.5)	8.3 [5.0, 9.6]		
14 Alcohol	T0	9.4 (2.4)	10.0 [10.0, 10.0]	9.9 (1.2)	10.0 [10.0, 10.0]	1.29 (-0.09 to 2.67)	.066
	T1	10.0 (0.0)	10.0 [10.0, 10.0]	10.00 (0.0)	10.0 [10.0, 10.0]		
15 Salt	T0	8.5 (1.8)	9.0 [8.5, 9.5]	8.7 (1.5)	9.0 [8.5, 9.5]	-0.19 (-0.65 to 0.27)	.420
	T1	8.7 (1.8)	9.0 [8.5, 9.5]	8.9 (1.4)	9.5 [8.5, 9.5]		
16 Unhealthy choices	T0	3.0 (3.7)	0.9 [0.0, 5.5]	3.3 (3.9)	1.3 [0.0, 6.6]	0.38 (-1.90 to 2.67)	.744
	T1	2.9 (3.8)	0.0 [0.0, 6.3]	2.8 (3.9)	0.0 [0.0, 5.9]		
17 Vitamin D	T0	8.4 (2.9)	10.0 [8.9, 10.0]	7.6 (3.7)	10.0 [5.0, 10.0]	0.48 (0.02 to 0.95)	.043
	T1	8.3 (2.5)	9.4 [7.8, 10.0]	6.8 (3.8)	9.4 [5.0, 10.0]		
18 Vitamin A	T0	8.6 (1.7)	10.0 [6.7, 10.0]	8.7 (1.7)	10.0 [6.7, 10.0]	1.19 (-0.34 to 0.71)	.486
	T1	8.8 (1.7)	10.0 [6.7, 10.0]	8.6 (1.9)	10.0 [6.7, 10.0]		
19 Soy	T0	9.7 (1.7)	10.0 [10.0, 10.0]	9.8 (1.4)	10.0 [10.0, 10.0]	-0.13 (-2.47 to 2.22)	.916
	T1	9.8 (1.3)	10.0 [10.0, 10.0]	9.9 (1.1)	10.0 [10.0, 10.0]		
20 Iodine	T0	4.5 (1.7)	4.4 [3.4, 5.4]	4.5 (1.8)	4.6 [3.3, 5.7]	0.40 (0.20 to 0.61)	.000
	T1	5.2 (1.8)	5.2 [3.9, 6.4]	4.7 (1.6)	4.7 [3.6, 5.8]		

*Folic acid was excluded because supplementation of folic acid is not recommended in the final stage of pregnancy.

EMPOWERMENT

Table 3.5 displays the results for the total empowerment score along with the scores for the 16 individual statements. The average total empowerment score showed a small increase in both the intervention group (T0: mean: 58.0 (SD: 5.7) T1: mean: 59.5 (SD: 4.6)) and the control group (T0: mean: 58.7 (SD: 3.8) T1: mean: 59.5 (SD: 4.4)), with a difference of 0.178 (95% CI: -1.52 to 1.88; $p = .824$).

Women scored high at baseline for most PRES statements, with a mean of 3.8 or 3.9 out of 4.0. However, the scores for PRES statement 12, 'I know if I am gaining the right amount of weight during my pregnancy', significantly differed from the other statements. At baseline, the scores for statement 12 were comparable between the intervention group (T0 mean: 2.9, SD: 0.8) and the control group (T0 mean: 3.1, SD: 0.8). The mean for statement 12 increased more in the intervention group (T1 mean: 3.5, SD: 0.7) than in the control group (T1 mean: 3.4, SD: 0.7), with a difference of 0.69 (95% CI: 0.14 to 1.36; $p = .045$).

SECONDARY OUTCOMES

All secondary outcomes, including QOL, SRH and SOC, showed similar patterns in both groups and remained relatively stable between T0 and T1 and showed no statistically significant differences (**Table 3.6**). No adverse events were reported during the trial.

TABLE 3.5: TOTAL EMPOWERMENT AND 16 COMPONENT SCORES FOR 342 PREGNANT WOMEN, BEFORE AND AFTER THE POWER 4 A HEALTHY PREGNANCY PROGRAM

	Time		Intervention		Control		Difference between groups	
			(Mean (SD))	Median [IQR 25, 75]	Mean (SD)	Median [IQR 25, 75]	Estimate (95% CI)	P
Empowerment – Total score								
	T0		58.0 (5.7)	59.0 [57.0, 61.0]	58.7 (3.8)	59.0 [57.0, 61.0]	0.08 (-0.44 to 0.59)	.771
	T1		59.5 (4.6)	60.0 [58.0, 62.0]	59.5 (4.4)	60.0 [58.5, 62.0]		
Provider Connectedness								
1. I can ask my healthcare provider about my pregnancy.	T0		3.9 (0.5)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]	0.24 (-0.80 to 1.27)	.656
	T1		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.5)	4.0 [4.0, 4.0]		
2. I have enough time with my healthcare provider to discuss my pregnancy.	T0		3.8 (0.5)	4.0 [4.0, 4.0]	3.8 (0.5)	4.0 [4.0, 4.0]	0.32 (-1.24 to 1.88)	.688
	T1		3.8 (0.5)	4.0 [4.0, 4.0]	3.8 (0.5)	4.0 [4.0, 4.0]		
3. My healthcare provider listens to me.	T0		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]	0.17 (-1.96 to 2.30)	.875
	T1		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.5)	4.0 [4.0, 4.0]		
4. My health care provider respects me.	T0		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]	0.10 (-1.62 to 1.81)	.913
	T1		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]		
5. I expect my healthcare provider to respect my decisions about my pregnancy.	T0		3.8 (0.6)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]	0.19 (-1.27 to 1.65)	.797
	T1		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]		
6. My healthcare provider respects my decision, even if it is different from her/his recommendation.	T0		3.7 (0.6)	4.0 [3.0, 4.0]	3.7 (0.6)	4.0 [4.0, 4.0]	.21 (-0.42 to 0.85)	.505
	T1		3.7 (0.5)	4.0 [3.0, 4.0]	3.7 (0.6)	4.0 [3.0, 4.0]		
Skillful Decision-Making								
7. I take responsibility for the decisions I make about my pregnancy like eating healthy food.	T0		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.3)	4.0 [4.0, 4.0]	-0.04 (-1.21 to 1.13)	.947
	T1		3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]		
8. I can tell when I have made a good health choice.	T0		3.6 (0.5)	4.0 [3.0, 4.0]	3.7 (0.5)	4.0 [3.0, 4.0]	-0.33 (-0.88 to 0.23)	.254
	T1		3.7 (0.6)	4.0 [3.0, 4.0]	3.8 (0.5)	4.0 [4.0, 4.0]		
9. Since I began prenatal care, I have been making more decisions about my health.	T0		3.1 (0.8)	3.0 [3.0, 4.0]	3.1 (0.9)	3.0 [3.0, 4.0]	-0.02 (-0.43 to 0.40)	.938
	T1		3.2 (0.8)	3.0 [3.0, 4.0]	3.2 (0.8)	3.0 [3.0, 4.0]		

Peer Connectedness						
10. Women need to share experiences with other women when they are pregnant.	T0	3.4 (0.6)	3.0 [3.0, 4.0]	3.3 (0.8)	3.0 [3.0, 4.0]	-0.27 (-0.81 to 0.27)
	T1	3.4 (0.6)	3.0 [3.0, 4.0]	3.4 (0.6)	3.0 [3.0, 4.0]	.332
11. I share my feelings and experiences with other women.	T0	3.2 (0.7)	3.0 [3.0, 4.0]	3.1 (0.9)	3.0 [3.0, 4.0]	-0.17 (-0.71 to 0.38)
	T1	3.3 (0.7)	3.0 [3.0, 4.0]	3.2 (0.8)	3.0 [3.0, 4.0]	.552
Gaining Voice						
12. I know if I am gaining the right amount of weight during my pregnancy.	T0	2.9 (0.8)	3.0 [2.0, 3.0]	3.1 (0.8)	3.0 [3.0, 4.0]	0.69 (0.14 to 1.36)
	T1	3.5 (0.7)	4.0 [3.0, 4.0]	3.4 (0.7)	4.0 [3.0, 4.0]	.045
13. I have a right to ask questions when I don't understand something about my pregnancy.	T0	3.9 (0.4)	4.0 [4.0, 4.0]	4.0 (0.2)	4.0 [4.0, 4.0]	0.09 (-1.13 to 1.32)
	T1	3.9 (0.3)	4.0 [4.0, 4.0]	4.0 (0.2)	4.0 [4.0, 4.0]	.882
14. I am able to change things in my life that are not healthy for me.	T0	3.6 (0.6)	4.0 [3.0, 4.0]	3.7 (0.5)	4.0 [3.0, 4.0]	-0.10 (-0.85 to 0.65)
	T1	3.7 (0.5)	4.0 [3.0, 4.0]	3.8 (0.4)	4.0 [4.0, 4.0]	.803
15. I am doing what I can to have a healthy baby.	T0	3.8 (0.5)	4.0 [4.0, 4.0]	3.9 (0.4)	4.0 [4.0, 4.0]	-0.45 (-1.04 to 0.15)
	T1	3.8 (0.4)	4.0 [4.0, 4.0]	3.9 (0.3)	4.0 [4.0, 4.0]	.142
16. If something is going wrong in my pregnancy, I know who to talk to.	T0	3.8 (0.5)	4.0 [4.0, 4.0]	3.8 (0.4)	4.0 [4.0, 4.0]	0.07 (-0.72 to 0.86)
	T1	3.9 (0.4)	4.0 [4.0, 4.0]	3.9 (0.3)	4.0 [4.0, 4.0]	.867

TABLE 3.6: SELF-RATED HEALTH, QUALITY OF LIFE AND SENSE OF COHERENCE SCORES FOR 342 PREGNANT WOMEN, BEFORE AND AFTER THE POWER 4 A HEALTHY PREGNANCY PROGRAM

	Time		Intervention		Control		Difference between groups	
			(Mean (SD)	Median [IQR 25, 75]	Mean (SD)	Median [IQR 25, 75]	Estimate (95% CI)	P
Self-Rated Health								
	T0		4.0 (0.7)	4.0 [4.0, 4.0]	4.2 (0.6)	4.0 [4.0, 5.0]	-0.22 (-0.66 to 0.22)	.325
	T1		4.2 (0.7)	4.0 [4.0, 5.0]	4.3 (0.7)	4.0 [4.0, 5.0]		
Quality of Life								
	T0		7.8 (1.5)	8.0 [7.0, 9.0]	8.1 (1.2)	8.0 [7.0, 9.0]	0.15 (-0.36 to 0.66)	.559
	T1		8.0 (1.4)	8.0 [7.0, 9.0]	8.0 (1.2)	8.0 [7.5, 9.0]		
Sense of Coherence – Total score <i>weak</i> (scores 6–9), <i>intermediate</i> (scores 4–5), and <i>strong</i> (score 3)								
	T0		4.2 (1.0)	4.0 [3.0, 5.0]	4.1 (1.1)	4.0 [3.0, 5.0]	0.31 (-0.30 to 0.92)	.323
	T1		4.0 (1.0)	4.0 [3.0, 5.0]	1.8 (0.9)	4.0 [3.0, 4.0]		
- Do you usually see a solution to problems and difficulties that other people find hopeless? (manageability)								
	T0		1.5 (0.5)	1.0 [1.0, 2.0]	1.5 (0.6)	1.0 [1.0, 2.0]	0.06 (-0.54 to 0.66)	.841
	T1		1.4 (0.5)	1.0 [1.0, 2.0]	1.4 (0.5)	1.0 [1.0, 2.0]		
- Do you usually feel that your daily life is a source of personal satisfaction? (meaningfulness)								
	T0		1.4 (0.5)	1.0 [1.0, 2.0]	1.2 (0.5)	1.0 [1.0, 1.0]	0.59 (-0.03 to 1.21)	.062
	T1		1.3 (0.5)	1.0 [1.0, 1.0]	1.1 (0.3)	1.0 [1.0, 1.0]		
- Do you usually feel that the things that happen to you in your daily life are hard to understand? (comprehensibility)								
	T0		1.3 (0.5)	1.0 [1.0, 2.0]	1.3 (0.5)	1.0 [1.0, 2.0]	0.44 (-0.25 to 1.12)	.215
	T1		1.3 (0.5)	1.0 [1.0, 2.0]	1.2 (0.5)	1.0 [1.0, 1.0]		

3.4 DISCUSSION

The present study aimed to quantitatively evaluate the impact of the P4HP programme on diet quality and empowerment among 342 pregnant women through a C-RCT. Our study was among the first to employ a collaborative midwife-dietitian empowerment programme to improve the diet quality of pregnant women. A key finding of this study was the improvement in total diet quality scores within the intervention group compared to the control group, with a difference of +4.3 units. Among the individual components, fish, iodine, and vitamin D intake exhibited significant differences between the intervention and control groups. These outcomes underscore the promising potential of the P4HP programme to positively influence the dietary habits of pregnant women through the use of empowerment as a means. Given the absence of prior research with a similar focus, this research not only contributes to existing knowledge but also highlights the potential for implementing empowerment-based interventions within maternal health contexts.

We found a significant improvement in diet quality, but the clinical relevance of this improvement remains unclear. There is no consistent evidence regarding the extent to which diet quality directly impacts the health of child-bearing women and their offspring (Marshall et al., 2022). However, there is broad consensus that pregnant women need to maintain a balance in body weight and blood pressure, with a nutrient-dense diet significantly contributing to achieving this balance.

This study demonstrated potential food components where the diet quality in this population can be improved. Certain food groups are more prevalent in Dutch dietary patterns than others. For example, adherence to fruit consumption guidelines is generally high, while legumes and nuts are less common in Dutch diets (van Rossum et al., 2023). The greatest differences in diet quality components between groups with below- and above-average total diet quality scores at T1 were evident for nuts, legumes, vegetables, fruit, fat and oils, and processed meat, suggesting the potential for change in these areas. It may be advisable to prioritise these components in nutritional communication.

There is considerable diversity in programmes aimed at improving nutrition behaviour among pregnant women. A systematic review of systematic reviews revealed that behaviour-change interventions have generally been successful in increasing fruit and vegetable consumption and reducing carbohydrate intake during pregnancy (Heslehurst et al., 2020). For example, the educational workshop-based programme ‘The Healthy Start to Pregnancy’ showed improvements in health behaviours such as increased fruit intake (Wilkinson & McIntyre, 2012). In contrast, the women-held record ‘The Pregnancy Pocketbook’ showed no effect on fruit and vegetable consumption (Wilkinson

et al., 2010). The Be Healthy in Pregnancy study, which provided bi-weekly nutrition counselling, led to improved diet quality and protein intake, but did not significantly impact gestational weight gain (Atkinson et al., 2022). Additionally, several studies focusing on managing gestational weight gain have failed to find significant intervention effects (Skouteris et al., 2016; Thomson et al., 2016).

The P4HP programme significantly improved iodine intake in the intervention group. While there are indications that iodine intake is declining across the Dutch population, little is known about iodine intake among pregnant Dutch women (Dinnissen et al., 2022; ter Borg et al., 2023). A large-scale study is ongoing to assess iodine intake among pregnant women in the Netherlands, contributing to the knowledge base in this research area (*Onderzoek Jodium En Zwangeren* | RIVM, n.d.; ter Borg et al., 2023). If this study finds a generally inadequate intake of iodine among pregnant Dutch women, the P4HP programme could be highly relevant, offering the advantage of addressing nutrition comprehensively.

While the P4HP programme incorporated empowerment principles, the similar empowerment scores between groups suggest that the improvements in diet quality may have stemmed from other programme elements, such as the additional repeated nutritional guidance or the collaborative care involving midwives and dietitians. Using the PRES, which evaluates both external and internal attributes of empowerment and their relationship to health outcomes (Leahy-Warren & Nieuwenhuijze, 2023), we found high baseline empowerment scores across most domains, with participants consistently scoring near the maximum of 4, leaving limited room for improvement. However, a notable exception emerged regarding weight gain awareness (statement 12), where the intervention group showed significant improvement. The uncertainty about gestational weight gain was not unique to our study population. Similar patterns have been observed among diverse populations, including low-income pregnant African American and Hispanic women in the United States (Klima et al., 2015).

Research indicates that pregnancy-related weight concerns can influence patterns of gestational weight gain (Heery et al., 2016). For example, a Norwegian cohort study involving 36,000 pregnant women demonstrated that increased worry about weight gain was associated with higher actual weight gain (Swann et al., 2009). The significant improvement in statement 12 ('I know if I am gaining the right amount of weight during my pregnancy') among intervention participants suggests that the P4HP programme effectively addressed this common concern. This improvement occurred despite participants' generally high baseline empowerment levels, indicating that even highly empowered women benefit from structured support regarding gestational weight management. These findings support previous research emphasising the importance of

incorporating interprofessional weight gain guidance into prenatal care programmes, regardless of women's baseline empowerment levels (Guthrie et al., 2020; R. Walker et al., 2019).

The evaluation of the intervention's impact extended beyond diet quality and empowerment by including SOC, QOL, and SRH. This comprehensive evaluation aimed to provide a holistic understanding of the programme's effects on participants' overall well-being. The short duration of this study and the generally high scores at baseline are possibly attributable to the relatively stable QOL, SOC, and SRH in this study. A high SOC for pregnant women is related to better well-being, reduced anxiety and a more favourable predisposition to depression (Ferguson et al., 2014; Sjöström et al., 2004). According to Antonovsky's theory, SOC is a stable disposition of personality, and pregnancy and delivery are not considered radical life events that significantly affect the degree of a woman's SOC (Antonovsky, 1979; Hildingsson, 2017). Indeed, no significant effect was detected in the SOC scores of this study, which is similar to the findings of research among 177 pregnant women in Sweden (Sjöström et al., 2004). However, it is important to note that women whose pregnancies ended or who experienced serious complications dropped out of this study ($n=11$), which may have influenced this outcome. In our study, QOL for women in the intervention group improved on average by +0.2, while for women in the control group, it decreased on average by -0.1. Lagadec et al. systematically reviewed the quality of life of pregnant women, showing a significant decrease in physical QOL throughout the trimesters (Lagadec et al., 2018). Similarly, Boutib et al. reported that QOL in the 9th month of pregnancy was lower than that in the 3rd month (Boutib et al., 2022). Therefore, achieving stability or a slight increase in QOL over such a short time, as observed in the intervention group, represents a positive outcome. While SRH related to pregnancy has been investigated, little is known about changes in SRH during pregnancy (Christian et al., 2013).

Given that empowerment was a key component of the P4HP programme, quantitative measures alone may not fully capture all of its beneficial effects. To gain a more comprehensive understanding, we conducted a complementary process evaluation using surveys and in-depth interviews with pregnant women, midwives, and dietitians. These surveys and interviews aimed to explore individual experiences, programme impacts, and implementation experiences (to be reported separately; see (Van Lonkhuijzen et al., n.d.; Van Lonkhuijzen, Prins, et al., 2025)). This evaluation demonstrated considerable variability in the goals women set for healthier dietary intake, resulting in diverse outcomes across different dietary components.

STUDY STRENGTHS AND LIMITATIONS

This trial has several strengths. Firstly, through this randomised trial, we are pioneering the execution of a programme specifically designed to empower pregnant women to make healthier dietary choices. Secondly, a strength of this pragmatic trial lies in its comparison of a relevant alternative to current practice in real-world settings, thereby providing generalisable results that can be directly applied in routine practice settings.

In addition, several limitations should be considered. The first concerns the timing of baseline measurements. The T0 measurements, taken at approximately week 11, may have missed the earlier pregnancy phase when women's motivation to adhere to dietary guidelines is typically strongest (Wennberg et al., 2013). Earlier measurements were not feasible due to standard Dutch birth care procedures, which include an initial midwife consultation between weeks 8-10, a first ultrasound between weeks 10-12, and a second consultation around weeks 14-16. As a result, study enrolment and the informed consent processes had to align with these standard care timepoints.

The second limitation concerns the characteristics of the study population. While the PRES has been validated previously, our study population showed high baseline empowerment scores, potentially creating a ceiling effect that may have limited our ability to detect changes related to the intervention. This finding raises important considerations for future research. First, it suggests that Dutch pregnant women, particularly those who voluntarily participate in nutrition-focused interventions, may already feel highly empowered in their healthcare interactions. Second, it indicates that future interventions might benefit from more sensitive measurement tools or alternative approaches when targeting highly empowered populations. Rather than viewing this as a methodological failure, we consider it an important insight for the design of future maternal health interventions. Tailored approaches may be needed for populations with varying levels of baseline empowerment, and recruitment strategies may need modification to better engage less empowered populations. This observation aligns with our finding regarding uncertainty around weight gain across all empowerment levels, suggesting that even highly empowered women benefit from specific forms of support during pregnancy.

Third, a notable challenge in the study was the relatively high number of missing values at T1, which reduced the power of the analysis. Throughout the study, researchers reached out to participating women repeatedly through various means, encouraging them to complete the questionnaires. Despite these efforts, many participants did not complete all of the questionnaires, resulting in differences in the percentage of complete datasets across midwifery practices. One possible explanation for this trend is that women in the early stages of their pregnancy may have been more engaged and

motivated to monitor their lifestyle and diet. While in pregnancy, their focus may have shifted to the final preparations for delivery and the arrival of their baby, resulting in decreased participation. Another factor affecting the retrieval of follow-up data is the extent to which the women were reminded by the midwifery practice. To address this, we used the LOCF analysis, which allowed for the inclusion of all participants in the final analysis, ensuring the generalisability of the findings, and showing the robustness of the primary results. However, it is important to note that the LOCF analysis, assumes that the diet quality at T0 is a valid estimate for missing values at T1, which may not always be accurate.

Fourth, baseline BMI was higher in the intervention group, potentially reflecting greater scope for dietary improvements, as suggested by the slightly lower baseline diet quality score. Though all models were adjusted for BMI, BMI data should be interpreted cautiously due to potential reporting errors and its association with dietary misreporting (Trijsburg, 2016), which may affect intervention outcomes. Measuring the self-reported BMI of participating pregnant women proved challenging due to variations in gestational age when completing the questionnaire (Fattah et al., 2009). It is worth noting that weight gain during the first trimester is typically minimal, which may partially mitigate this limitation (Fattah et al., 2010).

Fifth, a methodological consideration was that three midwifery practices were directly assigned to the intervention group based on their interest in nutrition support. While this non-random allocation might suggest potential bias, these practices showed varied outcomes (-11.3 to +11.2 points in diet quality), indicating that practice assignment alone did not determine intervention effectiveness. Rather, these variations highlight how implementation success likely depends on multiple factors, including provider engagement and practice culture.

Finally, the DHD-P has two limitations. First, participants were required to adhere to a traditional Dutch diet pattern in order to be assessed. This may have excluded individuals from migrant backgrounds who do not typically follow this dietary pattern. As a result, the findings may have limited applicability to more diverse populations with different cultural food preferences and eating habits. Future research should explore the effectiveness of motivational interviewing for dietary behaviour change in more heterogeneous samples that better reflect the diversity of the general population. A second limitation is the use of scoring truncation, where each component is restricted to a score ranging from 0 to 10. This constraint limits the index's capacity to capture all variations in dietary habits. Also, no weighting was applied to the nutrient and food components. By weighting, more importance could be given to components that are more relevant for pregnancy outcomes (Kirkpatrick et al., 2018).

IMPLICATIONS AND RECOMMENDATIONS

Our findings have several important implications for practice, policy, and research. The P4HP programme represents a unique initiative that places both empowerment and diet quality at the centre of prenatal nutritional care. While empowerment strategies are still relatively uncommon in nutrition interventions, despite their recognised potential (Brandstetter et al., 2015; Zinsser et al., 2020), our results demonstrate their effectiveness. The improvement in total diet quality scores, particularly for fish, iodine, and vitamin D intake, provides empirical support for empowerment-based approaches in supporting dietary changes during pregnancy.

The significant variation in effectiveness between practices (with improvements ranging up to 14 points) underscores the importance of identifying and sharing best practices among healthcare providers. Moreover, the successful collaboration between midwives and dietitians established in this study provides a valuable model for future collaborative care initiatives. As recommended in research by Beulen et al. (Beulen, Super, et al., 2020), the P4HP programme adhered to key recommendations for promoting healthy dietary intake during pregnancy, including accessibility, personalised guidance, and the incorporation of dietitian consultations. These characteristics align with other successful dietary interventions that have shown small but significant improvements in pregnancy outcomes, including reduced maternal blood pressure and preterm delivery rates (Gresham et al., 2016).

Future research should explore the applicability of these findings among populations with lower income levels than those in the current study, thus broadening the scope of generalisability. Additionally, assessing the cost-effectiveness of the P4HP programme would be valuable for informing broader implementation. From a public health perspective, our findings suggest that empowerment-based approaches could be beneficial in other health promotion contexts, particularly where behaviour change is a primary goal. These approaches could contribute to theoretical frameworks by providing innovative practice-based evidence to support health interventions (Cyril et al., 2016; Zinsser et al., 2020).

3.5 CONCLUSION

Pregnancy often introduces unique psychological and physiological factors that may influence dietary preferences and habits. Recognising the role of maternal nutrition in the health outcomes of both the mother and the baby, our study evaluated the effectiveness of the P4HP programme using a C-RCT among 342 pregnant women. The observed improvement in diet quality underscores the potential of the P4HP programme as an

effective intervention for improving diet quality during pregnancy. This study shows the need for support and counselling regarding weight gain during pregnancy for women of all empowerment levels and presents increased empowerment regarding gestational weight gain in the intervention group. This research lays the foundation for future investigations into the mechanisms through which empowerment can contribute to improved maternal and child health outcomes.

Ethics approval and consent to participate: The study was conducted according to the guidelines of the Declaration of Helsinki. Medical Research Ethics Committee Utrecht (NedMec) granted medical-ethical approval for this study on September 21st 2021 (protocol number 21-526/D). Informed consent was obtained from all study participants.

Funding: This research was funded by ZonMw, The Netherlands Organisation for Health Research and Development and Regiodeal Foodvalley. Because of this, we paid additional attention to recruiting midwifery practices from the eight municipalities in the centre of the Netherlands that compose Regio Foodvalley (Barneveld, Ede, Nijkerk, Rhenen, Renswoude, Scherpenzeel, Veenendaal, and Wageningen). The funders had no role in the conceptualisation, design, data collection, analysis, decision to publish, or preparation of this manuscript.

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ANNEX 3.1: CHARACTERISTICS OF THE MIDWIFERY PRACTICES PARTICIPATING IN THE C-RCT

Nr.	Phase	Group RCT	Randomisation	Number of participant inclusions	Number of participants with complete dataset (no missing at all times)	Mean total diet quality (SD) T0	Mean total diet quality (SD) T1
1 ^{*,***}	Pilot + RCT	Intervention	Directly into intervention group	5+21	10	134.0 (18.1)	138.9 (23.0)
2	Pilot	Not included		3	2	144.0 (26.2)	158.0 (8.5)
3	RCT	Control	Randomised	29	15	133.5 (15.7)	132.1 (18.2)
4 [*]	RCT	Intervention	Randomised	25	20	140.1 (16.1)	144.1 (15.9)
5 [*]	RCT	Control	Randomised	26	14	140.4 (18.4)	135.2 (19.6)
6	RCT	Intervention	Randomised	26	14	138.4 (18.9)	142.3 (13.7)
7	RCT	Control	Randomised	27	14	132.3 (18.4)	140.7 (16.3)
8 ^{**}	RCT	Intervention	Randomised	9	1	133.4 (14.0)	133.0 (15.6)
9	RCT	Control	Randomised	26	14	139.2 (15.4)	135.5 (16.3)
10	RCT	Control	Randomised	20	12	134.7 (19.0)	141.7 (16.4)
11 [*]	RCT	Intervention	Randomised	32	18	126.8 (18.3)	138.7 (15.3)
12 [*]	RCT	Control	Randomised	28	11	135.7 (17.4)	141.3 (16.9)
13	RCT	Intervention	Randomised	26	16	130.5 (16.4)	138.3 (15.7)
14 [*]	RCT	Intervention	Randomised	21	15	140.0 (11.7)	140.4 (13.3)
15	RCT	Control	Randomised	0	0	N/A	N/A
16 ^{***}	RCT	Intervention	Directly into intervention group	14	12	136.5 (13.8)	147.7 (17.9)
17	RCT	Intervention	Directly into intervention group	4	2	144.3 (12.5)	133.0 (N/A)

* located in the area of Regio Foodvalley, one of eight municipalities in the centre of the Netherlands (Barneveld, Ede, Nijkerk, Rhenen, Renswoude, Scherpenzeel, Veenendaal, and Wageningen)

** Midwifery practices with an existing collaboration with a dietitian

*** First two consultations provided by the dietitian

ANNEX 3.2: QUESTIONNAIRES FOR THE POWER 4 A HEALTHY PREGNANCY PROGRAMME

QUESTIONNAIRE 1: SOCIODEMOGRAPHICS , EMPOWERMENT, AND HEALTH

1	Which midwifery practice are you affiliated with?	
2	How many weeks pregnant are you now (approximately)?	
3	What is your first and last name?	
4	What is your phone number ?	
5	What is your email address?	
5	What is your year of birth?	
6	What are the four digits of your zip code?	
7	In which country are you born?	
8	Do both of your parents have the same country of birth as you?	Yes, my parents were both born in the same country as me No, my parents were not both born in the same country as me
8a	In which country was your mother born?	
8b	In which country was your father born?	
9	Do you already have children?	No, I don't have children yet Yes, 1 child Yes, 2 children Yes, 3 children Yes, 4 children Yes, 5 children or more
10	Which training(s) have you completed? (multiple answers possible)	Secondary education Secondary vocational education Higher professional education University education Other
11	Which categories best describe your current employment situation? (multiple answers possible)	I do paid work, per week average (in hours): I do volunteer work (unpaid) I do the housework/I take care of my family I receive benefits I am on the Sickness Benefits Act/WAO Other

12	What is your marital status?	Single Living together Married Divorced Widowed
13	What is your living situation?	I live alone I live with my partner I live with my partner and child(ren) I live with my children I live with other family members Other
14	What is your personal net monthly income?	€1,000 or less €1,001 to €1,500 €1,501 to €2,000 €2,001 to €2,500 €2,501 or more I do not know
15	What is the net monthly income of your household?	€1,000 or less €1,001 to €1,500 €1,501 to €2,000 €2,001 to €2,500 €2,501 to €3,000 €3,001 to €3,500 €3,501 to €4,000 €4,001 to €4,500 €4,501 or more I do not know
16	What is your height in cm?	
17	What is your current weight in kilograms?	
18	I can ask my healthcare provider about my pregnancy.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
19	I have enough time with my healthcare provider to discuss my pregnancy.	Completely disagree Somewhat disagree Somewhat agree Strongly agree

20	My healthcare provider listens to me.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
21	My healthcare provider respects me.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
22	I expect my healthcare provider to respect my decisions about my pregnancy.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
23	My healthcare provider respects my decision, even if it is different from her/his recommendation.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
24	I take responsibility for the decisions I make about my pregnancy like eating healthy food.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
25	I can tell when I have made a good health choice.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
26	Since I started prenatal care, I have been making more decisions about my health.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
27	Women need to share experiences with other women when they are pregnant.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
28	I share my feelings and experiences with other women.	Completely disagree Somewhat disagree Somewhat agree Strongly agree
29	I know if I am gaining the right amount of weight during my pregnancy.	Completely disagree Somewhat disagree Somewhat agree Strongly agree

30 I have a right to ask questions when I don't understand something about my pregnancy. Completely disagree
Somewhat disagree
Somewhat agree
Strongly agree

31 I am able to change things in my life that are not healthy for me. Completely disagree
Somewhat disagree
Somewhat agree
Strongly agree

32 I am doing what I can to have a healthy baby. Completely disagree
Somewhat disagree
Somewhat agree
Strongly agree

33 If something is going wrong in my pregnancy, I know who to talk to. Completely disagree
Somewhat disagree
Somewhat agree
Strongly agree

34 Do you usually see a solution to problems and difficulties that others see as hopeless? Yes, usually
Sometimes
No

35 Do you usually find that things that happen to you in everyday life are difficult to understand? Yes, usually
Sometimes
No

36 Do you usually find your daily life to be a source of personal satisfaction? Yes, usually
Sometimes
No

37 Overall, how do you rate your health status?



38 The scale resembles a thermometer. This means that "10" is the best quality of life you can imagine, and "0" is the worst. Please mark on the scale how you rate your quality of life today.



QUESTIONNAIRE 2: DHD-P

Q	Question	Answer options
1	How many weeks pregnant are you?	Between 0 and 10 weeks More than 10 weeks
2a	Do you use supplements that contain folic acid?	Yes No
2b	how many micrograms (mcg) of folic acid are in a supplement?	less than 200 micrograms 200 micrograms 400 micrograms 600 micrograms or more
2c	How many folic acid supplements do you take per day?	Less than 1 1 2 3
3a	Do you use supplements that contain vitamin D?	Yes No
3b	how many micrograms (mcg) of vitamin D are in one supplement?	less than 5 micrograms 5 micrograms 10 micrograms 15 micrograms or more
3c	How many vitamin D supplements do you take per day?	Less than 1 1 2 3
4a	Do you use supplements that contain iron?	Yes No
4b	Approximately how many milligrams (mg) of iron are in one supplement?	5 milligrams or less 10 milligrams 15 milligrams 20 milligrams or more
4c	How many iron supplements do you take per day?	Less than 1 1 2 3
5	Do you use supplements that contain vitamin A?	Yes No

		I don't eat muesli or (breakfast) grains
6a	How many days a week do you eat muesli or (breakfast) grains, such as oatmeal and corn flakes?	Less than 1 day per week
		1 or 2 days a week
		3 or 4 days a week
		5 or 6 days a week
		Every day
6b	How many tablespoons?	1-2 tablespoons
		3-4 tablespoons
		5-6 tablespoons
		7-8 tablespoons
		9-10 tablespoons
		11 tablespoons or more
6c	What kind of muesli and grains do you eat?	Whole grain without sugar
		Refined breakfast cereals
		Both whole grain and refined breakfast cereals
7	How many croissants and/or currant buns do you eat on average per week?	No
		Less than 1 day per week
		1 per week
		2 per week
		3 per week
		4 or more per week
8a	How much rusk, crispbread or crackers do you eat on average per day?	No
		Less than 1
		1 piece
		2 pieces
		3 pieces
		4 or more
8b	What kind of rusk, crispbread or crackers do you eat?	Usually brown/ whole wheat
		Mostly white
		Both brown/whole wheat and white
9a	How many slices of bread, rolls or buns do you eat on average per day?	No
		1 slice
		2 cuts
		3 cuts
		4 cuts
		5 or more cuts
9b	What types of bread, rolls or buns do you eat?	Usually brown/ whole wheat
		Mostly white
		Both brown/whole wheat and white

10a	Do you usually spread your bread, crispbread or rusk with low-fat margarine, margarine or butter?	No
		Yes
10b	What do you usually spread on your bread, crispbread or rusk?	With low-fat margarine , diet low-fat margarine , diet margarine or margarine
		With (semi-skimmed) butter
		Both low-fat margarine and butter
11a	How many days a week do you eat cheese as a topping?	No
		Less than 1 day per week
		1-2 days a week
		3-4 days a week
		5-6 days a week
11b	How many slices of bread, crispbread or rusk do you top with cheese on such a day?	Every day
		1
		2
		3
		4
		5
12a	How many days a week do you eat processed meats as a topping?	6 or more
		No
		Less than 1 day per week
		1-2 days a week
		3-4 days a week
12b	How many slices of bread, crispbread or rusk do you top with cold cuts on such a day?	5-6 days a week
		Every day
		1
		2
		3
		4
13a	How many days a week do you eat liver products as a topping?	5
		6 or more
		No
		Less than 1 day per week
		1 day per week
		2 days a week
		3 days a week
		4 or more days a week

13b	How many slices of bread, crispbread or rusk do you top with liver products, such as pâté, on such a day?	1
		2
		3
		4 or more
14a	How many days a week do you eat sweet toppings?	No
		Less than 1 day per week
		1-2 days a week
		3-4 days a week
		5-6 days a week
14b	How many slices of bread, crispbread or rusk do you cover with sweet toppings on such a day?	Every day
		1
		2
		3
		4
		5
15a	How many days a week do you drink milk, buttermilk or other dairy drinks without sugar?	6 or more
		No
		Less than 1 day per week
		1-2 days a week
		3-4 days a week
15b	How many glasses/cups of milk, buttermilk or dairy drinks without sugar do you drink on such a day?	5-6 days a week
		Every day
		1
		2
		3
		4
16a	How many days a week do you drink chocolate milk or other dairy drinks with sugar?	5
		6 or more
		No
		Less than 1 day per week
		1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day

		1
		2
16b	How many glasses/cups of chocolate milk or other dairy drinks with sugar do you drink on such a day?	3
		4
		5
		6 or more
		No
	How many days a week do you eat dairy products such as custard, pudding, (fruit) yoghurt, (fruit) cottage cheese or ice cream?	Less than 1 day per week
17a		1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		Less than 1 bowl
		1 bowl
17b	How many bowls of these dairy products do you eat on such a day?	2 bowls
		3 bowls
		4 bowls
		5 or more
		No
		Less than 1 day per week
18a	How many days a week do you use soy drink or soy yogurt?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		Less than 1
	How many glasses/bowls of soy drink/yogurt do you use on such a day?	1
18b		2
		3
		4 or more
		No
		Less than 1 day per week
19	How many plates or cups of soup do you eat on average per week?	1-2 per week
		3-4 per week
		5-6 per week
		7 or more

		No
		Once a month
20a	How often have you eaten legumes in the past month?	2 times a month
		3 times a month
		Once a week
		More than once a week
		1 serving spoon
20b	How many serving spoons of legumes (± 60 grams) do you eat?	2 serving spoons
		3 serving spoons
		4 serving spoons
		5 serving spoons
		6 or more serving spoons
		No
		Less than 1 day per week
21a	How many days a week do you eat boiled or stir-fried vegetables?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 serving spoon
21b	How many serving spoons of vegetables (± 50 grams) do you eat on such a day?	2 serving spoons
		3 serving spoons
		4 serving spoons
		5 serving spoons
		6 or more serving spoons
		No
		Less than 1 day per week
22a	How many days a week do you eat raw vegetables?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		Less than 1 bowl
22b	How many bowls of raw vegetables (of ± 50 grams) do you eat on such a day?	1 bowl
		2 bowls
		3 bowls
		4 bowls
		5 or more bowls

		No
		Less than 1 day per week
23a	How many days a week do you eat pasta?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 serving spoon
		2 serving spoons
23b	How many serving spoons of pasta (± 50 grams) do you eat on such a day?	3 serving spoons
		4 serving spoons
		5 serving spoons
		6 or more
		Usually whole wheat pasta
23c	What type of pasta do you eat?	Usually white pasta
		Both whole wheat and white pasta
		No
		Less than 1 day per week
24a	How many days a week do you eat rice?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 serving spoon
		2 serving spoons
24b	How many serving spoons of rice (± 50 grams) do you eat on such a day?	3 serving spoons
		4 serving spoons
		5 serving spoons
		6 or more
		Usually whole wheat rice
24c	What type of rice do you usually eat?	Mostly white rice
		Both whole wheat and white rice
		No
		Less than 1 day per week
25a1	How many days a week do you eat red meat?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day

		No
		Less than 1 day per week
25a2	How many days a week do you eat processed meat?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		No
		Less than 1 day per week
25a3	How many days a week do you eat chicken and other poultry?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		Less than 1
		1
25b	How many portions do you eat on such a day?	1 ½
		2
		2 ½
		3 or more
26	eat liver?	Yes
		No
		No
		Less than 1 day per week
27a	How many days a week do you eat soy products with a hot meal?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1
27b	How many portions of soy products do you eat on such a day?	2
		3
		4 or more
		No
		Less than 1 day per week
28a	How many days a week do you eat savoury snacks?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day

		Less than 1
		1
28b	How many portions do you eat on such a day?	1 ½
		2
		2 ½
		3 or more
		No
		Less than once a month
29	How often did you eat a portion of lean fish in the past month?	Once a month
		2 times a month
		3 times a month
		4 times a month or more
		No
		Less than once a month
30	How often did you eat a portion of oily fish in the past month?	Once a month
		2 times a month
		3 times a month
		4 times a month or more
31a	Do you usually use fat for the preparation of hot meals?	No
		Yes
	What type(s) of fat do you usually use for the preparation of hot meals? <i>NB. Multiple answers possible.</i>	Butter
31b		Margarine or baking product from a packet
		Margarine or baking product out of a bottle
		Oil
		No
		less than 1 day per week
32a	How many days a week do you eat sauces such as mayonnaise, garlic sauce or ketchup with a hot meal or with savoury snacks?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 tablespoon
		2 tablespoons
32b	How many tablespoons of sauce do you eat on such a day?	3 tablespoons
		4 tablespoons
		5 tablespoons
		6 or more

		No
		Less than 1 day per week
33a	How many days a week do you eat cheese with a hot meal or in between?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1-2 servings
33b	How many portions of cheese do you eat on such a day?	3-4 servings
		5-6 servings
		7-8 servings
		9-10servings
		11 or more
		No
		Less than 1 day per week
34a	How many days do you eat peanuts or nuts?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 handful
34b	How many handfuls of peanuts or nuts (of ± 25 grams) do you eat on such a day?	2 hands
		3 hands
		4 hands
		5 hands
		6 or more
		No
		Less than 1 day per week
35a	How many days a week do you eat chips or snacks?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1-2 handfuls
35b	How many handfuls of chips or snacks do you eat on such a day?	3-4 handfuls
		5-6 handfuls
		7-8 hands
		9-10 hands
		11 or more

		No
		Less than 1 per week
36	How many large cookies, cakes or pies do you eat on average per week?	1 per week
		2 per week
		3 per week
		4 or more per week
		No
		Less than 1 day per week
37a	How many days a week do you eat small cookies or gingerbread?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1-2 pieces
		3-4 pieces
37b	How many small cookies or slices of gingerbread do you eat on such a day?	5-6 pieces
		7-8 pieces
		9-10 pieces
		11 or more
		No
		Less than 1 day per week
38a	How many days a week do you eat chocolate or chocolates?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1-2 pieces
		3-4 pieces
38b	How many blocks of chocolate or chocolates do you eat on such a day?	5-6 pieces
		7-8 pieces
		9-10 pieces
		11 or more
		No
		Less than 1 day per week
39a	How many days a week do you eat fruit?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		Less than 1
39b	How many portions/pieces of fruit do you eat on such a day?	1
		Sometimes 1 sometimes 2
		2 or more

		No
		Less than 1 day per week
40a	How many days a week do you drink fruit juice?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 glass
		2 glasses
40b	How many glasses of fruit juice do you drink on such a day?	3 glasses
		4 glasses
		5 glasses
		6 glasses or more
		No
		Less than 1 day per week
41a	How many days a week do you drink soft drinks, fruit lemonade, sports drinks or energy drinks ?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 glass
		2 glasses
41b	How many glasses of soft drink do you drink on such a day?	3 glasses
		4 glasses
		5 glasses
		6 glasses or more
		No
		Less than 1 day per week
42a	How many days a week do you drink green or black tea?	1-2 days a week
		3-4 days a week
		5-6 days a week
		Every day
		1 cup
		2 cups
42b	How many glasses/cups/cups of green or black tea do you drink on such a day?	3 cups
		4 cups
		5 cups
		6 or more cups
		Virtually always
43	Add sugar or honey to the tea	Sometimes
		Never

		No
		1 cup
44a	How many cups/cups of coffee do you drink on average per day?	2 cups
		3 cups
		4 cups
		5 or more cups
		Coffee made with a paper filter or percolator, coffee pods or instant coffee
44b	What type of coffee do you usually drink? <i>NB. Multiple answers possible.</i>	Coffee from the machine, coffee from cups
		Coffee made with a cafetiere , cooking coffee, Greek or Turkish coffee
		I know not
45	Do you put sugar in your coffee?	Virtually always
		Sometimes
		Never
46	drink alcohol?	Yes
		No
47	Is salt added to potatoes, vegetables, meat, rice or pasta during the preparation of your hot meal?	Virtually always
		Sometimes
		Never
48	Do you add salt, maggi or ketjap to your meal or dish at the table?	Virtually always
		Sometimes
		Never

ANNEX 3.3: DIET QUALITY SCORES OF GROUPS THAT SCORE LOWER AND HIGHER ON AVERAGE DIET QUALITY AT T1, WITHOUT DISTINCTION BETWEEN INTERVENTION AND CONTROL GROUP

Component		DHD≤meanT1 (n=107)	DHD>meanT1 (n=102)	Difference between groups
Total score T1		136.31	163.68	27.37
1	Vegetables	5.05	7.71	2.66
2	Fruit	6.93	8.94	2.01
3	Whole-grain products	7.05	8.19	1.14
4	Legumes	4.47	8.27	3.8
5	Nuts	2.57	6.43	3.86
6	Dairy products	4.99	4.77	-0.22
7	Fish	3.34	5.15	1.81
8	Caffeine	7.38	8.43	1.05
9	Fat and oils	5.46	7.45	1.99
10	Coffee	7.43	8.63	1.2
11	Red meat	9.75	9.91	0.16
12	Processed meat	4.89	6.85	1.96
13	Sugar-containing beverages	6.37	7.99	1.62
14	Alcohol	10	10	0
15	Salt	8.7	8.78	0.08
16	Unhealthy choices	2	3.7	1.7
17	Vitamin D	6.92	8.36	1.44
18	Vitamin A	8.55	8.96	0.41
19	Soy	9.91	9.8	-0.11
20	Iodine	4.61	5.34	0.73



Chapter 4

PREGNANT WOMEN'S EXPERIENCES WITH A COLLABORATIVE MIDWIFE- DIETITIAN EMPOWERMENT PROGRAMME TO IMPROVE DIET QUALITY

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ABSTRACT

Background: Pregnancy is a crucial period prompting increased intentions for lifestyle changes. Suboptimal diet quality during pregnancy can cause adverse health outcomes for both mother and child. The Power 4 a Healthy Pregnancy (P4HP) programme aims to improve the diet quality of pregnant women through empowerment, by providing four additional consultations to discuss nutrition with a midwife and dietitian. This research aimed to study the experiences of pregnant women engaged in the P4HP programme.

Methods: A qualitative study using in-depth interviews was conducted. Participants were recruited through purposive sampling from women who completed the P4HP programme. Semi-structured interviews were conducted using time-lining as an explorative tool. Interview transcripts underwent thematic analysis following Braun and Clarke's six-phase process, combining inductive and deductive coding approaches.

Results: Twenty-two interviews were conducted with women from eight midwifery practices. Four main themes emerged: 1) Women report various dietary improvements, influenced by diverse factors, 2) Most pregnant women evaluate the P4HP programme positively, 3) The dietitian plays a key role in empowering pregnant women towards healthy dietary intakes, and 4) Midwives support pregnant women in maintaining dietary improvements. Participants viewed the P4HP consultations favourably, citing their role in facilitating empowerment by providing personalised guidance and reassurance, as well as by increasing awareness and confidence levels. Motivated by the desire to ensure optimal nutrition for their babies, women reported adopting multiple and various improvements in their diet quality. While the guidance of the midwife served as a motivational factor to sustain these changes, it was the personalised nutritional guidance provided by the dietitian that women found instrumental in achieving actual dietary changes.

Conclusion: Our outcomes emphasise the importance of integrating dietitian consultations in standard antenatal care to promote enhancements in the diet quality of pregnant women.

4.1 INTRODUCTION

Maintaining a healthy diet is essential for everyone, but is especially crucial for pregnant women to ensure the health of both mother and child (Bazer et al., 2004; Procter & Campbell, 2014). Because pregnant women are aware of the importance of the healthy development of their baby, they tend to be more willing to change dietary habits and seek out information regarding antenatal diet (Lindqvist et al., 2017; Phelan, 2010; Super & Wagemakers, 2021; Szwajcer et al., 2012). In a study among 343 Dutch women, 56% of participants reported increased lifestyle change intentions because of their pregnancy (Uzan et al., 2024). Pregnancy can therefore be seen as a teachable moment and vital transition period during which women are more receptive to improving their dietary choices than compared to other life stages.

Poor diet quality during pregnancy increases the mother's risk of gestational diabetes, excessive weight gain, and pre-eclampsia, as well as increasing the likelihood of low birth weight, premature childbirth, or future adverse health outcomes for the child, such as chronic diseases (Cox & Phelan, 2008; Langley-Evans et al., 2022; Ramakrishnan et al., 2012; Stang & Huffman, 2016). According to the World Health Organization (World Health Organization, 2016b), these guidelines include taking adequate energy, protein, vitamins and minerals, obtained through the consumption of a variety of foods, including green and orange vegetables, meat, fish, beans, nuts, whole grains, and fruit. In the Netherlands, specific dietary guidelines tailored for pregnant women have been established (Health Council of the Netherlands, 2021). These guidelines for pregnant women recommend taking adequate amounts of vitamin D, folic acid, iodine, iron, and calcium while advising them to avoid certain food groups, such as alcohol and liver products, for the proper development of the foetus. Adherence to an adequate diet during and before pregnancy is crucial to benefit the health of both the mother and baby, as well as the child's well-being during later life.

Pregnant women in general, and particularly those with low socioeconomic status (SES), struggle to adhere to the dietary guidelines (Blumfield et al., 2013; Caut et al., 2020). Women face several physiological challenges during pregnancy that could hinder healthy eating, such as nausea, cravings, tiredness, and food aversions (Chang et al., 2008; Grenier et al., 2021). In addition, pregnant women can experience multiple barriers: social barriers (e.g., lack of support, peer beliefs); psychological barriers (e.g., habits, emotional stress); cognitive barriers (e.g. lack of knowledge); emotional barriers (e.g. preference); interpersonal barriers (e.g. time, habits); and environmental challenges (e.g. availability of healthy foods) (Chang et al., 2008; Grenier et al., 2021; Sui et al., 2013; Super & Wagemakers, 2021). Considering these multifaceted challenges, supporting pregnant women in adhering to dietary guidelines is important for maternal and foetal

health.

In the Netherlands, midwives are the first informants for pregnant women to discuss nutrition. They perceive themselves as crucial in providing nutritional advice and guidance (Arrish et al., 2017; Beulen et al., 2021), even though nutrition communication is not explicitly mentioned in the counselling recommendations of Dutch midwives (De Boer & Zeeman, 2008). However, due to constraints including insufficient resources, knowledge, and time, midwives often struggle to provide adequate nutritional advice, typically limiting recommendations to general dietary guidelines (Garnweidner et al., 2013; McCann et al., 2018; Super & Wagemakers, 2021). Currently, often only pregnant women with medical issues such as excessive weight gain are routinely referred to a dietitian. However, research shows that low SES pregnant women would appreciate support in achieving a good diet quality, regardless of medical issues (Super et al., 2019, 2021). Therefore, dietitians could bridge this gap in prenatal care, offering their expertise in personalised nutritional guidance (Beulen et al., 2021; Super et al., 2021). Previous research has shown that midwives consider collaboration with other health professionals, especially dietitians, as a good strategy to optimise the provision of nutritional advice (Arrish et al., 2017). Nevertheless, collaboration between midwives and dietitians is currently limited in antenatal care (Beulen et al., 2021).

The Power 4 a Healthy Pregnancy (P4HP) programme has been developed to improve the diet quality of pregnant women through empowerment (Beulen, Super, et al., 2020; Super et al., 2021; Van Lonkhuijzen et al., 2022). To develop the P4HP programme, an iterative research process was undertaken to identify strategies to improve the diet quality of pregnant women. Development of the P4HP programme involved literature reviews, expert consultations, focus groups, and interviews with pregnant women from low socioeconomic status, midwives, and dietitians. In the final developmental stage, three co-creation sessions with stakeholders further improved P4HP with input from various prenatal care providers. As a result, the P4HP programme is a flexibly adaptable programme in which midwives, dietitians, and pregnant women collaborate to improve the diet quality of pregnant women through empowerment. Although initially designed for low-SES pregnant women, the P4HP programme is implemented among women of all socioeconomic backgrounds (Van Lonkhuijzen et al., 2022). The programme facilitates four additional nutrition consultations during pregnancy, with three conducted by midwives and one by dietitians. Midwives and dietitians were equipped with a comprehensive guide for the implementation of the P4HP programme (**Supplementary material 1**). The P4HP programme employs an empowering approach through Motivational Interviewing (MI). MI is a counselling method that recognises women as experts in their own lives, and is used to increase motivation, self-efficacy, and personal control among pregnant women to eat healthily

(Martins & McNeil, 2009; Miller & Rollnick, 2012). This approach aims to support women in making autonomous decisions about their dietary choices during pregnancy, rather than prescribing strict dietary rules. During P4HP consultations, midwives and dietitians used MI techniques to explore women's motivations and barriers regarding healthy eating, assisting them in identifying personally meaningful dietary goals and strategies. A visual conversation tool is employed, enabling pregnant women to mark the food groups they want to discuss during consultations, thereby promoting commitment to dietary improvements (Wileman, 1993). Emphasising a women-centred approach, the P4HP programme supports individual needs and autonomy, stimulating pregnant women to voice personal objectives (Van Lonkhuijzen et al., 2022).

The P4HP programme has been implemented and evaluated using a non-blinded clustered randomised trial (C-RCT) across 16 Dutch midwifery practices including 342 pregnant women. Total diet quality significantly improved in the intervention group, which will be reported elsewhere (Van Lonkhuijzen, de Vries, et al., 2025). It is unknown how pregnant women experience and evaluate the P4HP programme, and why. Studies on empowerment-based programmes aimed at promoting healthy nutrition during pregnancy are scarce (Brandstetter et al., 2015; Zinsser et al., 2020). Currently, similar programmes, utilising empowerment to improve the diet quality of pregnant women, do not exist. The added value of this research lies in its novel focus on evaluating the experiences of pregnant women participating in an empowerment programme aimed at improving diet quality. The objective of this qualitative study is therefore to examine 1) reported changes in diet quality among pregnant women and the factors influencing these changes, and 2) pregnant women's perceptions of the P4HP programme.

4.2 METHODS

STUDY DESIGN

This descriptive qualitative study aimed to explore the experiences of pregnant women who followed the P4HP programme (Jack et al., 2023; Moisey et al., 2022; Van Lonkhuijzen et al., 2022). Participant recruitment and data collection were performed from October to December 2022. Data collection involved in-depth interviews conducted by two researchers. Participation in this evaluation study was voluntary, and participants were free to withdraw at any time without consequences or the need to disclose their reasons. Participants provided written informed consent before each interview.

PARTICIPANT RECRUITMENT

Pregnant women who were participating in the P4HP C-RCT were invited to take part in this follow-up study (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al.,

2022). At the time of recruitment for our study, 212 women were enrolled in the P4HP C-RCT. The C-RCT inclusion criteria required women to be in their first trimester of pregnancy, over 18 years of age, fluent in Dutch, and following a typical Dutch dietary pattern (characterised by one hot meal per day). Women were excluded if they declined to provide informed consent, had severe chronic illnesses (e.g., cancer), or conditions that could affect diet quality (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., 2022). To be included in our study, participants needed to have fully completed the intervention part of the P4HP programme and given informed consent for follow-up research (**Figure 4.1**). We used a purposive sampling method, initially contacting potential participants by phone and sending follow-up emails if there was no response. Participant recruitment occurred in two phases. First, we recruited all women who met the inclusion criteria. Then, we took a more targeted approach, seeking women with specific characteristics that weren't fully represented in the initial sample. Specifically, we reached out to women from two midwifery practices where they received two consultations with a dietitian as part of the P4HP programme, rather than one (Van Lonkhuijzen, de Vries, et al., 2025), to delve deeper into their experiences.

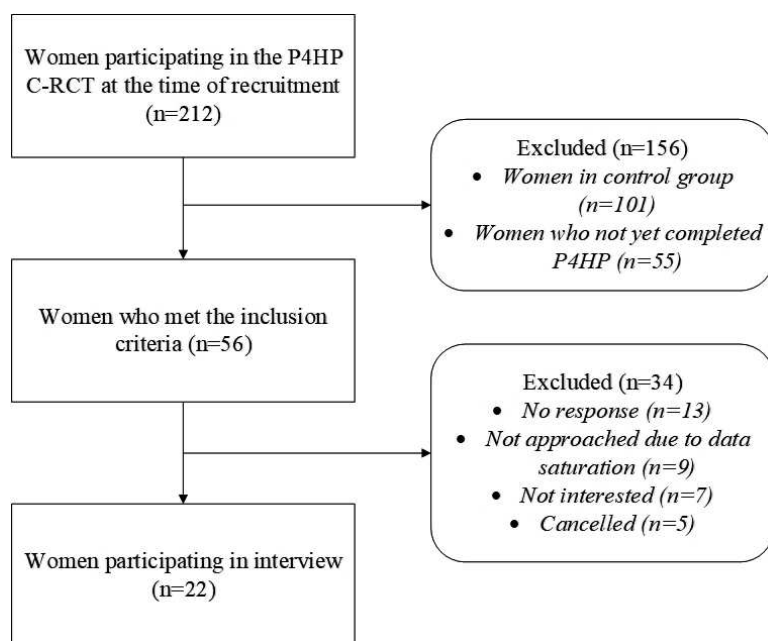


FIGURE 4.1: FLOWCHART OF THE RECRUITMENT PROCEDURE OF THE PARTICIPANTS

DATA COLLECTION

The interviews were conducted by two female researchers (FL and SP), who were MSc students Health & Society at the time and had undertaken training in qualitative research

methodologies. Interviews were audio-recorded using a dictation device and conducted with only the participant and researchers present, who had no prior relationship with each other. FL and SP alternated as the lead and supporting interviewer. To ensure a safe and supportive environment, the interviews were held at the woman's house. Before each interview, participants were informed about the researchers' affiliations and the full purpose of the research. Before starting, the researchers had a brief informal chat with each woman and reiterated that it was acceptable to avoid discussing uncomfortable topics. At the end of each interview, the interviewee received a children's book (~€15) as a token of appreciation.

A semi-structured interview guide was developed after extensive review by all authors (**Annex 4.1**), allowing for open conversation, and enabling researchers to ask probing questions and explore the topics in depth. The interviews began with open-ended questions about the woman's pregnancy experience, followed by questions on significant events during pregnancy, experience with the P4HP programme, perceived diet quality, and empowerment. Questions on diet quality were inspired by the inner circle of the wheel-shaped framework by Super and Wagemakers (Super & Wagemakers, 2021), describing five perspectives on diet quality during pregnancy: 1) health-promoting foods and products, 2) challenges in healthy eating, 3) risky products, 4) strategies for healthy eating, and 5) motivational aspects. For example, for strategies and challenges, we asked: "Did you find it difficult or easy to adhere to this eating pattern, and why?"

To prepare the interviews, the interviewers (FL and SP) read documents about the interviewees to familiarise themselves with the participants. The documents included information, documented by midwives and dietitians during the P4HP consultations, on the participant's goals, motivations, barriers, and strategies. Interview questions were not altered based on this information. The data in these documents corresponded with the findings of the interviews in 21 of the 22 cases. In a single case, the document stated that the woman struggled with healthy eating while, in contrast, the woman said during the interview that she did not struggle and that her pregnancy was actually a motivator for eating healthier.

During the interviews, an explorative timelining tool was used whenever possible to enhance communication, improve data validity and quality, and facilitate the relationship between the researcher and the participant (Glegg, 2019). We drew two parallel timelines on an A3-sized sheet, one for the pregnancy period and the other for the P4HP programme, including time points of the four consultations. The tool served as a visual aid, combined with questions about the woman's pregnancy and consultations, to help her identify "trigger points" that led to changes in diet quality during pregnancy (Adriansen, 2012). To actively engage the women, we asked her to

write the trigger points on the timeline herself, guiding the interview to explain her experience with the P4HP programme and her pregnancy. Field notes were taken during the timelining process and were incorporated into the analysis. Timelining was used in 14 of the 22 interviews. Timelining was not used in case of practical constraints (such as holding a baby or being in an unsuitable environment) or when assessing the tool would not be beneficial for the specific interview situation.

Throughout the data collection period, all authors regularly discussed emerging themes and patterns. After 17 interviews, new data primarily reinforced existing themes rather than generating new insights related to dietary changes, influencing factors, and programme experiences. To confirm this, we conducted five additional interviews, bringing the total to 22 interviews (Braun & Clarke, 2021).

DATA ANALYSIS

The audio recordings of the interviews were transcribed using intelligent verbatim transcription, leaving out filler words (i.e., ‘hmm’ and ‘uh’). Transcripts were then analysed in ATLAS.ti, version (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) using a hybrid coding approach, combining both deductive codes based on existing theoretical frameworks with inductive codes emerging directly from the interview data (Swain, 2018). This approach allowed for systematic analysis while remaining open to new insights. All interviews were conducted and initially analysed in Dutch. Relevant quotes were translated to English by FL and SP and verified by RL and AW to ensure accuracy. For the thematic analysis, we followed Braun and Clarke’s six-phase process (Braun & Clarke, 2006, 2013, 2019; Fade & Swift, 2011) to identify patterns within the data. The transcription and coding processes were done by two researchers (FL and SP) alternately. Initially, the interviews were transcribed to familiarise the researchers with the data. Subsequently, we explored the data by thoroughly reading and rereading the data to identify codes. Using a combination of inductive and deductive coding (Swain, 2018; Swift & Tischler, 2010), we generated initial themes. Deductive codes were based on the wheel-shaped framework by Super and Wagemakers (2021), which included categories such as healthy foods products, strategies and challenges to healthy eating, and the social environment. Next, potential themes were repeatedly reviewed and discussed among authors (RL, SP, FL and AW), with any uncertainties regarding codes or themes resolved through collective consensus. Finally, we present our findings and interpretation of the themes and analysis in the results section.

4.3 RESULTS

A total of 22 women participated in this study, with ages ranging from 25 to 40 years (mean age 31 years). Participants were recruited from eight distinct midwifery practices (A-H) (**Table 4.1**). At the time of the interviews, eight women were pregnant and fourteen were postpartum. The interviews lasted between 26 and 61 minutes, with an average duration of 41 minutes (see **Table 4.1** for detailed participant characteristics). Analysis of the interview data revealed four main themes: 1) Women report various dietary improvements, influenced by diverse factors, 2) Most pregnant women evaluate the P4HP programme positively, 3) The dietitian plays a key role in empowering pregnant women towards healthy dietary intakes, and 4) Midwives support pregnant women in maintaining dietary improvements.

TABLE 4.1: PARTICIPANTS CHARACTERISTICS OF 22 PREGNANT AND POSTPARTUM WOMEN PARTICIPATING IN THE QUALITATIVE EVALUATION OF POWER 4 A HEALTHY PREGNANCY PROGRAMME

Participant	Age	Highest attained education level	Personal monthly net income (€)	Household monthly net income (€)	Average working hours a week	Week of pregnancy (P) /Weeks postpartum (PP)	Number of children	Midwifery practice	Time of interview (minutes)
P1	28	University level education	2000-2500	5000+	28	36 P	1	A	41
P2	29	Higher vocational training	2000-2500	5000+	32	38 P	1	A	61
P3	37	University level education	2000-2500	5000+	40	4 PP	1	B	35
P4	36	Secondary vocational training	Unknown	Unknown	12	36 P	2	C	37
P5	25	Secondary education	2500+	4500-5000	32	5 PP	2	B	40
P6	34	Secondary education	<500	3500-4000	0	5 PP	2	D	26
P7	40	Secondary education	2000-2500	5000+	36	38 P	1	D	44
P8	31	University level education	1000-1500	3000-35000	28	3 PP	2	B	38
P9	34	University level education	2500+	5000+	32	4 PP	1	B	44
P10	26	Higher vocational training	1500-2000	4000-4500	36	6 PP	1	B	38
P11	32	University level education	2500+	5000+	36	12 PP	1	B	43
P12	29	Higher vocational training	2500+	5000+	34	16 PP	1	B	44
P13	40	University level education	2500+	5000+	32	12 PP	1	B	58
P14	36	Secondary vocational training	1000-1500	Unknown	12	4 PP	4	E	44
P15	31	University level education	2500+	5000+	32	36 P	1	F	37
P16	31	Higher vocational training	2000-2500	5000+	24	5 PP	2	G	41
P17	31	Higher vocational training	2000-2500	5000+	36	38 P	1	D	53
P18	29	Higher vocational training	2000-2500	5000+	40	9 PP	1	D	51
P19	26	Secondary vocational training	<500	2000-2500	0	7 PP	6	C	38

P20	28	Higher vocational training	1500-2000	4000-4500	24	36 P	2	E	33
P21	25	Secondary vocational training	1000-1500	3000-3500	20	37 P	2	E	32
P22	29	Higher vocational training	2500+	4500-5000	30	4 PP	2	H	32

THEME 1: WOMEN REPORT VARIOUS DIETARY IMPROVEMENTS, INFLUENCED BY DIVERSE FACTORS

During pregnancy, all 22 women in this study made changes to their diet. On average, women mentioned changing the intake of seven types of foods during pregnancy with a range from three to ten changes per woman. **Table 4.2** presents the primary reported changes in diet quality, explains the change and presents examples of quotes regarding dietary changes. Making dietary improvements was influenced by physical well-being, reasons for changing diet quality, challenges, feelings of responsibility, and the postpartum period.

The diet quality of pregnant women fluctuates during pregnancy, mainly influenced by their physical well-being. Many women experience reduced appetite during the first trimester of their pregnancy, due to nausea, causing them to eat less. As most consultations with the dietitian took place at the end of the first trimester, many women received targeted advice on managing nutrition during nausea, such as consuming crackers or fruit. Later in pregnancy, women commonly experience an increase in appetite, with nearly one-third of the women mentioning they consumed more and smaller portions throughout the day. Pregnant women faced challenges in improving their diet quality due to physical wellbeing issues. Common challenges included nausea and heartburn, leading women to restrict their food intake making it difficult to obtain adequate nutrients. In addition, women commonly face challenges such as cravings and aversions impacted by hormonal changes. Some women developed aversions to healthy foods such as fish or vegetables. In addition, women frequently developed cravings for unhealthy sweet treats, although most women tried to resist indulging in these cravings, striving to find a balance in their diet. Finally, many women experienced temptations during pregnancy, such as the urge to snack or to resist undesirable food groups. These challenges highlight the complex relationship between physical well-being and diet quality during pregnancy.

Pregnant women expressed various reasons for changing their dietary pattern during pregnancy. Firstly, a key driver for many women was receiving trustworthy information or advice, particularly from sources such as the dietitian and the app *Zwangerhap*. The internet in general was identified as a source of conflicting information about nutrition during pregnancy. As a result, women valued the opportunity to receive personal guidance from dietitians. Secondly, pregnancy itself was a strong motivator to start eating healthier. Many women reported maintaining a relatively healthy diet before pregnancy but were motivated to optimise their diet quality during pregnancy to ensure adequate nutrition for their baby's health. Thirdly, women's concerns about their physical appearance played a role in motivating the improvement of their diet quality during pregnancy. Some were driven by a desire to avoid excessive weight gain,

TABLE 4.2: REPORTED PRIMARY IMPROVEMENTS IN DIET DURING PREGNANCY BY PARTICIPATING WOMEN (N=22), WITH EXPLANATION AND EXAMPLE QUOTES

Food product	More or less consumption	Explanation	Example quote
Dairy products	More (n=15)	Women frequently increased their consumption of milk (n=11) and yoghurt (n=11). To provide women with strategies to obtain adequate calcium and protein intake, the dietitian recommended women to consume more dairy foods e.g. by always drinking a glass of (butter)milk or yoghurt drink with a meal, consume a dairy food during a snack moment, or to switch to supplements. Also some midwives recommended taking supplements when women found it difficult to obtain sufficient calcium through their diet.	PW4: "I mentioned that I eat more yoghurt now and she [the dietitian] said I can do that much more. Just like I get a dip around 4 PM, I can also take yoghurt with some muesli for example. That kind of things, as a tip that you can also do that at other times of the day."
Fish	More (n=8)	The dietitian frequently emphasised the importance of eating more fish during pregnancy, primarily to obtain omega-3 fats. Almost every interview included a remark on fish (n=18) and many women started eating more fish or tried to during their pregnancy (n=8). Women experienced challenges regarding fish intake because it is expensive, they don't usually purchase fish, many types of fish are not allowed during pregnancy, or women or partners disliked fish. To provide women with strategies to obtain sufficient omega-3 fats, dietitians advised buying cheaper (frozen) fish from the supermarket, cooking it thoroughly, or choosing alternatives such as nuts or supplements.	PW5: "She [the dietitian] was pleased with what I said about it being difficult to know which fish is safe to eat. It's also quite expensive to go to the fishmonger and get a fresh piece of fatty fish, so I didn't do that often. She said: well then don't buy fatty fish often, but just white fish from the freezer in the supermarket. I thought: oh, it doesn't have to be all or nothing. [...] That's not optimal but it's at least something, so I started doing that."
Supplements	More (n=8)	In addition to taking nutrient supplements targeted for pregnancy, women started supplementing if they struggled with getting enough calcium or fish oil containing omega-3 fats as a strategy to get sufficient micronutrients. This strategy was frequently recommended by the dietitian or midwife, but some women also initiated this themselves.	PW17: "[...] that [the recommended dairy intake] was a lot of glasses of milk, so then I decided to also take calcium supplements because I knew that I would never make it."

Fruit & vegetables	<p>More (n=13)</p> <p>Women frequently increased their fruit and vegetable intake during pregnancy (n=13), with ten women eating more fruit and nine eating more vegetables. Many women became aware of their diet quality through pregnancy and recognised the importance of having an adequate fruit and vegetables intake to meet their nutrient requirements. To provide women with strategies to eat enough fruit and vegetables, the dietitian recommended blending fruit and vegetables into smoothies, eating them as a snack after or between meals, or adding vegetables to sandwich fillings. Other strategies of women were to curb sweet cravings with fruit or incorporate vegetable snacks in their meals</p>	<p>PW18: "I really craved something sweet, and with fruit, I could satisfy that [...]. So I started eating a lot of strawberries and apples, and really sweet fruit like mango."</p>
Water	<p>More (n=9)</p> <p>Many women experienced drinking water as a challenge. Before pregnancy, nine women struggled with this, but during pregnancy women realised the importance of drinking enough water for themselves and for the baby and therefore started doing or attempting to do more. Women faced challenges such as not feeling thirsty or finding drinking water boring. To provide women with strategies to drink sufficient water, dietitians recommended adding a flavour to make water taste better, setting an alarm, or keeping bottles of water in sight. A couple of women replaced soft drinks and coffee with water or tea, as recommended by the dietitian.</p>	<p>PW6: "I also ended up just filling up the fridge eventually with some more flavoured water and things like that, because of the advice [of the dietitian]. Of course, water is pretty boring if you drink that every day."</p>
(Whole grain) bread	<p>More (n=8)</p> <p>Many women were unaware that they required additional nutrition while pregnant. Eight women started eating more whole grain slices of bread, as recommended by the dietitian to feel longer satiated as their appetite increased, to improve nausea, or as a substitute for wheat products or (rice) crackers. Most women followed the dietitian's advice, but a few struggled because they dislike bread or do not eat it regularly. A dietitian recommended storing bread in the freezer as a strategy to make it easy to take bread. Some women had to get used to eating that much bread in a day since it was not a habit.</p>	<p>PW21: "[...] and she [the dietitian] said that I was allowed to eat more whole grain products and bread. Soon after the nausea is gone, you just eat 'normally' again. I think she said to have 3 or 5 slices of bread a day, which I thought was a lot, but apparently it's allowed."</p>
Unsalted unroasted nuts	<p>More (n=7)</p> <p>The dietitian often recommended consuming more unsalted, unroasted nuts, as they are a nutrient-dense food group. In the interviews, these were commonly referred to as "healthy nuts". Almost a third of the women (n=7) consumed more nuts as a replacement for unhealthy snacks or to feel more satiated. However, women frequently encountered challenges such as the fact that nuts are expensive, it is not a habit for them to grab them, they do not like them, or nuts are high in energy.</p>	<p>PW8: "Now I take a small container with me with some nuts and a few raisins to keep it somewhat healthy, and then it's also good because the nuts fill up quite well."</p>

Sugar	More (n=11) or less (n=4)	Eleven women increased the consumption of sugary food products or beverages (including fruit juices) during pregnancy, whereas four women consumed less sugar during pregnancy. Women limited sugar intake because of a sense of responsibility for the baby's health and fear of gaining excessive weight. However, many women admitted that they struggled with sweet cravings, mentioning chocolate in particular. Resisting temptations became increasingly challenging as women's appetites increased throughout pregnancy. To provide women with strategies to cope with temptations and cravings, the dietitian recommended eating more whole grain or dairy products during the day to feel more satiated, to replace sugary drinks with water or tea or to replace sugary food products with healthy snacks women like such as nuts, fruits, or dairy products.	I: "Was it a conscious choice to drink sodas with more sugar before pregnancy?" PW1: "No, I was already drinking it, but more often. So since the onset of pregnancy, I have really started paying attention to limiting it to one glass a day." I: "And what was the reason for you doing that now and not before pregnancy?" PW1: "I think there was a little fear that you will gain a lot of weight."
Risky food products	Less (n=11)	Half of the women explicitly reported consuming fewer unsafe foods during pregnancy, such as raw products, red meat, certain types of fish, and coffee. While no explicit reasons were given for this reduction, the risks of certain food groups are well-known among pregnant women. As consuming unsafe food products was a habit for women, they had to actively avoid them during pregnancy. Women found it challenging to give up these prohibited food groups and looked forward to consuming them again after pregnancy. Almost all women consulted <i>Zwangerhap</i> from The Netherlands Nutrition Centre, a mobile application to check whether food products are safe to eat during pregnancy, if they were uncertain whether particular foods were safe to consume during pregnancy. Most women found the app clear enough, but some discussed ambiguities with the dietitian such as how to handle certain types of cheeses. Besides, the dietitian recommended how to consume certain unsafe food products by heating them properly or looking for alternatives.	I: "If you had any doubts about the Zwangerhap app, did you discuss that with the dietitian?" PW15: "Yes, I remember we talked about cheese as well, because it's not always clear which ones are okay and which ones aren't. For example, if you heat it, is it safe or not? These are the kinds of things you can't find on the internet very well [...]. So it was great that I could ask her."

particularly those who had previous pregnancies or were already concerned about weight gain before conception. On the contrary, others wanted to relieve the pressure of strict dietary control during pregnancy, arguing that weight gain is an unavoidable aspect of pregnancy or that obsession over a balanced diet can become overwhelming. For example, one woman stated:

PW9: “[...]on top of that, when you’re pregnant you’re very focused on the things you’re not allowed to eat, you already get enough stress from that. And if at some point you have to start stressing about the things you do need to eat, eating just isn’t fun anymore. So at some point, I let it go a bit.”

Improving diet quality was accompanied by several challenges and strategies, despite the awareness of the significance of good diet quality and the motivation women felt because of the P4HP consultations and the baby’s health. First, making substantial changes in dietary choices was often experienced to be difficult because of certain habits or dislikes, whereas many women found it easy to make small changes in dietary intake. Consequently, for most women, it was valuable to receive guidance from a dietitian to obtain targeted advice on tackling these challenges. Second, for women on maternity leave, disrupted daily routines posed challenges. Some women became more prone to unhealthy snacking more to boredom, while others used the opportunity to focus on healthier eating habits and meal preparation. Third, women perceived the family environment as both a challenge and a strategy for improving their diet quality during pregnancy. A prevalent coping strategy involved creating a healthy home food environment by avoiding stocking unhealthy foods. However, social events such as holidays, birthday parties, or dining out provided additional challenges. As women often take responsibility for the family diet, they consider the preferences of other family members. As a result, partners or children may tempt them to eat unhealthy foods for example because they prefer fast foods. In addition, if their partner or children dislike healthy foods, such as fish or vegetables, they avoid preparing them. The family environment also acted as a strategy, as some women started eating healthier to set a good example for their children or to provide them with adequate nutrition.

PW11: “Yeah, what also really helped was that my boyfriend was really supportive. He is also into healthy things, so it’s great that you don’t have to do it all by yourself. He also says things like ‘let’s make a salad’ or ‘let’s just cook’ if I want something unhealthy for dinner.”

PW16: “I feel the responsibility to eat healthily, also for the other children. You set a good example. I really want them to enjoy everything, and also understand the value of healthy eating, not only now but also later.”

Almost all women perceived their dietary intake as solely their responsibility, often taking charge of the grocery shopping, and cooking regularly. Women started to think about their diet quality and came up with strategies for independently improving it since they felt a strong feeling of responsibility for the health of their unborn child. Nine women reported dietary changes that were self-initiated rather than prompted by a dietitian or midwife. These changes sometimes were based on their own perceived knowledge or from information they found online. For example, concerns about potentially inadequate intake of nutrients by their children led to these dietary adjustments. However, women did not want to be too restricted regarding their dietary intake, allowing some flexibility.

PW3: "I think it is my responsibility. I'm pregnant, so I influence what he [the baby] gets in. So, I definitely think it's my responsibility."

While nearly all women viewed their dietary intake as their responsibility, three women explicitly mentioned their partner as sharing in this responsibility. Particularly shared meals and grocery shopping were perceived as joint responsibilities. Twelve women were supported by their partners regarding their dietary intake practically, such as by cooking or grocery shopping, and emotionally. Partners attended consultations, often reassured the women about their dietary intake, and encouraged healthy eating habits. However, one woman did not feel supported by her partner. During grocery shopping, she would sometimes become emotional when faced with foods she could no longer eat due to pregnancy food safety guidelines. In response, her (PW6) partner's dismissive remarks, such as "don't be so moronic" made her feel judged and unsupported.

PW7: "So yes, it is a shared responsibility, because we have dinner together. But the rest of the day, of course, it's my responsibility. So, it's a little bit of both."

Pregnant women who had not yet given birth expressed a desire to sustain a good diet quality postpartum and intended to follow the dietitian's recommendations recognising the importance for their own and their children's health. All fourteen postpartum women experienced responsibility for additional changes in dietary intake in the postpartum phase, for example when breastfeeding. As they recognised that having a baby is a life-changing event, many women underestimated the impact of this period and reported the need to re-establish a regular daily routine. Some reported that sustaining a good diet quality during the postpartum phase was more challenging than during pregnancy, due to factors such as increased appetite from breastfeeding, sleep deprivation, time constraints, and irregular schedules. In addition, many women lacked external motivation to eat healthily for the baby, making them prone to reverting to previous eating habits. However, the prospect of future breastfeeding or providing nutritious meals for their child motivated some women to maintain a healthy diet.

PW11: “After breastfeeding, I think [healthy eating] will continue because she will also start eating and you want her food to be healthy. And you also think about the better your immune system is, the fewer diseases you will pass on, so there’s a motivation behind it.”

THEME 2: MOST PREGNANT WOMEN EVALUATE THE P4HP PROGRAMME POSITIVELY

Sixteen women experienced the P4HP programme as positive. Women expressed gratitude for the emphasis on healthy eating during pregnancy because they recognised their responsibility for the baby’s health. The benefits of the P4HP programme extended beyond pregnancy; they contributed also to maintaining good dietary habits in the postpartum period. Almost half of the women perceived the consultations as a motivation to change their diet because they knew their diet would be a topic of discussion. This prompted them to reflect on and become aware of the significance of their diet quality.

PW4: “Yes, and from then [the moment the midwife asked if she wanted to participate] I thought okay, then I’m just going to try to pay attention [on healthy eating] from now on. And the dietitian made it more clear what I’m doing it for”.

The empowering style of consultation was experienced positively. Women received personalised nutritional advice tailored to their specific needs, which made them feel heard and understood. This strategy provided confidence and reassurance in their dietary choices, with the dietitian often confirming that they were generally eating well.

PW5: “It was nice to hear from the dietitian that it’s fine to snack in the evening [...] and because I got some peace of mind from that, I have been snacking less.”

Four women were neither distinctly positive nor negative of the P4HP programme, mainly due to their belief of having a diet of good quality requiring only minor adjustments. However, they acknowledged the importance of the P4HP programme for others who may benefit more from it. They made various suggestions for improvement, such as additional consultations with the dietitian, more in-depth nutrition conversations with the midwife, and group-based implementation of the P4HP programme to foster mutual accountability and motivation.

Two women were not satisfied with the P4HP programme and consultation style, mainly due to differing expectations. One woman preferred more frequent consultations with the dietitian and a larger focus on knowledge transfer about maintaining a healthy diet during pregnancy. The other woman, who had maintained an extremely healthy diet before her pregnancy, was not satisfied with the P4HP programme since she preferred

more extensive discussions and a stricter approach.

PW12: "I thought if it [the P4HP programme] keeps me eating healthily during the whole pregnancy and I will be able to resist cravings, that would be great. But that wasn't the case. Maybe there needed to be more conversations [...] and a better overall view, and for someone to explicitly say: 'You absolutely need to resist that because it's not good for you'."

In total, nineteen women recommended the P4HP programme to other pregnant women, regardless of their own experiences, whether positive, negative, or ambivalent, with the programme. Although almost all women indicated that the P4HP programme was valuable to them, many women perceived that it could be more relevant to other pregnant women. For example, they suggested that the P4HP programme might be particularly beneficial for pregnant women with low SES, poor dietary intake, or those unaware of their intake. Interestingly, most of these participants perceived themselves as already being aware of their dietary intake and their diet quality as healthy and varied. Therefore, some did not consider themselves as the target group for the P4HP programme. Nevertheless, they endorsed the P4HP programme, believing it could raise awareness among other pregnant women of their dietary intake.

PW13: "The consultation with the dietitian was particularly memorable and helped me a lot. It was very relevant to me, which was funny because I also realised that maybe I wasn't really the target audience for the study. I know, or thought I knew, what good nutrition is and making conscious choices in that. I always have. I can imagine that the study is aimed more at people who have trouble making good choices and maybe need more support in that. Therefore, I thought I was not really the target group at all, but in the end, I got a lot out of it."

THEME 3: THE DIETITIAN PLAYS A KEY ROLE IN EMPOWERING PREGNANT WOMEN TOWARDS HEALTHY DIETARY INTAKES

Participants experienced the role of the dietitian as very valuable and therefore perceived the consultations positively. The main reason for this positive perception was that the consultations heightened the awareness of all women, prompting reflection on their nutritional behaviour. Through these consultations, the dietitian provided new insights with specific and practical dietary advice, empowering participants to make healthier food choices. Additionally, half of the participants liked to be reassured by the dietitian about their nutritional behaviours and dietary intake, also because of the responsibility the women felt towards their baby's health.

PW19: “The consultations made me extra conscious of what you’re eating, when you’re eating, and what you’re doing it for. You already know that, and you do it, but you’re extra mindful and extra careful.”

Moreover, fifteen participants experienced it as pleasant that the consultation helped them to gain more confidence in their dietary intake. This enhanced confidence was often due to the provided reassurance and confirmation by the dietitian. As a result, gaining confidence positively affected women’s feeling of being in control of dietary intake.

PW12: “I always had the fear of, what if I get fat and I can’t get it off? Being too fat has always been a thing for me, so that’s my insecurity. But the dietitian said, ‘You are already well on your way, just keep it up’. That was good to hear.”

The empowerment aspect of the consultations was also experienced positively by the participants, as women experienced that their situation and capabilities were taken into account by the dietitian. In addition, some women appreciated being in control during the consultations. For example, they found it beneficial to address their challenges such as cravings and nausea, and discuss topics of personal importance during the consultations. In addition, the dietitian considered the individual nutritional needs of the women and provided, based on this, personalised information. This increased their nutritional knowledge, which was experienced positively. This personalised information mainly consisted of practical and concrete advice or strategies that were easily applicable. By giving such tailored guidance, the dietitian supported changes in diet quality for almost all women increasing their perceived control over their dietary intake. Women perceived the nutritional expertise of the dietitian as positive and trustworthy, appreciating the increase in their nutritional knowledge. Some considered the dietitian more trustworthy regarding nutritional knowledge than the midwife, as the midwife’s knowledge was often perceived to be more basic, while the dietitian had received specialised education in nutrition.

PW11: “She said, as your pregnancy progresses, more nutrients will go to the baby, leading you to build up a deficit. So it was nice to get some explanation and advice at the same time, because she gave me very concrete advice (...). That’s what I like most, that you don’t just get some advice or vague tips or things like that, but that it is very concrete.”

Eight participants, especially postpartum women, mentioned a wish to have more consultations with the dietitian. These additional consultations could be valuable for evaluating the woman’s dietary intake and reflecting on the advice given by the dietitian. Additionally, considering that the nutritional needs of pregnant women vary across

pregnancy trimesters and dietary preferences may change throughout the pregnancy, some women advocated for a consultation with the dietitian per trimester. These extra consultations would allow the woman to ask the dietitian more questions, discuss challenges throughout pregnancy, serve as a motivation for maintaining dietary changes, and provide more reassurance. An additional consultation dedicated to, or during the breastfeeding phase with the dietitian would be appreciated since nutritional needs change again during this phase. This was neither discussed during the dietitian nor the midwife consultations. Specific barriers during the postpartum phase were experienced, such as lack of time, lack of sleep, and an increased appetite. Therefore, it would be appreciated to be able to discuss such challenges and barriers during both pregnancy and postpartum periods with the dietitian.

PW18: "(...) Especially when your stomach is getting smaller, you just can't eat as much, but it's still important to get good nutrients in, and I think that the transition between your second and third trimester might be a good time to have another conversation with a dietitian to talk about, 'I'm going to eat less now, how can you best accommodate that, what kind of product can you eat best?' Especially in your eating pattern at that time."

PW9: "For me eating after pregnancy was maybe even more challenging, because when you're breastfeeding you need a lot of extra calories. I noticed that in the first 4 weeks after giving birth, I started eating unhealthier at that point, purely to get your calories in."

Six women in this study had two consultations, instead of one, with the dietitian. Four of them explicitly reported this extra visit as helpful. Having two consultations with the dietitian was experienced positively as the second visit allowed for reflection on the first consultation. In addition, the follow-up consultation allowed them to tackle any challenges encountered since the first consultation, and explore additional strategies to improve diet quality. One woman preferred scheduling the second session later in pregnancy because of evolving nutritional challenges.

PW17: "Having two dietitian consultations was good, because in the first one, we talked more about what I could do better, and in the second one we talked about whether it worked. And if it didn't work out, you can get new tips on how to do it. Though another consultation might be helpful, because you can fall back into your old habits."

THEME 4: MIDWIVES SUPPORT PREGNANT WOMEN IN MAINTAINING DIETARY IMPROVEMENTS

All participants experienced the consultations with the midwife positively, as they often reminded them to stay aware of their dietary intake and any adjustments made. This

motivated women to maintain a healthy dietary intake. Women appreciated being reassured or confirmed by the midwife, and some women explicitly stated that these interviews made them more aware of their dietary choices. They reported experiencing control over the discussion topics during the consultations. Participants also perceived that the midwife considered their personal situation, challenges and abilities when discussing dietary intake.

PW5: “During the conversations with the midwife, it came up, of course, and it was a moment of ‘oh yeah, that’s what the dietitian said, I’ll pick that up again.’ I experienced that as positive.”

PW11: “You had to think for yourself beforehand about your questions, so that helps you think about what my questions are, or what is bothering me. And I thought that that was the case for both the midwife and the dietitian, that they did ask ‘What are your questions or what are you still struggling with, what do you find difficult or what is going well?’ So that was good.”

While the participants generally experienced consultations with their midwife positively, many perceived them to have a smaller impact on their dietary intake than the consultations with the dietitian. During reflection consultations around the 22nd and 32nd weeks of pregnancy, dietary intake was often briefly addressed, before the midwife continued with the remainder of the consultation and physical check-ups. In general, the consultation with the midwife was remembered in less detail compared to those with the dietitian. However, the midwifery consultations were experienced as helpful reminders of topics discussed with the dietitian, leading to increased awareness and sustained improvements in diet quality:

PW15: “The two follow-up consultations with the midwife were very short conversations. She asked a few times how it had been with the dietitian and if I had gotten anything out of it. (...) But they didn’t amount to much. It was more like, ‘did it help you’, ‘yes’, ‘how exactly’, and she wrote that down and that was it.”

Three participants experienced insufficient coordination between the midwife and the dietitian. For example, similar questions were asked during the consultations with both healthcare professionals. These women expressed that the consultations with the midwife could have been more valuable had she been better briefed on the content of previous dietitian consultations. This would have allowed more meaningful reflection and discussion regarding participants’ dietary intake and changes.

PW14: "It didn't seem like the midwife was aware of the information from the dietitian, I had to tell them again what I had discussed with the dietitian because she asked about that, but then I had to explain it again. If the midwife had been more aware of what was discussed, I think they could go deeper into other things, if they had thought about that beforehand."

4.4 DISCUSSION

This study explored pregnant women's experiences with the P4HP programme and its impact on dietary behaviours during pregnancy. All participating women made dietary improvements during pregnancy, primarily promoted by their baby's health. The P4HP programme was positively evaluated by most participants, with women particularly valuing the personalised nutritional guidance from dietitians and the supportive role of midwives in maintaining dietary changes. Importantly, the programme successfully employed an empowerment approach, increasing women's awareness and confidence in making dietary choices through reassurance and confirmation from a midwife and dietitian.

Pregnant Dutch women participating in the P4HP programme significantly improved their diet quality (Van Lonkhuijzen, de Vries, et al., 2025). Women in this study reported increased consumption of dairy products, fruits, vegetables, fish, and water, while omitting unsafe foods and making changes to sugary food intake. However, women faced challenges from conflicting online information. This was also shown previously in a study by Super et al. (Super et al., 2021) that highlights the significant role of dietitians in raising awareness about the importance of diet and promoting meaningful dietary changes. A systematic review by Hanifi et al. (Hanifi et al., 2024) showed a lower prevalence of low birth weight and preterm infants when dietitians were involved in antenatal care. Given the positive impact dietitians can have on dietary change during pregnancy (Di Carlo et al., 2013; Wennberg et al., 2013), and considering these reported challenges, additional dietitian consultations during pregnancy and in the postpartum phase could be beneficial to address nutrition challenges during these critical periods.

Both dietitians and midwives contributed significantly to women's experiences of empowerment. Dietitians provided detailed nutritional guidance, while midwives reinforced and supported preferred dietary changes over time. The strong positive response to dietitians' personalised guidance likely reflects their professional training in MI (Martins & McNeil, 2009; Miller & Rollnick, 2012; Super et al., 2021). This complementarity suggests that the collaboration between differently trained professionals may strengthen the programme's effectiveness. Although midwives have rarely been involved in behaviour change programmes (Zinsser et al., 2020), our findings indicate

that their contribution to the P4HP consultations was valuable. Midwives helped increase pregnant women's awareness and strengthened their dietary confidence through reassurance and confirmation. As Szwajcer et al. (2012) argue, "hot awareness is more than cold knowledge" – when women value healthy eating and receive thoughtful guidance, this "hot" awareness leads to more active monitoring of eating habits.

However, midwives face several barriers in providing nutritional support. McCann et al. (McCann et al., 2018) found that midwives often lack confidence in delivering pregnancy-specific dietary advice. There is limited information on nutrition training in midwifery education programs (Arrish et al., 2014). Consequently, pregnant women in developed countries often receive inadequate nutrition advice (Lucas et al., 2014). Despite these challenges, our findings suggest that when midwives collaborate with dietitians, their ongoing supportive relationship with women can effectively reinforce and sustain the specialised dietary guidance provided by dietitians. Our findings align with Abayomi et al. (Abayomi et al., 2020) in demonstrating that women want positive, practical dietary guidance focused on achievable actions rather than dietary restrictions. This emphasises the need for collaborative care between dietitians and midwives, where dietitians provide their specialised nutritional expertise while midwives leverage their unique patient relationship to reinforce and sustain dietary changes. Together, this combined approach creates an empowering environment that supports pregnant women in achieving and maintaining positive dietary changes.

Participants reported heightened awareness and confidence about their dietary intake because of the P4HP programme, indicating they felt empowered to adopt a healthier diet. This increase in confidence often came from reassurance and confirmation by health professionals. These experiences align with Tengland's (2008, p.90) definition of empowerment in a professional setting: *"A change (internal or external to the person) is an increase in empowerment if (if and only if) it is an increase in the person's control over the determinants of her quality of life, through (necessarily) an increase in either health (e.g., through self-confidence, self-esteem, self-efficacy, autonomy), or knowledge (self-knowledge, consciousness-raising, skills development, competence), or freedom (negative or positive)".* While most women appreciated this empowerment-based approach, a minority preferred a more strict and educational approach, with dietitians providing detailed information or advocating for specific dietary restrictions. This variation in preferences aligns with Tengland's (2008) statement that empowerment can be achieved through various processes such as recommending, suggesting, encouraging, and informing, depending on the caregiver's influence and the power balance between caregiver and client. Therefore, we recommend that both dietitians and midwives tailor their empowerment strategies to individual preferences, flexibly adapting their approach both within and between consultations to enhance the effectiveness of nutrition guidance during pregnancy.

This research advances both scientific understanding and clinical practice by demonstrating the effectiveness of an empowerment approach to improving diet quality during pregnancy. While education has traditionally dominated health behaviour interventions for pregnant women, our findings support previous research indicating that knowledge alone is insufficient (Arlinghaus & Johnston, 2018; Nutbeam, 2000; Zinsser et al., 2020). Currently, midwives' nutrition guidance typically focuses narrowly on food safety issues rather than comprehensive healthy eating strategies (Garnweidner et al., 2013), despite evidence that consistent attention to healthy eating can foster sustained nutritional awareness and eventually lead to automatic responses (Aarts & Dijksterhuis, 2000). While midwives are ideally positioned to provide ongoing nutritional guidance, they often lack the necessary resources, knowledge, and time (Arrish et al., 2014). These limitations underscore the need for innovative approaches to nutrition communication in maternal healthcare.

A promising approach to enhance nutrition support in antenatal care is CenteringPregnancy, which offers empowering group sessions that provide peer support and motivation for maintaining healthy dietary habits (Carlson & Lowe, 2006; Rising, 1998). However, recognising that group consultations may not suit all women's comfort levels or communication preferences, we advocate for a flexible, collaborative model between midwives and dietitian that can accommodate individual needs. This collaboration allows midwives and dietitians to leverage complementary expertise (Beulen et al., 2021; Super et al., 2021), particularly when supported by physical proximity to facilitate access, and reduce barriers to nutritional guidance.

STUDY STRENGTHS AND LIMITATIONS

A first strength of this research is the qualitative design used to study pregnant women's experiences with and perceptions of the P4HP programme, providing a detailed understanding of mechanisms behind changes in diet. Second, achieving data saturation enhances the robustness of this research. Third, conducting all interviews in the women's homes provided a confidential and familiar environment allowing women to feel secure and share personal information, thereby facilitating a deeper understanding of experiences and perceptions (Borbasi et al., 2002). Fourth, the information discussed during the P4HP consultations corresponded to information discussed during the interviews for all but one woman. This suggests that the information shared during the interviews was reliable and that the women were open and honest during the interviews.

A limitation of this study is the restricted generalisability of its findings due to the characteristics of the participant group. The study primarily comprises a group of relatively highly educated and motivated individuals. Many participants reported maintaining a fairly healthy and varied diet before pregnancy and perceived themselves

as already being well-informed about their dietary intake. As pointed out by several interviewees, the fact that pregnant women with low SES experience more barriers and have more to gain as they tend to have lower diet quality to begin with, this group may particularly benefit from the P4HP programme. In line with this, a limitation of our study was the requirement for participants to follow a traditional Dutch dietary pattern, which may have excluded individuals with migrant backgrounds who maintain different cultural food practices. This criterion possibly limited the diversity of experiences and perspectives captured in our interviews. As a result, the findings derived from this specific sample may not be broadly applicable or reflective of the entire study population, thus limiting the external validity of the study. Future research could explore the experiences of pregnant women from various cultural and economic backgrounds with the P4HP programme, as their needs, challenges, and preferences may differ from our study population.

Before conducting the interviews, it was expected that employing a visual aid and allowing the interviewee to contribute to a timeline would foster a collective process triggering collective memory and enhancing the participant's ownership (Adriansen, 2012). However, a limitation was that the timelining tool did not always have the intended effect because women's experiences and changes in diet quality were already well-established in their minds due to the relatively short and unique event of pregnancy. In addition, the researchers were more active in completing the tool than the participants, who frequently forgot to record important topics. With time-lining often being used for life history research (Adriansen, 2012), the relatively short duration of pregnancy may have contributed to this ineffectiveness. Another reason was that some participants were occupied with caring for their babies, making it impractical for them to write on the timeline. Nevertheless, the tool was helpful for the researchers to ask questions about the different consultations in chronological order, thereby structuring the interview, and enabling more in-depth explorations of consultations separately. In future research, timelining could therefore be a valuable aid to assist interviewers.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

Based on our findings, we recommend several key changes to improve antenatal care. First, we advocate for the integration of dietitian consultations into standard antenatal care, ideally each trimester of pregnancy and extending into the postpartum period. The complementary roles of dietitians and midwives highlighted in our study could inform updated antenatal care guidelines, emphasising the importance of structured nutrition consultations throughout pregnancy. Implementing these recommendations will require policy changes, particularly regarding insurance coverage for nutritional care, and should be supported by further research. Future studies should evaluate the cost-effectiveness of integrated dietitian services, explore strategies for establishing sustainable collaborative

care models, and assess the long-term impact of the P4HP programme on maternal and child health outcomes. This comprehensive approach has the potential to significantly improve nutritional support for pregnant women and ultimately enhance maternal and child health outcomes.

4.5 CONCLUSION

This study investigated the experiences of pregnant women who participated in the P4HP programme, including reported changes in diet quality, factors influencing these changes, and the pregnant women's perceptions of the P4HP programme. Overall, pregnant women perceived the P4HP programme positively as they raised awareness, reassurance and confirmation regarding the quality of their dietary intake, thereby increasing their confidence. Even though all pregnant women reported making changes to their diet during pregnancy to improve their and their baby's health, they encountered challenges in sustaining these changes, including after childbirth. Although the consultations with the midwife motivated them to sustain changes, it was the dietitian who provided personalised nutritional advice that made women aware of their diet quality, offered them new insights, and boosted their confidence and reassurance. The P4HP programme demonstrates the potential of collaborative, empowerment-based approaches to improve prenatal nutrition. While our findings advocate for the integration of dietitian services into routine antenatal care, successful implementation will require addressing systemic barriers and ensuring accessibility for all socioeconomic groups. Based on the findings, we recommend incorporating dietitian consultations as part of standard maternal healthcare to promote lasting improvements in diet quality.

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Ethics statement: The research was approved by the Medical Research Ethics Committee Utrecht on September 21st 2021. Participation in this study was voluntary and participants were free to withdraw at any time without consequences or the need to disclose their reasons. Participants provided written informed consent before each interview.

ANNEX 4.1: INTERVIEW GUIDE

1. Warm-up questions:
 - a. How are you doing?
 - b. What is your family composition?
 - c. How did you experience your pregnancy?
2. Introducing timelining-tool
3. General information pregnancy-timeline
 - a. How did you experience the care during your pregnancy?
 - b. How did you experience the care regarding nutrition?
What were important moments for you in the beginning of your pregnancy?
Can you remember any important moments thereafter?
4. General information P4HP
You signed up for P4HP at the beginning of your pregnancy. Therefore, you experienced four additional moments during your pregnancy with your midwife and a dietitian to talk about nutrition.
 - a. What was the reason you participated in P4HP? (*motivation*)
 - b. What do you remember from the consultations?

➔ **Questioning consultations 1, 2, 3 and 4 separately**

 - c. How did you experience consultation x? (x= consult 1, 2, 3, 4)
 - i. Can you tell us how these consultations went?
 - ii. Can you remember any important moments from these consultations?
 - iii. What did you learn from these consultations?
 - d. If you had to give P4HP a grade, what grade from 1 to 10 would it be? Why a ... and not a ...? What needs to happen to make this grade a 9 or 10?
5. Context diet quality
We are also specifically curious about what happened you regarding your diet.
 1. What does a healthy diet entail for you during pregnancy? Has this changed from before pregnancy?
 - i. How has your diet evolved during pregnancy?
 - ii. What has changed? Did you start eating certain food products or not? (*risky/health promoting food products*)
 - iii. Can you remember specific trigger points when your eating habits changed during your pregnancy?
 - iv. Did the discussions with the midwife/dietitian influence this? Did other factors contribute to this?
 - v. Did you find it easy/difficult to stick to this pattern? (*strategies/challenges*)

- vi. Would you handle food differently in a future pregnancy? If so, how? (*motivation*)
 - vii. Are there any important lessons you learned about yourself and healthy eating during this pregnancy?
- 6. Context empowerment

P4HP aimed to focus on pregnant woman's desires and abilities to eat healthier during nutrition consultations, and that the woman has control during these conversations.

 - a. Did you experience this? (*open dialogue*)
 - b. Did you consider healthy eating during pregnancy to be your own responsibility? (*control*)
 - i. Do you feel that you have control over what you eat during your pregnancy? How? (*control*)
 - ii. Does this affect your diet? How?
 - iii. How do you assess your own knowledge regarding healthy eating? (*control*)
 - iv. Did you feel heard during conversations with the midwife/dietitian? Were all your questions answered? (*control/open dialogue*)
 - v. Did you receive tailored advice from your midwife and the dietitian? (*Personalised information*)
 - vi. Were things discussed during the consultation that you found difficult? (*different motivations*)
 - 2. What was the influence of your environment on your eating behaviour? (*social environment*)
 - i. Was this discussed during the consultation? (*open dialogue*)
- 7. Closing
 - a. Is there anything we haven't discussed yet that you would like to tell/discuss?
- 8. Thanking participants for their participation



Chapter 5

MIDWIVES AND DIETITIANS' PERSPECTIVES ON AN EMPOWERMENT PROGRAMME TO ENHANCE DIET QUALITY IN PREGNANT WOMEN:

A MIXED-METHOD STUDY

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This chapter has been submitted to
Midwifery.

ABSTRACT

Background: Healthy nutrition during pregnancy is essential for mother and child. Midwives, as trusted sources of information, play a key role in supporting maternal health but current nutrition communication remains limited. The Power 4 a Healthy Pregnancy (P4HP) aims to improve the diet quality of pregnant women through four additional empowerment consultations on nutrition (three with midwives, one with a dietitian). This study evaluated healthcare professionals' (HCPs) perspectives on the P4HP programme implementation, with a focus on interprofessional collaboration, facilitators, and barriers.

Methods: A mixed-method process evaluation was conducted, incorporating quantitative data from online surveys (n=29; 18 midwives, 11 dietitians) using the Measurement Instrument for Determinants of Innovations, along with in-depth interviews (n=36 HCPs). Survey data were analysed using descriptive statistics, while interview data were analysed through thematic analysis.

Results: HCPs reported improved understanding of each other's roles in nutritional care and enhanced interprofessional collaboration. While dietitian consultations provided valuable personalised advice that empowered women to make healthier dietary choices, midwives played a crucial role in supporting the maintenance of these changes. Key facilitators included the programmes clear procedures, implementation flexibility, and the HCPs' commitment to promoting healthy eating. The main barriers identified were time constraints and limited staff availability among midwives, as well as the financial burden associated with consulting a dietitian.

Conclusion: The P4HP programme successfully enhanced interprofessional collaboration between midwives and dietitians, offering significant nutritional support to pregnant women. However, addressing the financial barrier of out-of-pocket costs is crucial for facilitating broader integration into routine antenatal care.

5.1 INTRODUCTION

Healthy nutrition during pregnancy is crucial for both maternal and foetal health, with significant implications for long-term well-being (Christian et al., 2015). While many women adjust their diets during pregnancy to promote their baby's health (Forbes et al., 2018; Super & Wagemakers, 2021), environmental and social factors can lead to less healthy choices. Recent data from the Netherlands show that pregnant women generally meet the recommended intake of most nutrients including protein, vitamins, and minerals. However, there are concerns about insufficient consumption of fruits, vegetables, and (fatty) fish (ter Borg et al., 2023). National guidelines in the Netherlands recommend supplementation of folate and vitamin D during pregnancy, as dietary intake alone is typically insufficient for these essential nutrients (Health Council of the Netherlands, 2021; ter Borg et al., 2023). Pregnant women often seek support for various nutrition challenges, emphasising the need for personalised dietary guidance (Super & Wagemakers, 2021).

Midwives are the primary and most trusted source of nutritional information during pregnancy. However, they often face time constraints and may lack specialised knowledge for providing personalised nutritional support (Baron, Martin, et al., 2017; Super & Wagemakers, 2021; Szwajcer, Hiddink, Maas, et al., 2008). As a result, their guidance typically focuses on food safety and risk management rather than offering comprehensive advice on healthy eating or preventing diet-related diseases (Beulen et al., 2021; Super et al., 2021). While collaboration with dietitians could enhance prenatal dietary guidance (Beulen et al., 2021; Super et al., 2021), in the Netherlands, dietitian referrals are typically limited to specific medical conditions such as gestational diabetes or excessive weight gain. This creates a gap in providing comprehensive nutritional support within Dutch antenatal care.

The Power 4 a Healthy Pregnancy (P4HP) programme was developed through iterative stakeholder collaboration to improve the diet quality of pregnant women through empowerment (Beulen, Super, et al., 2020; Super & Wagemakers, 2021; Van Lonkhuijzen et al., 2022). The programme incorporates four additional consultations – three with midwives and one with a dietitian – facilitating in-depth nutritional discussions from an empowerment perspective (Van Lonkhuijzen et al., 2022). While Dutch midwives support follow-up contacts for collaborative goal-setting using behaviour change techniques (Beulen et al., 2021), they report challenges including limited nutritional expertise, time constraints, and low self-efficacy (Arrish et al., 2014; Beulen et al., 2021). In contrast, dietitians are well-equipped to provide comprehensive nutritional support, often using motivational interviewing to engage with pregnant women's motivations and explore practical dietary changes that fit into their daily lives (Super et al., 2021).

Results from an effect evaluation demonstrate significant improvements in pregnant women's dietary intake through the P4HP programme (Van Lonkhuijzen, de Vries, et al., 2025).

This study aims to evaluate the implementation of the P4HP programme from the perspectives of midwives and dietitians, examining the interprofessional collaboration, and identifying key facilitators and barriers to successful implementation. The insights gained from this real-world implementation and evaluation of the P4HP programme could inform the integration of more empowerment-focused nutritional interventions into antenatal services, with the potential to enhance maternal and foetal health outcomes.

5.2 METHODS

STUDY DESIGN

This study presents a convergent parallel mixed-methods process evaluation of healthcare professionals' (HCPs) perspectives on the implementation of the P4HP programme (Creswell & Clark, 2017). Quantitative data were collected through online surveys using the Measurement Instrument for Determinants of Innovations (MIDI) questionnaire among intervention practices (n=29). Qualitative data were gathered through in-depth interviews (n=36) with both intervention and control practices. Both data collection methods were guided by the MIDI questionnaire, serving complementary purposes: surveys systematically assessed implementation determinants, while interviews provided deeper insights into implementation experiences, contextual factors, and practical implications. Control practices were included in the qualitative phase to explore the effects of study participation and potential implementation biases. Survey and interview data were analysed independently before being integrated during interpretation to provide comprehensive insights into real-world application of the P4HP programme (Östlund et al., 2011).

The process evaluation was part of a larger P4HP study (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., 2022; Van Lonkhuijzen, Prins, et al., 2025), which involved midwifery practices participating in a cluster randomised controlled trial (C-RCT). Details of HCP recruitment and participation in the P4HP programme are described elsewhere (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., 2022). Ethical approval was granted by the Medical Research Ethics Committee NedMec (September 21st, 2021) (25).

THE P4HP PROGRAMME

The P4HP programme aims to improve diet quality and empower pregnant women through four reimbursed consultations (three with midwives, and one with a dietitian). Participating HCPs received implementation guidelines including Motivational Interviewing techniques, and a client-centred counselling approach (**Supplementary material 1**). Motivational interviewing has shown effectiveness in various health domains, by recognising individuals as experts in their own lives, emphasising autonomy, and supporting personal choice in behaviour change (Martins & McNeil, 2009; Miller & Rollnick, 2012). A visual conversation card, based on national health recommendations, was used to facilitate dietary discussions (Health Council of the Netherlands, 2021; Voedingscentrum, n.d.-a). The programme was evaluated within a C-RCT study involving 342 pregnant women across 16 midwifery practices (10 intervention, 6 control). It was assessed by pregnant women, midwives, and dietitians. Results of both the effect evaluation and process evaluations among pregnant women are published elsewhere (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen, Prins, et al., 2025).

DATA COLLECTION

QUANTITATIVE DATA COLLECTION BY SURVEYS

Online surveys were administered between December 2022 and January 2023 using the MIDI questionnaire to assess implementation determinants that could either positively or negatively influence the implementation of the P4HP programme (Fleuren et al., 2014). All HCPs involved in the implementation of the P4HP programme, approximately 40 midwives and 20 dietitians, were invited via e-mail to anonymously complete the survey online via Qualtrics.

The survey covered four key areas: innovation (the P4HP programme; 7 determinants, 9 questions), user (HCPs and pregnant women; 11 determinants, 27 questions), organisation (midwifery and dietitian practices; 8 determinants, 10 questions), and socio-political context (the Dutch healthcare setting with its laws and regulations; 1 determinant, 4 questions) (Fleuren et al., 2014). Most MIDI items were scored using five-point Likert response scales, ranging from 1 (e.g., “totally disagree”) to 5 (“totally agree”). Questions were specifically tailored to the target population and the P4HP programme, with additional items addressing aspects such as diet quality, empowerment, and the roles of midwives and dietitians.

MIDI determinants were categorised as barriers if $\geq 20\%$ of HCPs disagreed or strongly disagreed, and as facilitators if $\geq 80\%$ agreed or strongly agreed (Ankersmid et al., 2024; Schepers et al., 2017). The survey also collected HCPs' sociodemographic data including age, gender, and years of experience.

QUALITATIVE DATA COLLECTION BY INTERVIEWS

In-depth interviews were conducted between January and March 2023 with midwives and dietitians from both intervention and control clusters. All HCPs involved in the P4HP C-RCT, approximately 50 midwives and 20 dietitians, were invited via e-mail to schedule an evaluation interview. Each cluster had the freedom to choose how many members of their cluster would take part in the interviews.

A semi-structured interview guide, based on the MIDI framework determinants, was used (**Annex 5.1**) (Fleuren et al., 2014) to guide the interviews. The guide included open-ended questions to explore motivation for participation, implementation experiences, and programme evaluation. In the final stage of each interview, preliminary general findings and midwifery practice-specific results from the P4HP C-RCT were shared and discussed with the HCPs (Van Lonkhuijzen, de Vries, et al., 2025). All interviews were audio-recorded with written informed consent obtained from the participants.

DATA ANALYSIS

Following the convergent parallel design, the quantitative survey data and qualitative interview data were analysed separately using their respective analytical approaches (Creswell & Clark, 2017). Survey data were analysed using descriptive statistics (SPSS v28), with dietitians' and midwives' results presented separately when notable differences between the groups emerged. Interviews were transcribed verbatim and analysed using reflexive thematic analysis, following Braun and Clarke's six-phase process using Atlas.ti 22 (Braun et al., 2019). First, Dutch transcripts were carefully read by the researchers (RL and SC) to become familiar with the data. Second, initial codes were created to organise the data into meaningful patterns. SC independently coded 12 out of 20 transcripts, all from the intervention clusters. RvL then independently coded three of these transcripts, overlapping with SC's coding. Authors RvL and AW reviewed the codes for the overlapping transcripts to resolve discrepancies and reach consensus on the codes. After establishing consensus, RvL proceeded to code all 20 transcripts, ensuring consistency across the entire dataset. Third, initial themes were constructed. Fourth, these themes were reviewed and refined. Fifth, themes were defined and discussed (RvL, AW, JdV) until consensus was reached. The themes identified were: 'The dietitian consultation provides value', 'Empowerment can play out in different ways', 'Adaptation to P4HP consultations', 'Strengthened collaboration between midwives and dietitians', and 'Implementation challenges and the research process'. Relevant quotations from the transcripts were translated into English, with participant names anonymised. Finally, the survey and interview results were compared and contrasted to gain a comprehensive understanding of the implementation of the P4HP programme.

5.3 RESULTS

SURVEY RESULTS

The survey was completed by 29 female HCPs from 17 organisations (9 dietitian practices, and 8 midwifery practices). Participants included 18 midwives (median age 41 years, range 24-66; median experience 15 years, range 3.5-36) and 11 dietitians (median age 33 years, range 25-58; median experience 13 years, range 1.5-27). **Table 5.1** outlines their responses to MIDI determinants, highlighting potential facilitators and barriers to implementing the P4HP programme.

The survey identified key facilitators and barriers across the four areas of implementation: innovation, users, organisation and socio-political context. For innovation, HCPs identified the P4HP programme's procedural clarity and ease of use as facilitators, while barriers included incomplete guidance, incompatibility with existing workflows, and lack of observable outcomes. Especially for midwives, barriers included providing nutritional guidance and aligning the P4HP programme with their usual way of working.

The assessment of user determinants revealed several facilitators, including HCPs strong sense of responsibility for promoting healthy eating, adequate collegial support, and a sense of self-efficacy in using P4HP materials. However, barriers in this domain, particularly among midwives, included initial scepticism about the programme's effectiveness in improving diet quality and empowerment. HCPs indicated out-of-pocket costs as a major factor influencing women's satisfaction. Additionally, most HCPs reported no prior training in nutrition or motivational interviewing, yet felt their existing skills were sufficient for programme implementation.

Several organisational barriers were identified, such as lack of performance feedback both within and between midwives and dietitians, and limited staff, financial resources, and time to implement the P4HP programme as intended. Midwives, in particular, reported insufficient staff capacity and time to implement the P4HP programme effectively. In the socio-political context, the programme's strong alignment with dietitian roles was a key facilitator.

When asked about primary implementation challenges, HCPs highlighted client perception of healthy eating and time constraints as the top barriers (n=11 each), while financial resources were less of an issue (n=2). Additional concerns (n=5) included reaching the appropriate target group and ensuring adequate referrals from midwives.

TABLE 5.1: DETERMINANTS OF INNOVATION REPORTED USING THE MIDI QUESTIONNAIRE FOR THE IMPLEMENTATION OF THE P4HP PROGRAMME BY MIDWIVES AND DIETITIANS (N=29)

Determinants associated with the Innovation (i.e. the P4HP programme)	Totally agree/ Agree (n)	Neutral (n)	Totally disagree/ Disagree (n)
Procedural clarity: It is clear what is expected from me when offering the P4HP programme	<u>24</u>	3	2
Procedural clarity: it is clear which activities I should perform in which order when offering the P4HP programme	23	3	3
Correctness: The P4HP programme is based on factually correct knowledge	22	6	1
Completeness: All information and materials for working with the P4HP programme are properly provided	22	4	3
Completeness: The P4HP programme gives me enough guidance to discuss nutrition as intended with my client	18	5	<u>6</u>
Midwives	10	2	6
Dietitians	8	3	0
Complexity: the P4HP programme is not too complex for me to use ¹	<u>25</u>	2	2
Compatibility: The P4HP programme aligns well with my usual way of working	10	6	<u>13</u>
Midwives	5	3	10
Dietitians	5	3	<u>3</u>
Observability: The outcomes of using the P4HP programme are clearly observable	5	9	<u>15</u>
Relevance for client: the P4HP programme is relevant for my patients	17	9	3
Determinants associated with the users (i.e. pregnant women and HCPS; midwives and dietitians)	Totally agree/ Agree (n)	Neutral (n)	Totally disagree/ Disagree (n)
Personal benefits/drawbacks: Regular conversations about healthy eating are important for all pregnant women.	<u>26</u>	0	3
Personal benefits/drawbacks: It is important to increase my client's level of empowerment through the P4HP programme.	<u>24</u>	2	3
Personal benefits/drawbacks: It is important to improve the diet quality of my client through the P4HP programme.	<u>26</u>	0	2

Outcome expectations: I expect the P4HP programme to enhance the empowerment of my client.	15	6	8
Midwives	7	3	8
Dietitians	8	3	0
Outcome expectations: I expect the P4HP programme to improve the diet quality of my client.	12	10	7
Midwives	4	7	7
Dietitians	6	3	0
Professional obligation: I am responsible to support my clients in healthy eating during pregnancy	26	2	1
Patient satisfaction (n=18): Clients will generally be satisfied when I use the P4HP programme during a midwifery consultation.	8	7	3
Patient satisfaction: Clients will generally be satisfied if they visit the dietitian for P4HP consultation (IF NOT deducted from their deductible).	27	1	1
Patient satisfaction: Clients will generally be satisfied if they visit the dietitian for a P4HP consultation with the dietitian (IF deducted from their deductible).	4	12	13
Patient cooperation (n=18): Clients will generally cooperate with conversations about nutrition during a consultation at the midwifery practice.	14	2	2
Patient cooperation: Clients will generally cooperate in meeting with a dietitian.	14	10	5
Midwives	7	6	5
Dietitians	7	4	0
Social support: I can count on sufficient help from my colleagues, if needed, when using the P4HP programme.	26	3	0
Subjective norm (n=18): My colleagues expect me to use the P4HP programme.	10	5	3
Subjective norm: The opinions of my colleagues matter a lot to me when working with the P4HP programme	10	13	6
Self-efficacy: I am confident in my ability to conduct the first P4HP consultation from an empowerment perspective	22	7	0
Self-efficacy: I will be successful in using the conversation card during P4HP consultations about nutrition	25	3	1
Self-efficacy: The conversation card is a valuable tool for the P4HP consultations	13	9	6
Self-efficacy (n=18): I will manage to have the P4HP reflection consultations	13	5	0

Knowledge: I have sufficient knowledge about nutrition to conduct the P4HP consultations	22	5	2
Knowledge: I am currently interested in taking an additional course on nutrition during pregnancy	5	9	<u>15</u>
Knowledge: I have sufficient interview technique skills to conduct the P4HP consultations	<u>29</u>	0	0
Knowledge: I am currently interested in taking a course on motivational interviewing and empowerment	4	10	15
	Yes (n)	No (n)	
Knowledge: I completed a course on nutrition during pregnancy ²	9	20	
Knowledge: I completed a course on motivational interviewing and empowerment ²	9	20	
	A majority, Almost all colleagues, All colleagues (n)	Half of colleagues (%)	Not a single colleague, almost no colleague, a Minority (n)
Descriptive norm (n=18): Proportion of colleagues that use the P4HP programme ²	12	6	
Determinants associated with the Organisation (i.e. midwifery and dietitian practices)	Totally agree/ Agree (n)	Neutral (n)	Totally disagree/ Disagree (n)
Staff capacity: There is sufficient staff in our organisation to use the P4HP programme as intended.	18	0	<u>11</u>
Midwives	8	3	7
Dietitians	<u>10</u>	1	0
Financial resources: There are enough financial resources available to use the P4HP programme as intended.	10	13	<u>6</u>
Time available: Our organisation provides me with enough time to include the P4HP programme as intended in my day-to-day work.	14	4	<u>11</u>
Midwives	5	3	10
Dietitians	<u>9</u>	1	1
Information accessible about use of innovation: It is easy to find information in my organisation about using the P4HP programme as intended	20	8	1
Performance feedback (n=18): Feedback is regularly provided about progress with the implementation of the P4HP programme in my organisation	10	1	7

Performance feedback: Feedback is regularly provided about progress with the implementation of the P4HP programme between midwife and dietitian.	9	7	13
	Yes (n)		No (n)
Formal ratification by management: There are formal arrangements relating to the use of the P4HP programme ³	18		11
Coordinator: One or more staff members have been designated to coordinate the process of implementing the P4HP programme ³	20		9
Unsettled organisation: There are no other changes occurring that could impact implementation of the P4HP programme ^{1,3}	19		10
Midwives	9		9
Dietitians	1		10
Determinants associated with the socio-political context	Totally agree/ Agree (n)	Neutral (n)	Totally disagree/ Disagree (n)
Legislation and regulations (n=18): The activities of the P4HP programme fit in well with existing legislation and regulations for the midwifery profession	14	3	1
Legislation and regulations (n=11): The activities of the P4HP programme fit in well with existing legislation and regulations for the dietitian profession	<u>10</u>	1	0
Legislation and regulations: The activities of the P4HP programme fit in well with existing legislation and regulations within my profession	20	9	0
Legislation and regulations: The activities of the P4HP programme fit in well with existing legislation and regulations within the Dutch healthcare system	21	4	4

Abbreviations: HCP: healthcare professional, MIDI: Measurement Instrument for Determinants of Innovations, P4HP: Power 4 a Healthy Pregnancy. MIDI determinants that were answered by $\geq 20\%$ of HCPs with "totally disagree/disagree" (or equivalent responses such as "no" or "not a single colleague", "Almost no colleague" or "A minority") were considered barriers, and items answered by $\geq 80\%$ with "agree/totally agree" (or equivalent responses such as "yes" or "A majority", "Almost all colleagues" or "All colleagues") were considered facilitators. Numbers underscored on the left represent a HCP-reported a facilitator, and numbers underscored on the right represent a HCP-reported barrier. Dietitians' and midwives' results are presented separately as well if there is a notable difference between the groups.

¹Determinant is reversed for readability/interpretability.

²Possible answer categories were divided into: "true" (= facilitator) and "false" (= barrier); answering option: "I don't know" not considered as part of categorisation as facilitator or barrier. ³Answer categories were divided into (1) "a majority, almost all colleagues, all colleagues"; (2) "half of colleagues"; and (3) "not a single colleague, almost no colleague, a minority"

INTERVIEW RESULTS

Twenty interviews were conducted with 36 healthcare professionals (20 midwives, 13 dietitians, and 3 practice assistants), from all intervention (n=14) and control clusters (n=6). All participants, except one male dietitian, were female. Interviews lasted 22-66 minutes (median: 53.5 minutes) and were conducted via MS Teams (n=10), face-to-face (n=9), or phone (n=1). Some were individual interviews, while others included multiple participants from the same practice. **Table 5.2** outlines cluster and interview characteristics. Sixteen interviews were conducted by two researchers (RvL and SC), three by SC alone, and one by RvL alone. One cluster (Cluster 1) discontinued after the pilot phase due to time constraints and maternity leave, but their perspectives were captured through an informal evaluation and written feedback. Data saturation was reached by the eighth interview within the intervention group, though minor variations reflecting individual practice contexts continued. The final dataset comprised approximately 138,000 words of transcribed text.

DIETITIAN CONSULTATION PROVIDES VALUE

Dietitian consultations were highly valued for providing personalised nutritional advice and motivating change. HCPs recognised that pregnant women often recalled these sessions vividly, demonstrated greater dietary awareness, and made positive changes. However, dietitians expressed a need for more frequent appointments, as nutritional needs and challenges vary throughout pregnancy.

HCPs observed that many pregnant women initially viewed dietitians as strict or judgmental, and are often unaware that consultations could be scheduled without a referral. A midwife from cluster 16 explained: *“I think they perceive it as criticism. When someone feels like they need to see a dietitian because they’re not managing their lifestyle correctly, it can create an uncomfortable feeling that people tend to avoid.”* A dietitian from cluster 5 added: *“Some women were hesitant about the consultation, fearing I’d criticise their choices. I have heard from a few ladies that they appreciated that I didn’t do that.”*

Pregnant women reported feeling motivated rather than judged after dietitian consultations. Some preferred discussing nutrition in detail with the dietitian, rather than with the midwife, due to the dietitian’s specific expertise. A few women even sought additional guidance from dietitians outside the research context. This shift in perception extended to midwives, as exemplified by a cluster 1 midwife who went from initial scepticism to actively supporting dietitian involvement in antenatal care after receiving positive feedback from clients. Many HCPs now advocate for universal dietitian consultations during pregnancy, recommending one per trimester and postpartum care, to better support women throughout their pregnancy journey.

TABLE 5.2: CHARACTERISTICS OF INTERVIEWS WITH HCPS

Interviews	Date	Method	Interview participant(s) (n=36)	Duration	Completed questionnaires (n=29)
Intervention clusters¹					
Cluster 1	03-08-22	Face to face	1 midwife	N/A	Midwife (n=1) and dietitian (n=1)
	29-08-22	Phone	1 dietitian	N/A	
Cluster 2	31-01-23	Face to face	1 midwife and 1 dietitian	65 min	Midwife (n=4) and dietitian (n=1)
Cluster 3	12-01-23	MS Teams	2 midwives	54 min	Midwife (n=2) and dietitian (n=3)
	13-02-23	MS Teams	1 dietitian	40 min	
Cluster 4	13-03-23	Face to face	2 midwives and 2 dietitians	57 min	Midwife (n=1) and dietitian (n=1)
Cluster 5	14-02-23	MS Teams	1 dietitian	55 min	Midwife (n=1) and dietitian (n=1)
	17-03-23	MS Teams	1 midwife	40 min	
Cluster 6	21-02-23	MS Teams	1 midwife and 2 dietitians	62 min	Midwife (n=3) and dietitian (n=1)
Cluster 7	23-02-23	Face to face	2 midwives and 2 dietitians	55 min	Dietitian (n=1)
Cluster 8	28-02-23	Face to face	2 midwives and 1 practice assistant	56 min	Midwife (n=4) and dietitian (n=1)
	27-02-23	MS Teams	1 dietitian	39 min	
Cluster 9	16-03-23	MS Teams	1 midwife and 1 dietitian	54 min	Dietitian (n=1)
Cluster 10	14-04-23	Face to face	1 midwife and 1 dietitian	66 min	Midwife (n=1)
Control clusters¹					
Cluster 11	16-01-23	Face to face	1 midwife	53 min	
Cluster 12	18-01-23	Face to face	1 midwife	41 min	
Cluster 13	30-01-23	Face to face	1 midwife and 1 practice assistant	35 min	
Cluster 14	01-02-23	MS Teams	1 midwife and 1 practice assistant	28 min	
Cluster 15	02-02-23	MS Teams	1 midwife	35 min	
Cluster 16	15-02-23	MS Teams	1 midwife	22 min	

¹A cluster consists of a midwifery practice (control) or of a collaboration between a midwifery and dietitian practice (intervention).

Dietitian consultations were valuable for all pregnant women, whether addressing specific concerns or uncovering needs during the visit. These sessions offered personalised advice, practical tips, and reassurance, boosting dietary confidence more effectively than midwife consultations. HCPs noted their practicality, as women could easily adopt *the dietitian's suggestions into their lifestyle and diet*. As one dietitian (cluster 8) explained: *"There's always something to improve or achieve, even if the conversation seemed unimportant at first, there was always progress by the end."*

The cost of consulting a dietitian outside the study was widely reported by HCPs as a major financial barrier, discouraging midwives from making referrals. As the dietitian from cluster 1 emphasised: *"For an initiative to improve maternal nutrition to succeed, there should be no financial barrier."* Some midwives noted that pregnant women's priorities often influence their spending. As a midwife from cluster 13 observed: *"They cut back on this care, but will spend 95 euros on an ultrasound for fun. I find that very difficult."* Financial constraints have also hindered dietitian involvement in antenatal care. A midwife from cluster 12 illustrates: *"We tried to include a dietitian in CenteringPregnancy, but finances became an issue."*

P4HP consultations addressed diverse topics, including weight management, nutrient intake, and supplementation, allowing HCPs to tailor their approach to each woman's needs. Dietitians found this variety stimulating and appreciated addressing specific concerns. The dietitian in cluster 5 illustrates this variety: *"There were several women who were overweight, who were concerned about developing gestational diabetes. So I received a lot of questions about carbohydrates in foods such as soda, fruit, pasta and potato. Another woman struggled significantly with food safety. She was hesitant to eat foods with peels despite washing it thoroughly, and wanted to know the exact number of seconds something had to be washed to ensure it was safe."* The dietitian noted positive outcomes: *"Women felt reassured. (...), more relaxed about their choices, and learned to manage their intake instead of avoiding foods altogether."*

EMPOWERMENT MANIFESTS A MULTIPLE LEVELS

Empowerment emerged at multiple levels in the P4HP programme, from individual dietary choices to family dynamics. HCPs observed that validation and reassurance boosted women's confidence. A dietitian from cluster 3 noted: *"It gives them more confidence and strength during this exciting period. (...) positively impacting their overall well-being."* This confidence extended beyond nutrition. As a midwife from cluster 7 explained: *"The way you handle food says a lot about your personal life. Nutrition reflects personal identity and self-perception, making it a powerful stepping stone for empowerment."*

The programme's impact extended into family systems, with women recognising how dietary changes influenced their households and parental roles. Partner support was crucial, potentially either promoting or hindering dietary changes. A male dietitian from cluster 6 observed: *"Some women asked how to convince their husband to eat healthier. (...) Not one woman came [to the consultation] with her partner which is a shame. As a man I'd advocate: bring the men, so they understand their influence."* The midwife (cluster 6) agreed: *"The environment matters. Children are walking around, the partner is there, so the woman likely eats with them. Without support, it is harder to sustain changes. Few men attended our consultations."* This highlights the role of social support in empowering dietary changes.

ADAPTATION TO P4HP CONSULTATIONS

HCPs initially found the P4HP programme challenging but quickly adapted after their first sessions. Dietitians noted differences from their usual problem-focused approach, while some midwives felt uncomfortable about knowledge gaps. The timing of consultations significantly influenced their focus. First-trimester sessions often prioritise managing nausea, therefore overshadowing other nutritional concerns, prompting some dietitians to suggest scheduling follow-ups at 14-15 weeks and 6-7 months to address evolving nutritional needs. Some practices implemented two early dietitian consultations. A midwife (cluster 10) noted: *"I thought it was perfect. In the first three months, prenatal tests and ultrasounds leave no room for discussing nutrition."* The dietitian (cluster 10) agreed, adding, *"It made sense to take the time to early discuss the comprehensive diet, as it helps guide future, shorter consultations."*

The conversation card received mixed reviews. Some HCPs valued it for structuring discussions, while others preferred established methods. HCPs were skilled at deciding when the conversation card was helpful. One dietitian (cluster 5) noted: *"I would recommend it to other dietitians. It helps patients identify priorities, which leads to more effective treatment. Sometimes they just need a nudge to ask a question or come up with solutions."*

Professional differences shaped follow-up consultations. While some midwives found repeating dietary advice uncomfortable, dietitians considered reinforcement as standard practice to sustaining behaviour changes. Later pregnancy consultations often competed with birth preparation discussions such as birth plans, delivery concerns, and postpartum preparation. Midwives valued the reflections as reminders for women to maintain their dietary goals, but suggested dietitians might be better suited for follow-ups, given their expertise and focused nutrition discussions.

Many HCPs agreed that building on each other's consultations added value, as it provided

continuity and direction for follow-up visits. Notes from the first consultation helped dietitians build on previous steps or address new points. However, the extent of this “handover” varied, impacting continuity between consultations. Dietitians appreciated when pregnant women had already started addressing nutritional points raised during previous midwife consultations, allowing them to further build on that progress.

STRENGTHENED COLLABORATION BETWEEN MIDWIVES AND DIETITIANS

The P4HP programme improved collaboration between midwives and dietitians, deepening their understanding of each other’s roles. By reviewing dietitian notes, midwives gained practical insights that made nutritional counselling more actionable, boosting their confidence in nutrition discussions and their ability to identify cases when a referral to a dietitian would be beneficial.

This collaboration fostered mutual professional interest. Dietitians developed a greater focus on pregnancy, and many midwives incorporated nutrition discussions into their routines beyond the study. As one midwife (cluster 5) reflected: *“What I enjoyed about this study is that it gave a clearer picture of the value of what women gain from dietitian consultations.”*

In some practices, this collaboration led to structural changes, such as one midwife (cluster 1) implementing standard 20-week follow-up calls. These nutrition-focused calls increased women’s awareness and engagement with healthy eating. She found that separating this conversation from regular consultations added value, as it allowed for a more focused discussion on nutrition. She hopes that this focus to nutrition would continue postpartum.

IMPLEMENTATION CHALLENGES AND THE RESEARCH PROCESS

HCPs participated in the P4HP programme due to interest in research, nutrition, learning, and preventive care. Many saw it as an opportunity to address the overlooked topic of nutrition in pregnancy, believing it could benefit their population. Most HCPs found participation a valuable learning experience, providing new insights into nutrition, antenatal care, empowerment, and interdisciplinary collaboration. As one midwife (cluster 3) reflected on their evolving perspective: *“The subject [of nutrition or empowerment] has become more integrated into my practice. (...) I used to think some didn’t need a dietitian. But they do.”*

Initially sceptical, about the effects of the P4HP programme, HCPs views shifted after reviewing the C-RCT results. Dietitians observed improvements in food intakes they specifically targeted such as dairy, fruit, and sugary drink consumption. In line, some midwives noted increased vitamin D supplementation when they actively emphasised

its importance to clients. The impact exceeded expectations, with one dietitian (cluster 8) noting: *"I didn't expect that, but it's nice. I'm a little taken by surprise."* These outcomes suggested the programme benefited a broader group than anticipated.

Implementation experiences varied across practices. For example, cluster 7, a large practice, maintained consistency by limiting the programme implementation to three midwives for proficiency. The P4HP programme's inherent flexibility proved crucial, allowing practices to adapt consultation timing and format to existing workflows. A significant challenge across practices was participant recruitment, with health-conscious women more likely to participate. As one midwife (cluster 3) noted: *"Some clients I hoped would benefit didn't join."*

5.4 DISCUSSION

This mixed-method study aimed to explore the perspectives of midwives and dietitians on implementing the P4HP programme, designed to improve the diet quality of pregnant women through empowerment. The implementation and evaluation of the P4HP programme demonstrated the value of integrating dietitian consultations into antenatal care, the need for flexibility in implementation, and the importance of a supportive environment to foster empowerment. However, key challenges for implementation identified by HCPs included pregnant women's perceived value of healthy eating, time constraints, and the out-of-pocket cost of dietitian consultations.

Midwives and dietitians involved in implementing the P4HP programme reported enhanced interprofessional collaboration, which led to a stronger awareness of each other's professional roles and more integrated nutrition counselling. For midwives specifically, the P4HP programme improved confidence in nutrition discussions, and in referring pregnant women to dietitians. This is important, as previous research shows a need for improved communication and referral systems between HCPs in antenatal care (Heslehurst et al., 2017). Furthermore, previous research has emphasised the importance of improving antenatal nutritional care (Beulen et al., 2021; Bragg et al., 2025; Heslehurst et al., 2017). Our results are consistent with previous research indicating that midwives often lack confidence in providing comprehensive nutrition advice during pregnancy (Arrish et al., 2014). However, the involvement of midwives in nutrition communication is crucial as they are highly trusted by pregnant women, which enhances their capacity to facilitate shared decision-making (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021; O'Brien et al., 2021). The distinct consultation approaches between midwives and dietitians highlight their complementary roles, suggesting that structured collaboration could help bridge gaps in antenatal nutrition education (Basu

et al., 2014).

The ability to tailor the timing and delivery of consultations while preserving the essential elements of the P4HP programme proved crucial for its successful implementation across diverse practice settings. Two practices offered two dietitian consultations, while others adjusted the consultation timing to better align with existing schedules. This flexibility, combined with the retention of key components such as repeated consultations and an empowerment focus, is consistent with principles of implementation science and suggests the potential for broader adoption of the programme (Fixsen et al., 2005; Kelly & Perkins, 2012). However, time constraints and staff availability remain barriers for midwives to implement the P4HP programme effectively, particularly in smaller practices. This underscores the importance of balancing flexibility with the need to maintain core programme elements and uphold quality standards for successful implementation.

The study revealed that empowerment extended from individual dietary choices to family dynamics. HCPs observed that as women gained confidence in making dietary decisions, this empowerment often extended beyond personal nutrition, influencing household eating patterns as they embraced their identity as parents. Support from the social environment is a key aspect of women's experiences during the perinatal period, as it enhances their sense of security and contributes to a more fulfilling experience (Vogels-Broeke et al., 2020, 2021). Research shows that social support during pregnancy leads to better health outcomes for both mother and child (Battulga et al., 2021; Oakley et al., 1996). Partners, in particular, played a crucial role in either supporting or hindering dietary changes. However, healthcare professionals noted that partner involvement in consultations was often minimal despite their significant influence on food choices. Previous studies underscore the crucial role of partners in (dis)empowerment and in maintaining healthy dietary behaviours during pregnancy (Van Lonkhuijzen et al., 2023; Vanstone et al., 2017). These findings suggest that antenatal care programmes should actively incorporate strategies to engage partners and broader social networks.

HCPs identified three primary challenges to implementing the P4HP programme. First, pregnant women's perception of the importance of healthy eating was a significant barrier to engagement. HCPs observed that those most likely to participate were already health-conscious, while women who could benefit the most from nutritional support were often harder to reach or less interested. Second, time constraints, particularly for midwives, made it difficult to integrate additional consultations into their already busy schedules. The third and most substantial barrier was the out-of-pocket cost for consulting with a dietitian. Although consultation costs were covered for women participating in the study, out-of-pocket expenses for dietitian consultations present a significant barrier for pregnant women in routine antenatal care. HCPs observed a

marked difference in women's willingness to engage with dietitian services when costs were covered versus when they were not, emphasising the need for systemic changes in healthcare funding. This financial barrier is particularly concerning given that low-income women face greater challenges in maintaining diet quality during pregnancy (Fowles et al., 2012), potentially exacerbating existing health disparities. For the P4HP programme to have its intended impact in standard care, health insurance should cover the costs of dietitian consultations during pregnancy, including out-of-pocket costs, as part of standard antenatal care.

STRENGTHS AND LIMITATIONS

A strength of this study is its comprehensive mixed-methods approach, which facilitated a deeper exploration of the research objectives. The MIDI questionnaire enabled the systematic identification of implementation determinants (Fleuren et al., 2014), while in-depth interviews provided a rich contextual understanding of how these factors manifested in practice. This complementary approach was particularly valuable, as the survey data highlighted key facilitators and barriers to implementing the P4HP programme, while the interviews offered insights into how professionals navigated these facilitators and barriers in their daily practice.

The study achieved strong engagement from healthcare professionals, with a survey response rate of approximately 50% among intervention practices, which is higher than previous studies involving midwives which reported rates of 32% and 42% (Cooper & Brown, 2017; L'Ecuyer et al., 2023). This higher engagement may be attributed to the personal contact with researchers and HCPs throughout the study period. Eight out of ten intervention midwifery practices were represented in the survey data, while interviews captured perspectives from all intervention and control clusters. This comprehensive coverage provides a robust evaluation of the programme across various practice settings. The substantial participation of HCPs in both data collection methods strengthened our ability to integrate findings; however, the anonymous nature of the survey prevented us from determining the exact overlap between survey respondents and interview participants. This presents a limitation as we may have missed insights from HCPs who participated in only one format. Additionally, the self-selected nature of participating HCPs may limit the generalisability of findings.

The discrepancies between MIDI survey results and interview findings underscore the value of mixed-methods approaches in implementation research (Creswell & Clark, 2017; Palinkas et al., 2011). While the survey identified certain barriers, the interviews revealed nuanced or important contextual explanations for these barriers. For example, what appeared as insufficient performance feedback in survey responses was better understood through interviews, which revealed that while formal feedback mechanisms

were limited, professionals were satisfied with using informal communication channels. Similarly, survey responses suggesting a lack of programme clarity were contextualised in the interviews that showed this likely reflected the programme's intentionally flexible, women-centred design – an approach that created space for individual goals (Health Council of the Netherlands, 2021; Voedingscentrum, n.d.-a). This flexibility aligns with principles of implementation science and supports the programme's empowerment-focused approach (Fixsen et al., 2005; Tengland, 2012). These findings suggest that future process evaluation studies using MIDI would benefit from incorporating qualitative methods, as survey results alone may not capture the full complexity of implementation experiences.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

The P4HP programme demonstrated potential for improving nutritional care in pregnancy through enhanced interprofessional collaboration and empowerment-focused approaches. While implementation challenges exist, the programme's flexibility and clear benefits suggest potential for broader implementation. We recommend: (1) policy changes addressing financial barriers to dietitian consultations; (2) strategies to actively engage partners and social networks in nutritional care; and (3) approaches to reach and engage pregnant women who are less motivated to prioritise healthy eating. Future research should explore effective strategies for implementing these recommendations and evaluate their impact on reaching a broader population of pregnant women.

5.5 CONCLUSION

The P4HP programme enhanced interprofessional collaboration between midwives and dietitians, demonstrating how their complementary roles can improve nutritional care during pregnancy. The P4HP programme's flexible approach allowed practices to adjust implementation while maintaining core elements, showing how structured nutrition support can be integrated into routine antenatal care. While some HCPs' felt initial scepticism, this evolved into strong support after experiencing or reviewing positive results. Three main challenges emerged: reaching women less interested in healthy eating, time constraints especially for midwives, and financial barriers to dietitian consultations. These findings suggest that while the P4HP programme offers a promising approach to improving antenatal nutritional care, its successful integration into routine care will require addressing systemic barriers regarding the accessibility of all pregnant women.

ANNEX 5.1: SEMI-STRUCTURED INTERVIEW GUIDE

QUESTIONS FOR THE EVALUATION WITH PROFESSIONALS (MIDWIVES AND DIETITIANS) AFTER PARTICIPATION IN THE INTERVENTION GROUP OF THE POWER 4 A HEALTHY PREGNANCY STUDY

1. Provide information about the purpose of the interview

Explain that we go through all parts of the research, recruitment, interviews, collaboration with healthcare providers and researchers, communication.

Starting questions

- a. What is the reason why you as a practice decided to participate in P4HP?
(Determinants: task view (10), client relevance (7))
- b. How was the division of tasks in your practice?
- c. Have all midwives had the conversations?
- d. Was there a coordinator? *(Determinant coordinator (25))*
- e. You ended up in the intervention group through randomisation. What do you think about this?

2. Evaluation of the conversations : Depending on the discussion partner, midwife or dietitian, request consultations 1, 2, 3 and 4 separately

- a. How did you experience consultation x? (x= consultation 1, 2, 3, 4)
 - i. Can you tell us how these consultations went?

During P4HP, the focus was on the pregnant woman's own wishes and options for healthier eating and that the woman has more control during these conversations.

- b. Do you think you were able to offer consultation X in the way it was intended? *(Determinant Self-efficacy (16))*
- c. Can you give examples from these consultations where you felt that you were working on empowerment? *(Determinant Self-efficacy (16))*
- d. Can you also remember times when you found this difficult? *(Determinant Self-efficacy (16))*
- e. How do you think the participants experienced this consultation?
(Determinant Client Satisfaction (11))
- f. To what extent have you been able to see that the conversations have had an effect on your clients? *(Determinant visibility outcomes (6))*
- g. Based on the conversations you experienced yourself, what are your expectations regarding the results? *(Determinant outcome expectation (9))*

3. Tools for the conversations: Manual and conversation card

- a. The **conversation card** is a visual aid for the conversation.
 - i. How often have you used the **conversation card** ?
 - ii. How did you use the conversation card?
 - iii. What went well and what didn't go well when using the conversation card?
 - iv. To what extent did the conversation card help you in the

- consultations? (*Determinant self-efficacy (16)*)
 - v. To what extent did the conversation card help you to let the woman choose what the conversation is about? (*Determinant self-efficacy (16)*)
 - vi. Would you recommend the conversation card to others and if so, why? If no, why not?
 - b. You have received a **manual** for the program
 - i. How did you use the manual? (*Determinant completeness*)
 - ii. To what extent did the manual help you run the programme as intended?
 - iii. Are there things you missed in the manual? (*Determinant completeness (3)*)
 - c. Did you miss other tools or support for conducting the conversations? (*Determinant completeness (3), availability of information about innovation (27)*)
- 4. Adjustment options in the program: Timing and division of tasks** (*Determinant Congruence of current working method (5)*)
- a. **Timing** of the consultations: analyse per practice whether and at what gestational age the consultations took place.
 - i. When we look at the timing of the conversations, we see very different dates. What is the optimal timing of the conversations for you?
 - ii. In practices where the protocol has been successfully adhered to:
 - 1. What makes it possible for your practice to schedule consultations as intended?
 - 2. What would you recommend to other practices to plan the conversations as much as possible as intended?
 - iii. In a practice where it is difficult to schedule conversations according to protocol:
 - 1. What makes it important in your practice to be flexible with timelines?
 - 2. What do you recommend to other practices to still be able to offer all conversations as intended (with flexible timing)?
 - b. **Division of tasks** by midwife/dietitians
 - i. In your practice, the midwives conducted the first conversation and the reflection conversations and the dietitian conducted the second conversation.
 - 1. How do you view this division of tasks?
 - 2. To be able to use P4HP effectively, how important is it to be able to deal with this flexibly?

- ii. In your practice, the dietitian conducted the first two conversations and the midwives conducted the reflection conversations.
 1. How do you view this division of tasks?
 2. To be able to use P4HP effectively, how important is it to be able to deal with this flexibly?

5. Collaboration between midwives and dietitians

- a. Have you already worked with a dietitian/midwife before participating in P4HP?
- b. How is the collaboration with the dietitian/midwives?
 - i. What did you think went well? Is this the best way of working together for you?
 - ii. What could be even better?
 - iii. How do you rate the collaboration on a scale of 1-10?
 1. What makes it a... is a not a 2?
 2. What would have to happen to turn a... into a 10?
- c. Do you want to continue the collaboration after participating in P4HP? In what way?
- d. Suppose you would also continue to offer P4HP after the research phase, together with the dietitian/midwifery practice.
 - i. How would you like to arrange the documentation of conversations and information exchange between healthcare providers?
 - ii. At what points do you think it would be important for researchers and healthcare providers to keep in touch with each other?

6. Implementation of P4HP after the research phase

- a. Has the research made you view the subject of empowerment and nutrition during pregnancy differently?
- b. Do you incorporate aspects from P4HP into your daily practice?
- c. If you also want to implement P4HP in your practice after the research, what problems do you think you will encounter?
 - i. In the case of barrier costs: what financing options do you know, in addition to reimbursement through the health insurer? (*Determinant financial resources (22)*)
 - ii. With barrier time: what would have to happen to give you the feeling that you have enough time for this? (*Determinant time (23)*)

7. Closing

- a. If you had to give P4HP a grade, what would it be from 1 to 10?
 - i. Why one... and not...?
- b. What needs to happen to make this grade a 9 or 10?
- c. Is there anything we haven't discussed yet, but you would like to tell/discuss?



Chapter 6

DEVELOPING POWER 4 A HEALTHY PREGNANCY:

REFLECTIVE INSIGHTS ON CO-CREATING AN EFFECTIVE
DIETARY PROGRAMME FOR PREGNANT WOMEN

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ABSTRACT

While pregnancy is recognised as a ‘teachable moment’ for lifestyle changes, many pregnant women struggle to meet dietary guidelines due to multiple barriers, including limited nutritional support in antenatal care and challenges such as physical discomfort, food aversions, and conflicting information. Power 4 a Healthy Pregnancy (P4HP), a programme which flexibly integrates four consultations into routine antenatal care, has demonstrated significant improvements in pregnant women’s diet quality. This article reflects on the programme’s participatory development process, examining how stakeholder engagement and empowerment principles shaped an effective programme. We claim that the programme’s success is rooted in its co-creation with midwives, dietitians, and pregnant women, offering valuable insights for developing sustainable health promotion programmes in antenatal care.

6.1 INTRODUCTION

A healthy diet during pregnancy is crucial for both mother and child, influencing pregnancy outcomes, foetal development, and long-term health (Raghavan et al., 2019). Pregnancy is often seen as a ‘teachable moment’ for lifestyle changes, but challenges such as physical discomfort, food aversions, and conflicting information can hinder the adoption and maintenance of dietary changes (Phelan, 2010). The Health Council of the Netherlands has established dietary guidelines for pregnant women (Health Council of the Netherlands, 2021). These guidelines encompass daily fruit and vegetable targets, weekly fish consumption, limited processed foods, and mandatory folic acid and vitamin D supplementation. However, many pregnant women, particularly those with lower socioeconomic status (SES), struggle to meet these recommendations, potentially leading to adverse health outcomes for both mother and child (Baron et al., 2015; Caut et al., 2020).

Midwives in the Netherlands are ideally positioned as trusted sources of nutritional guidance during pregnancy (Bookari et al., 2017). However, they are rarely involved in promoting healthy nutrition, as current antenatal care primarily focuses on food safety and risk prevention, with limited attention to supporting women in establishing and maintaining healthy dietary patterns (Beulen et al., 2021). Despite acknowledging their important role, midwives face barriers such as limited time and knowledge, which hinder their ability to provide comprehensive dietary support (Baron, Heesterbeek, et al., 2017; Beulen et al., 2021). This leads to an apparent paradox: pregnancy provides an optimal opportunity for dietary intervention, yet the healthcare system does not miss the opportunity to benefit from women’s increased motivation. Despite having limited knowledge and time, midwives are in a unique position to address this gap through improved nutritional support because of their trusted relationships and frequent contact. By recognising the expertise of healthcare practitioners and encouraging women’s autonomy, an empowerment approach could lay the path to effective nutritional support.

Empowerment is a crucial factor in improving health outcomes and could play a promising and significant role in enhancing pregnant women’s self-reliance and capability to manage their nutrition (Brandstetter et al., 2015; Nieuwenhuijze & Leahy-Warren, 2019; Zinsser et al., 2020). It encompasses both external factors (such as facilitation of choices and access to resources) and internal factors (such as belief in one’s abilities and control over the situation) (Nieuwenhuijze & Leahy-Warren, 2019). This dual focus is crucial, as both supportive environments and personal confidence are needed to make and sustain healthy choices. An empowerment approach goes beyond traditional knowledge transfer, fostering respectful partnerships between women and healthcare providers, where power is shared equally (Bookari et al., 2017; Nieuwenhuijze & Leahy-

Warren, 2019). In this approach, healthcare professionals shift from being experts to facilitators, helping women to identify and work towards their own meaningful goals (Koelen & Lindström, 2005). While healthcare providers offer expertise, the woman's priorities and readiness for change guide dietary improvements. This approach recognises that supporting self-chosen goals, no matter how small, fosters openness for ongoing dietary changes. The healthcare provider's role is to share knowledge with permission and engage in dialogue that raises awareness, ensuring women retain control over their dietary choices. Additionally, it acknowledges that dietary behaviours are embedded in women's broader life contexts and that sustainable change occurs when choices align with both health goals and life circumstances. Given midwives' trusted relationships with pregnant women and their integral role throughout pregnancy, programme alignment with midwifery practice becomes crucial for effective implementation. However, existing programmes aimed at changing health behaviour during pregnancy often focus on education rather than empowerment and do not align well with Dutch midwifery care (Brandstetter et al., 2015; Zinsser et al., 2020). It is therefore recommended to implement programmes that include opportunities for learning new behaviour-change skills.

Building on these empowerment principles, Power 4 a Healthy Pregnancy (P4HP) was developed and integrated into routine antenatal care to empower pregnant women to make healthier dietary choices. The P4HP programme has demonstrated significant improvements in pregnant women's diet quality and positive evaluations by pregnant women, midwives and dietitians (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., n.d., 2022; Van Lonkhuijzen, Prins, et al., 2025). This underscores the importance of understanding how its development process shaped an effective programme. This article describes the P4HP programme, presents the developmental steps, and examines how the programme's participatory development process contributed to these outcomes, offering insights for future programme development in antenatal care.

6.2 METHODS AND FINDINGS

Figure 6.1 provides a comprehensive overview of the P4HP programme's journey from 2018 to 2023, encompassing four phases: exploratory research, iterative programme development, pilot implementation, and implementation and evaluation. Throughout all phases, key stakeholders, including midwives, dietitians, and pregnant women, were actively involved, contributing to both the programme's development and its evaluation. Throughout all phases, regular meetings were held with an external project group from relevant institutions to discuss developments, progress and future plans for

the programme.

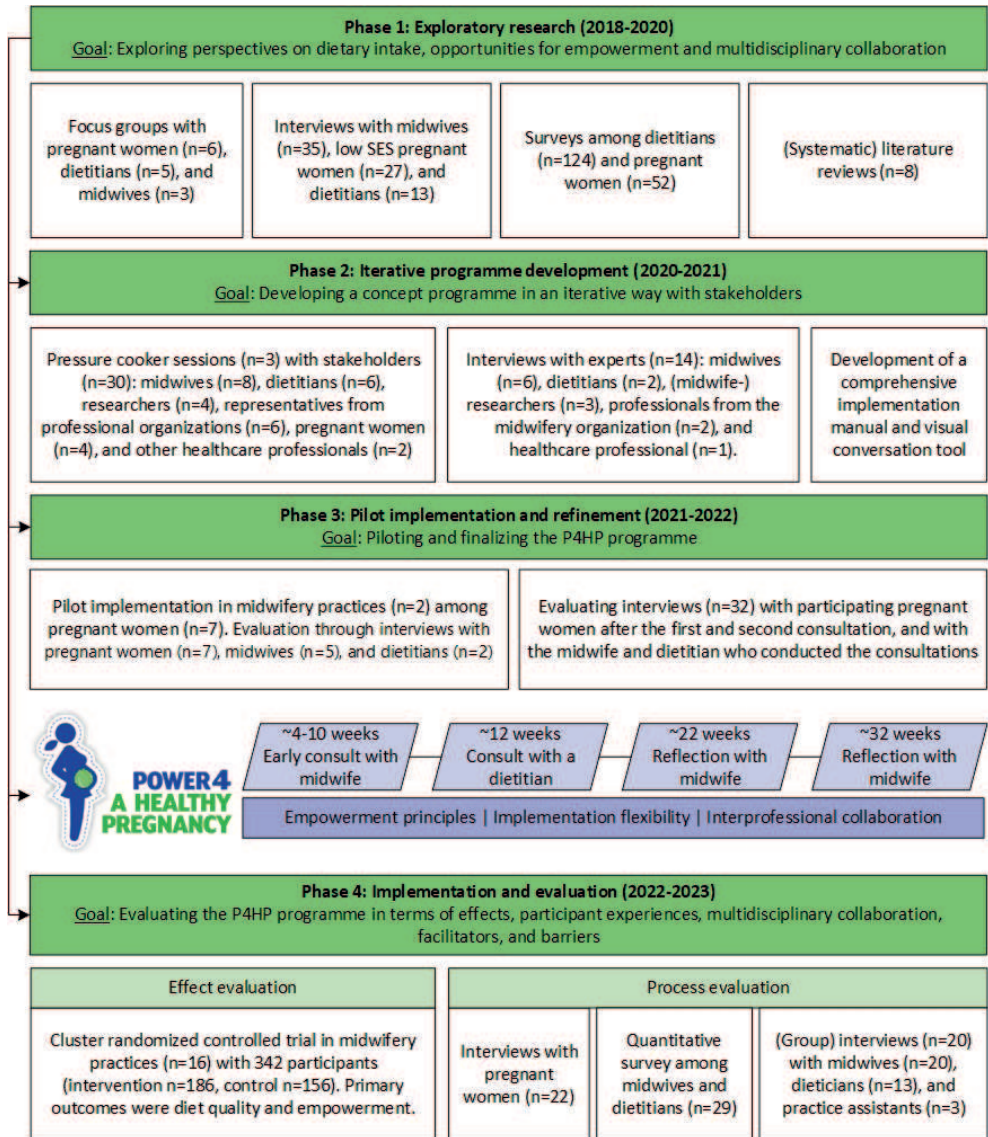


FIGURE 6.1: PHASES OF DEVELOPMENT, EVALUATION, AND FINAL COMPONENTS OF THE P4HP PROGRAMME

PHASE 1: EXPLORATORY RESEARCH

In Phase 1 we investigated the perspectives of pregnant women, midwives, and dietitians through multiple research methods. We used focus groups with all stakeholders to investigate current practices, available or lacking tools in nutrition communication, and to design interview methods for the interviews with pregnant women with the target

group. Interviews with pregnant women, particularly those from lower SES groups, explored food-related experiences and needs, while midwife interviews examined nutritional communication practices and collaboration potential. Surveys assessed dietitians' interest in expanding their role and measured women's empowerment levels across socioeconomic groups. Eight (systematic) literature reviews were conducted, covering topics including empowerment (programmes), dietary factors and assessment tools for (low SES) pregnant women, the role and resources of midwives in nutritional guidance, interprofessional collaboration in prenatal care, and the effectiveness of dietary promotion tools. The methodology for these reviews followed systematic review guidelines with comprehensive database searches, defined inclusion/exclusion criteria, and quality assessment procedures. Full details for each review are available from the authors upon reasonable request, with titles and abstracts provided in **Annex 6.1**.

Key findings revealed that pregnant women need personalised information tailored to their specific situation, practical strategies for healthy eating, and support in managing challenges such as nausea and social pressure (Super & Wagemakers, 2021). They expressed a desire for guidance on foods to avoid and for positive guidance on healthy nutrition (Super & Wagemakers, 2021). Women with lower SES scored significantly lower on most empowerment subscales than women with higher SES. The research in Phase 1 identified possibilities to improve nutrition communication in antenatal care at both the system level (structured midwife-dietitian collaboration) and individual level (empowering women). While midwives acknowledged their crucial role in nutrition guidance and expressed interest in tools to facilitate nutrition discussions, they faced time and knowledge constraints (Beulen et al., 2021). Dietitians, who often see pregnant women late in pregnancy when problems are already present, advocated for a more preventive approach through closer collaboration with midwives (Super et al., 2021). Facilitating factors to improve the diet quality of pregnant women in antenatal care included integrated care pathways, empowerment-focused tools, emphasis on women's autonomy, and enhanced professional training in nutrition counselling.

PHASE 2: ITERATIVE PROGRAMME DEVELOPMENT

In Phase 2 we conducted pressure cooker (PC) sessions where multidisciplinary stakeholders translated research findings into practical programme components, prioritising professional implementation expertise and organisational knowledge to ensure feasible healthcare system integration. After reviewing Phase 1 findings, participants identified key pregnancy moments for nutrition intervention and necessary tools. These sessions established four core principles: 1) early pregnancy intervention, 2) repeated nutrition communication, 3) a positive, empowering approach, and 4) combined expertise of midwives and dietitians. Based on this session and expert consultations, an initial concept for the P4HP programme was developed and further

refined during the second and third PC sessions. This led to a revised second concept that was simplified and included a dietitian consultation. We evaluated this version through expert interviews, resulting in several refinements: greater implementation flexibility across different practices, better integration with existing care pathways, clearer role definitions between midwives and dietitians, and the development of supporting materials. A notable addition was a visual conversation tool illustrating key food groups for pregnant women (Health Council of the Netherlands, 2021), designed to empower women to steer conversations toward nutrition topics most relevant to their individual situations (**Supplementary material 1**). We used this refined third concept of the P4HP programme in the pilot study.

PHASE 3: PILOT IMPLEMENTATION AND REFINEMENT

The third concept of the P4HP programme was piloted in two midwifery practices, resulting in positive experiences across all stakeholder groups. Pregnant women reported increased motivation for dietary changes and valued the personalised approach and practical tips provided by midwives during the first consultation. Midwives were generally satisfied but encountered challenges integrating the consultation into their existing care routines. The second consultation with dietitians was particularly well-received, with women appreciating access to specialised nutritional expertise. Dietitians reported high participant motivation and observed early behavioural changes following the first consultation. The visual conversation tool was well-received by both women and professionals, facilitating more targeted discussions. This pilot evaluation resulted in only minor adjustments to the content of the final P4HP programme.

THE FINAL P4HP PROGRAMME

The development process resulted in the P4HP programme, focused on improving nutrition from an empowerment perspective. The unique aspect of the P4HP programme is its integration of empowerment principles with practical support, facilitated through consultations by midwives and dietitians. Throughout these consultations, empowerment principles are reinforced using Motivational Interviewing (MI), a counselling method that recognises women as experts in their own lives. MI is used to enhance motivation, self-efficacy, and personal control (Miller & Rollnick, 2012). The implementation of the P4HP programme is supported by a comprehensive manual for professionals, which includes example questions, case studies, information about MI, and a visual conversation tool (**Supplementary material 1**).

The P4HP programme consists of four nutrition-focused consultations, designed to be integrated into routine antenatal care. The midwife's consultations can be combined with existing prenatal check-ups, ensuring efficient use of both the midwife's and woman's time. These consultations are complemented by one dedicated session with a

dietitian. Specifically:

- In the first consultation (10-15 minutes) the midwife engages in a conversation to understand the client's perspectives on healthy eating during pregnancy. The goal is to identify opportunities for empowerment and set realistic, achievable short-term dietary goals that foster confidence and motivation for long-term dietary improvements.
- In the second consultation (30-45 minutes), the dietitian builds on the midwife's initial conversation by using empowering interviewing techniques to help the client reflect on their progress, explore challenges in depth, and develop new actionable goals, all while maintaining a woman-centred approach that respects the client's autonomy.
- The midwife conducts two reflective follow-up consultations (both 10-15 minutes), during which they review the woman's nutritional journey, identify barriers and opportunities, develop further achievable actions if possible, and prepare for postpartum nutrition needs. These consultations can be combined with existing consultations.

Empowerment is the core principle of the P4HP programme (Super & Wagemakers, 2021). By fostering equal partnerships between healthcare providers and women, the programme integrates both external factors (facilitating choices and meaningful connections) and internal factors (women's belief in their abilities, and control over their circumstances) (Nieuwenhuijze & Leahy-Warren, 2019). These principles are put into practice during consultations where women analyse their situations and create their own solutions. Although the programme includes visual tools, their potential is not automatic – their effectiveness depends on how they are used to facilitate women's autonomy in decision-making.

The P4HP programme incorporates several key approaches to operationalise empowerment. It shifts the focus of nutritional support from traditional expert-driven care to facilitative partnerships, placing women's self-identified goals and readiness for change at the centre. Midwives and dietitians take a holistic approach to nutrition, recognising that factors such as women's daily challenges and conflicting priorities significantly influence their dietary choices. The programme intentionally adopts a strength-based approach, emphasising women's potential rather than focusing solely on nutritional issues. Pregnant women reported sustained motivation for dietary changes, and both women and healthcare providers appreciated the positive framing, focus on women's context, and the collaborative dynamic.

PHASE 4: IMPLEMENTATION AND EVALUATION

The P4HP programme was implemented on a larger scale in midwifery practices and evaluated through a cluster randomised controlled trial (C-RCT) and process evaluations. The programme was delivered at no cost to pregnant women, with participating midwives and dietitians receiving reimbursement for their consultations through the research project.

The C-RCT demonstrated significant improvements in pregnant women's diet quality (Van Lonkhuijzen, de Vries, et al., 2025). Process evaluations revealed high satisfaction among pregnant women, who particularly appreciated the personalised advice from dietitians who could answer specific questions about nutrition, while midwives helped them stay motivated throughout their pregnancy (Van Lonkhuijzen, Prins, et al., 2025). In addition, the P4HP programme enhanced interprofessional collaboration between midwives and dietitians (Van Lonkhuijzen et al., n.d.). A key takeaway was the importance of implementation flexibility – while the P4HP programme's core elements remained unchanged (empowerment principles, repetition, and interprofessional collaboration), its integration into existing care routines needed to be adaptable. This flexibility was achieved by allowing healthcare professionals to determine consultation timing that suited their practice routines. Additionally, practices can opt for dietitians to deliver the first consultation when this is preferred – which two practices chose for. This adaptable approach enabled the programme to accommodate different practice realities while maintaining its essential components.

6.3 DISCUSSION

The P4HP programme has been developed in close collaboration with key stakeholders to enhance the diet quality of pregnant women through empowering consultations provided by midwives and dietitians. This article reflects on the participatory development process of the programme. The participatory development approach employed in P4HP aligns with implementation science principles, demonstrating that stakeholder engagement enhances programme adoption and sustainability (Cargo & Mercer, 2008). The empowerment focus resonates with global woman-centred care recommendations, recognising women's expertise while providing professional support (World Health Organization, 2018). We claim that the success of the P4HP programme lies in its co-creation with midwives, dietitians, and pregnant women.

The P4HP programme's success lies in how stakeholder engagement shaped both the programme's content and implementation approach. The comprehensive stakeholder engagement embodied the empowerment principles we aimed to integrate into the programme itself. The development process demonstrates that meaningful stakeholder

engagement requires creating multiple opportunities for voice and influence (Nieuwenhuijze & Leahy-Warren, 2019). The extensive research in Phase 1 proved to be crucial not just for gathering information but also for building relationships and trust that carried through subsequent development phases. This comprehensive understanding enabled us to translate empowerment from an abstract concept into concrete, actionable programme components that addressed the multifaceted influences on prenatal dietary choices. Phase 2's pressure cooker sessions demonstrated the value of true co-creation, with multi-disciplinary group dynamics facilitating programme translation from research to practice. This co-creation approach reflects evidence that interprofessional collaboration improves maternal health outcomes (Renfrew et al., 2014).

While healthcare professionals were generally enthusiastic participants, recognising the programme's importance, we faced some implementation challenges, including recruiting low-SES pregnant women and heavy workloads that sometimes limited midwifery practices' participation. Nevertheless, we successfully matched local dietitians with midwifery practices where no existing collaboration had been established. The iterative development process revealed that successful implementation required balancing standardisation with local adaptation. While maintaining core elements was essential for programme integrity, the ability to adjust timing and delivery to local contexts proved crucial for sustainable adoption in real-world settings. The successful outcomes of the P4HP programme demonstrate that integrating nutritional support into routine antenatal care through an empowerment-based approach is both feasible and effective when supported by appropriate structures (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., n.d.; Van Lonkhuijzen, Prins, et al., 2025).

Engaging stakeholders early and maintaining their involvement throughout the developmental process was essential in ensuring the P4HP programme was practical and aligned with real-world requirements and preferences. However, time constraints within midwifery practices and the financial barriers of dietitian consultations pose challenges to integrating the P4HP programme into routine antenatal care. While larger-scale research is needed to determine the cost-effectiveness of the P4HP programme, our research offers valuable insights for developing sustainable health promotion initiatives in antenatal care through participatory development and empowerment principles. This study underscores the necessity of consistent investment in preventative care to reduce downstream healthcare costs associated with adverse health outcomes.

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ANNEX 6.1: INFORMATION ON (SYSTEMATIC) LITERATURE REVIEWS

Nr	(Systematic) literature reviews
1	Empowerment programmes for pregnant women to obtain a healthier dietary intake - A systematic literature review
<i>Abstract</i>	<p>Dietary intake of pregnant women is important for the health of mother and child. However, pregnant women do not adhere to nutrition guidelines sufficiently. Empowerment is one of the factors which influences dietary intake of pregnant women. Hence, health promotion programmes aim to empower pregnant women to obtain a healthier dietary intake. The aim of this thesis is to get insight into components of empowerment programmes. This will help to further develop empowerment programmes and ultimately to obtain a healthier dietary intake of pregnant women. Data was obtained by a two-way method. First, a systematic search was performed using the databases Scopus and PubMed. The search included articles about empowerment of pregnant women in developed countries, aiming to improve dietary intake. Second, logic models of empowerment programmes were created. In total, 13 articles and 5 programmes were reviewed and analysed to identify components. Components were viewed in light of the salutogenic model and different levels of empowerment: individual, community and organisational. Literature identified eleven components. Knowledge was found as the most common component in articles, the other components are: cooperation between different actors, social support, flexibility, timing, service provision, evaluation, responsibility, access to food, contracts, communication. Empowerment programmes used flexibility as the most common component. Next to the process of empowerment, a process of reflection is important for empowerment programmes. Empowerment involves different components. There is a difference between components mentioned in articles and used in empowerment programmes. Not all components mentioned in literature were found in programmes as well, and other components were not as common. Furthermore, components address different levels of empowerment. Next to empowerment, reflection is important. Both processes of salutogenesis, empowerment and reflection, are needed to empower pregnant women to obtain a healthier dietary intake.</p>
2	Why pregnant women eat what they eat – Factors influencing dietary intake among pregnant women from low SES groups
<i>Abstract</i>	<p>Pregnant women with low socio-economic status (SES) often do not meet the recommended daily intakes, which makes them more at risk for maternal complications and adverse pregnancy outcomes. Existing methods to improve the dietary intake are inappropriate because they are often very general and not tailored to specific groups. This study aims to gain insight in factors influencing why pregnant women with low SES eat what they eat, to contribute to the improvement of nutrition of low SES groups. A systematic literature study was used to investigate the factors influencing the diet of pregnant women. Complementary, in-depth interviews with 14 pregnant women with a low SES were performed to check whether these factors also apply for pregnant women with a low SES and to discover additional influencing factors. All pregnant women with a low SES in this study indicated to make changes in</p>

their diets for the health of the baby. Other factors influencing dietary intake in pregnant women are opinion towards own diet, psychological factors, knowledge, motivation, control, familiarity and self-efficacy. Besides that, physical factors, dietary habits, responsibilities and information search are influencing the diet. Furthermore, the social environment, including received information, and culture play a role in dietary intake in pregnant women with a low SES. Lastly, the physical environment and the midwife are influencing the diet of pregnant women with a low SES. Individual and collective factors influencing dietary intake among pregnant women coming forward in both interviews and literature, differ a lot among the women. Because of varying influencing factors among women with a low SES, interventions or method should be tailored more specifically. Further research should investigate how to motivate these women to improve their diets during pregnancy and how to overcome their barriers.

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- 3 Paving the way to better maternal and neonatal health outcomes - Identifying factors that influence dietary quality in low SES pregnant women: a literature review
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Abstract This systematic literature review examined factors influencing dietary quality among low socioeconomic status pregnant women in developed countries, utilising the social ecological model as a theoretical framework to categorise multilevel influences on nutritional behaviors. The exploratory review searched Scopus and Web of Science databases for peer-reviewed articles published from 2010 onwards, focusing specifically on barriers and facilitators to healthy eating among economically disadvantaged pregnant populations. The analysis of nine high-quality studies encompassing 1,287 low SES pregnant women revealed a predominant emphasis on intrapersonal factors, with nutritional knowledge deficits identified as the most prevalent barrier across five studies. Additional individual-level obstacles included psychological stressors such as depression, taste preferences favoring unhealthy foods, and pregnancy-related cravings. At the interpersonal level, family dynamics emerged as significant influences, with four studies documenting pressure from relatives to overconsume based on “eating for two” beliefs, while partner support demonstrated protective effects on dietary quality. Policy-level barriers, particularly financial constraints and elevated costs of nutritious foods, constituted the primary structural impediments identified across four studies. Notably, research addressing community and institutional factors remained limited, revealing substantial gaps in understanding environmental determinants of dietary behavior among this population. The geographical restriction to United States-based studies further limits generalisability to other developed nations with different healthcare systems and social policies. These findings underscore the complex, multilevel nature of dietary challenges facing low SES pregnant women and highlight the need for comprehensive interventions addressing individual knowledge gaps alongside broader socioeconomic barriers to nutritional adequacy during pregnancy.

4 Overview of dietary assessment tools for pregnant women: a literary review

Abstract This literature review aimed to investigate which tools are available for dietary assessment in pregnant women, and which of these may be suitable for women with low Socio-Economic Status (SES) in the Netherlands. This was done on behalf of a study which will be performed in Dutch low SES pregnant women and will try to establish and optimise pregnant women's dietary intake. Different search terms in various online databases were used to find a variety of dietary assessment tools. The search resulted in a total of 1185 articles, of which eight remained after reading the titles and/ or abstracts and applying inclusion and exclusion criteria. Of these eight tools, four of the eight were Food Frequency Questionnaires, two were image-based methods, and two were dietary records. In conclusion, the most appropriate tool may be the DietBytes image-based dietary assessment tool. This tool is a smartphone application in which pictures of consumed food can be loaded up to. Voice- and/ or text descriptions can be added for further explanation. The DietBytes method is stated to give an adequate and objective estimation of the dietary intake of pregnant women.

5 Interprofessional Collaboration Between Midwives and Healthcare Professionals in Prenatal Care: A Scoping Review

Abstract Maternal nutrition significantly influences pregnancy outcomes and long-term health for both mother and child. While midwives serve as primary prenatal care providers globally, they often lack adequate training in nutrition and weight management. Collaboration with dietitians and other healthcare professionals may enhance nutritional support during pregnancy, particularly for vulnerable populations. To examine existing forms of collaboration between midwives, dietitians, and other healthcare professionals regarding nutrition care for pregnant women, with particular attention to poorly educated populations. A scoping literature review was conducted using Scopus database. Search terms included combinations of "midwife," "nutritionist/dietitian," "prenatal care," and "collaboration." After applying inclusion and exclusion criteria, six studies were analysed, representing various study designs from five countries (Canada, United Kingdom, Netherlands, Austria). No studies specifically examined collaboration between midwives and dietitians regarding nutrition care for poorly educated pregnant women. The identified literature focused primarily on general interprofessional collaboration between midwives and other healthcare providers. Key barriers to collaboration included poor communication, divergent care philosophies, limited resources, territorial disputes, and inadequate understanding of professional roles. Facilitating factors comprised good communication, mutual respect, co-location, and joint working arrangements. One study demonstrated that interprofessional workshops improved collaborative attitudes and intentions among healthcare professionals. Current research reveals a significant gap in evidence regarding midwife-dietitian collaboration for nutritional support during pregnancy. While healthcare professionals value interprofessional collaboration, substantial barriers impede effective implementation. Future research should investigate how collaborative models influence maternal and infant health outcomes and examine specific strategies for integrating nutritional expertise into prenatal care, particularly for vulnerable populations.

- 6 Do Dutch pregnant women from a lower SES adhere with the nutritional guidelines during their pregnancy?

Abstract This study examined dietary intake quality among low socioeconomic status (SES) pregnant women in the Netherlands, addressing a significant research gap in understanding nutritional patterns within this vulnerable population. The research employed a cross-sectional design, analysing data from 37 Dutch pregnant women of lower SES at 17.9 weeks gestation, utilising a Meal-Based Food Frequency Questionnaire to assess usual dietary intake and the 2015 Dutch Healthy Diet index (DHD15-index) to evaluate adherence to food-based dietary guidelines. The findings revealed substantial deficiencies in dietary quality among low SES pregnant women compared to higher SES populations. The study population demonstrated poor adherence to both food-based dietary guidelines and micronutrient requirements, with particularly low DHD15-index scores averaging 4.2 across 12 components. The most pronounced deficiencies occurred in the consumption of vegetables, fruits, whole grains, nuts, dairy products, and tea, while excessive intake of red meat and sweetened beverages was observed. Micronutrient analysis indicated concerning inadequacy frequencies, particularly for vitamin A (30.6%), folate (16.5%), and vitamin B1 (11.7%), alongside elevated risk for iron deficiency (23.8%). These results align with international literature demonstrating dietary disparities across socioeconomic strata, though this study represents the first examination specifically targeting low SES pregnant women in the Netherlands. The research highlighted critical methodological considerations, including the absence of pregnancy-specific nutritional guidelines and incomplete supplementation data, which may have influenced inadequacy estimates. The findings underscore the necessity for targeted nutritional interventions, potentially involving enhanced midwifery counselling or specialised dietitian consultations, to address the elevated health risks facing low SES pregnant women and their offspring.

- 7 Midwives and nutrition communication with pregnant women: what is their perceived role and what resources do they need?

Abstract This research examined midwives' perspectives on nutrition communication during pregnancy, addressing a critical gap in prenatal care delivery through a mixed-methods approach combining a systematic literature review of ten publications with semi-structured interviews of twenty midwives conducted between September 2017 and January 2018. The study revealed significant ambivalence among midwives regarding their nutrition communication responsibilities, with some embracing this role while others questioned whether nutrition guidance fell within their professional scope or belonged to other healthcare providers. Current nutrition communication practices focused predominantly on basic safety information, supplementation, and risk avoidance rather than comprehensive dietary guidance. Midwives identified specific resource requirements for enhanced nutrition communication, including expanded nutritional knowledge, communication skills training, standardised guidelines, and dedicated consultation time. They expressed particular interest in collaborative tools such as mobile applications,

educational materials, and group-based interventions like CenteringPregnancy to improve their practice effectiveness. However, implementation challenges created substantial barriers to optimal nutrition communication. These included financial constraints, limited consultation time, policy gaps regarding nutrition communication protocols, and difficulties engaging vulnerable populations. Additionally, some midwives perceived nutrition as a sensitive topic requiring specialised expertise beyond their current training. The findings suggest that while midwives acknowledge responsibility for nutrition communication, systematic improvements require multifaceted interventions addressing both individual competencies and structural constraints. The research indicates that developing standardised nutrition communication protocols, providing targeted professional development opportunities, and establishing clearer interprofessional collaboration frameworks represent essential steps toward optimising maternal nutrition outcomes during pregnancy.

8 *Dietary Interventions for Healthy Pregnant Women: A Systematic Review of Tools to Promote a Healthy Antenatal Dietary Intake*

Abstract Maternal nutrition is essential for the development and lifelong health of the offspring. Antenatal care provides unique opportunities for nutrition communication, and health promotion tools (e.g., guidelines, instruments, packages, or resources) might help to overcome several concurrent barriers. We conducted a systematic literature review to map tools that are available for the promotion of a healthy dietary intake in healthy pregnant women in Western countries, and to identify what makes these tools feasible and effective for these women and their healthcare providers. Seventeen studies were included, evaluating tools with various delivery modes, content, and providers. Nine studies employed multiple, complementary delivery methods and almost all studies (n = 14) tailored the content to varying degrees, based on the individual characteristics and lifestyle behaviours of the participants. We found that the feasibility of a tool was dependent on practical issues, time investment, and providers' motivation, skills, and knowledge, while the effectiveness was related more to the type of provider and the content. Most effective interventions were provided by dietitians and nutritionists, and were highly tailored. Based on the results of this review, we believe that custom tools that are sensitive to inequalities are needed to support all women in obtaining or maintaining a healthy diet during pregnancy.



Chapter 7

THE ROLE OF THE PARTNER IN THE SUPPORT OF A PREGNANT WOMAN'S HEALTHY DIET:

AN EXPLORATIVE QUALITATIVE STUDY

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ABSTRACT

Background: Active partner involvement during pregnancy is an effective strategy to enhance both maternal and newborn health outcomes. The presence of a supportive partner equips women with a heightened sense of empowerment to deal with the challenges of pregnancy, including maintaining a healthy diet during pregnancy, which is important for the health of both the mother and child. However, little information exists regarding the partner's role in encouraging a pregnant woman's healthy dietary choices. This study aimed to explore the perspectives of pregnant women and their partners concerning the partner's role in promoting a healthy dietary intake during pregnancy.

Methods: Sixteen semi-structured couple interviews were conducted in the Netherlands, involving expecting couples. Based on Berkman's social networks and support theory, we categorised various forms of support as emotional, instrumental, appraisal, and informational. The interviews were accurately recorded, transcribed verbatim, and analysed using an inductive approach.

Results: In general, pregnant women reported being positive regarding the support they received from their partners. Partners primarily offered instrumental support to pregnant women, such as cooking, grocery shopping, and helping them avoid unsafe foods. Partners provided informational support, mainly about foods considered unsafe during pregnancy. Emotional support was relatively less common. The primary motives for giving support were pregnancy-related symptoms, the importance of the health of the mother and baby, and solidarity with the pregnant woman. Support from the partner was more willingly accepted by pregnant women if the support was perceived as being helpful, showing involvement, and positive. Conversely, partner support was not accepted if it was perceived as judgmental or unwanted.

Conclusions: The majority of pregnant women were satisfied with the support received from their partners, although there are opportunities for a partner to provide more support to improve the dietary intake of pregnant women. To optimise this support, partners are advised to tailor their support to the needs and expectations of pregnant women. Personalising dietary support can be achieved by couples communicating their dietary wishes and expectations regarding support.

7.1 INTRODUCTION

A healthy diet during pregnancy, including a variety of nutrient-dense foods that provide an adequate intake of energy, protein, vitamins, and minerals, while avoiding unsafe foods such as alcoholic beverages, is vital to meet both maternal and foetal needs (World Health Organization, 2016b). A healthy diet is important during pregnancy because it contributes to favourable short- and long-term health outcomes for the mother and child (Caut et al., 2020; Marshall et al., 2022; Versele, Debekker, et al., 2021). However, overall adherence to dietary guidelines during pregnancy is suboptimal (Caut et al., 2020; World Health Organization, 2016b). Inadequate maternal nutrition, characterised by excessive energy intake or micronutrient deficiencies, may lead to several negative health outcomes in the mother, such as gestational diabetes, hypertension, and caesarean delivery (Braveman et al., 2010; Grenier et al., 2021; Koletzko et al., 2019). Furthermore, an unhealthy maternal diet could also negatively impact the health of the child, including an increased risk of preterm birth, deviation in birth size, and non-communicable diseases in later life such as obesity, diabetes, and cardiovascular diseases (Grenier et al., 2021; Koletzko et al., 2019; Versele, Debekker, et al., 2021). Although most women change their diet by avoiding alcohol, caffeine, and unsafe foods, they tend not to improve their overall diet (Grenier et al., 2021). Whilst it has been reported that pregnant women should consume a balanced diet according to dietary recommendations, focusing on foods that contain critical nutrients (Koletzko et al., 2019), a deeper understanding of the factors that influence their eating behaviour would be valuable.

Social support can serve as an important predictor for both mental and physical health during this critical period (Greenhill & Vollmer, 2019; Grenier et al., 2021; Versele, Debekker, et al., 2021). Social support is a fundamental component within the framework of social networks (Berkman et al., 2000; Heaney & Israel, 2008). In pregnancy-related research, defining support is regularly based on the social networks and support theory of Berkman et al. (2000) (Hetherington et al., 2020; Parrott et al., 2009). Berkman et al.'s (2000) theory divides support into emotional, instrumental, appraisal, and informational support, with definitions for each provided in **Table 7.1**.

TABLE 7.1: DEFINITIONS OF SUPPORT

Concept	Definition
Emotional support	Expressions of empathy, love, trust and caring (Heaney & Israel, 2008). Emotional support also entails sympathy, understanding and/or esteem or value provided by others (Berkman et al., 2000)
Instrumental support	Help, aid or assistance with tangible needs and services (Heaney & Israel, 2008)
Appraisal support	Provision of information that is useful for self-evaluation, help in decision making and giving appropriate feedback (Berkman et al., 2000; Heaney & Israel, 2008)
Informational support	Provision of advice, suggestions and information in the service of particular needs (Berkman et al., 2000; Heaney & Israel, 2008)

Pregnant women who receive substantial social support experience several favourable improvements in their dietary choices (Elsenbruch et al., 2007), including the enhancement of prenatal intake of healthy foods, such as fruits and vegetables (Greenhill & Vollmer, 2019; Grenier et al., 2021). The supporting role of partners is particularly important (Galle et al., 2021; Greenhill & Vollmer, 2019; Rini et al., 2006; Tokhi et al., 2018). Firouzan et al. (2018) stated that the participation of the father is essential for a healthy pregnancy. The World Health Organization (WHO) indicates that partner involvement, also referred to as male involvement, during pregnancy, childbirth, and the postpartum period is an effective strategy to improve both maternal and newborn health outcomes (World Health Organization, 2016b).

However, different interpretations have been given to the term ‘partner involvement’ across the world (Galle et al., 2021). In Mozambique, partner involvement was defined as taking care of the family through financial support, participating in decision-making, and expressing affection towards one’s partner. A study in the USA showed that partner involvement was manifested by being present and being emotionally and physically involved, including doing household chores and attentively listening to women’s concerns (Galle et al., 2021). Tokhi et al. (2018) extended this definition to encourage pregnant women to adopt health-promoting behaviour, such as encouraging a healthy diet and better hygiene practices (Tokhi et al., 2018).

While research has been conducted in the field of financial, emotional, and physical support of partners during pregnancy (Galle et al., 2021; Rini et al., 2006; Tokhi et al., 2018), studies on partner support for dietary intake in pregnant women are scarce (Greenhill & Vollmer, 2019; Grenier et al., 2021; Koletzko et al., 2019; Versele, Debekker, et al., 2021; Versele, Stok, et al., 2021; World Health Organization, 2016b). Therefore, the objective of this study was to explore the perspectives of Dutch pregnant

women and their partners on the role of the partner in supporting the healthy diet of pregnant women.

7.2 METHODS

STUDY DESIGN AND SETTING

To explore the influence of partner support on the dietary intake of pregnant women, an exploratory qualitative study was performed. Support involves transactions between two people and is therefore an interdependent relationship (Rini et al., 2006). In this study, pregnant women and their partners were interviewed using semi-structured couple interviews. Couple interviews offer the unique opportunity of shared storytelling and intra-couple dynamics, add to retrieving rich data (Bjørnholt & Farstad, 2014), and have been suggested as an 'appropriate method for studying complex shared practices such as making health decisions' (Polak & Green, 2016).

Recruitment and interviews were conducted between October 2021 and January 2022. In total, 16 couples, and thus 32 participants, were recruited using convenience and snowball sampling (**Figure 7.1**). The interview invitation was publicly shared online and posted across the researchers' social networks. The inclusion criteria were that couples spoke and understood Dutch, were in a relationship where they lived in the same household, and the woman was currently pregnant. Upon agreeing to participate, the date and time of the interviews were scheduled. Participants were asked whether they knew of other pregnant couples to participate in the study. **Figure 7.1** illustrates the various ways of how participants were recruited.

INTERVIEWS

The interviews (N=16) lasted between 35 and 63 minutes, with an average duration of 45 minutes, and were audio-recorded in Dutch. Most interviews took place online (n=14) due to Covid-19 regulations. In-person (n=2) interviews were conducted in a quiet room of the participants' choice which ensured confidentiality. All interviews were conducted by interviewer HR with both the pregnant woman and partner present, which made it possible to observe the interaction between the couple and compare perspectives on the subjects during the interview. The characteristics of the couples are listed in **Table 7.2**. Data saturation was achieved around interview number 11, but five more interviews were conducted to ensure no additional themes, opinions, or codes occurred in the data (Guest et al., 2006; Hennink & Kaiser, 2022).

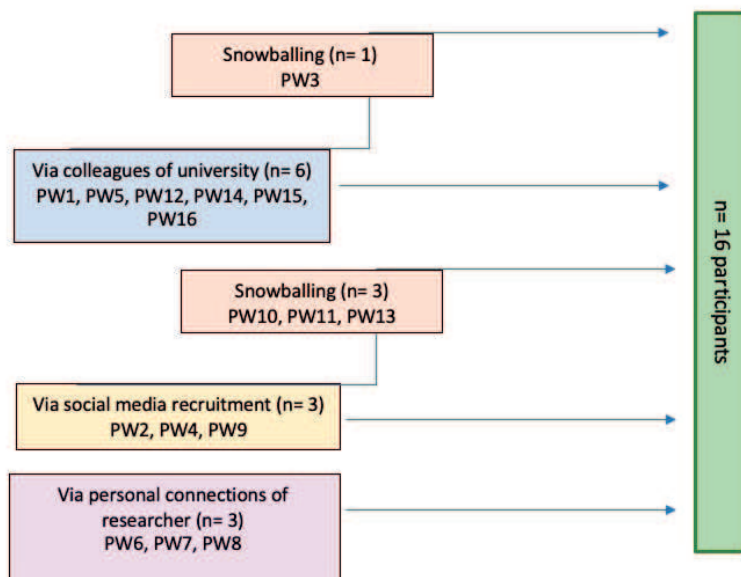


FIGURE 7.1: RECRUITMENT AND INCLUSION OF PREGNANT WOMEN AND THEIR PARTNERS (PW=PREGNANT WOMAN)

The semi-structured interview guide (**Annex 7.1**) was prepared through a review of the literature and inspired by the research of Super and Wagemakers (2021), who learned during co-design meetings that eating during pregnancy is a potentially sensitive topic. Therefore, the interviewer was careful not to judge or comment on the interviewees' eating behaviour, and to contribute to an open, safe, and supportive environment during the interviews. The interview guide had open-ended questions, ensured that predetermined themes were discussed, and enabled follow-up on new insights during the interview when new interesting themes emerged. During the interviews, the interviewer asked exploratory and clarifying follow-up questions to enable an in-depth understanding of the couples' points of view.

The interviews were structured into four parts: 1) background information about the couples and their pregnancy, 2) dietary intake before and during pregnancy, 3) perspectives on and acceptance of support, and 4) possibilities to improve support. The questions for parts 1 and 2 were created to gain insight into the background information about the couple and pregnancy. The questions for part 3 were inspired by (Greenhill & Vollmer, 2019; Super & Wagemakers, 2021), and Berkman et al. (2000). Greenhill and Vollmer (2019) focused on the couples' perceptions of the father's role regarding a pregnant woman's nutrition and physical activity behaviour. Super and Wagemakers (2021) studied the perspectives of pregnant women on food intake and eating behaviour, experiences of social support, and opportunities for empowerment toward healthy

TABLE 7.2: DESCRIPTIVE INFORMATION OF COUPLES

Couple	Age (PW, P)	Week of pregnancy at the time of the interview	Pregnant with baby no.	Sex of couple
1	35, m.d.*	25	1	Male + Female
2	22, 23	32	1	Male + Female
3	34, 38	25	2	Male + Female
4	32, m.d.	20	2	Male + Female
5	34, m.d.	38	1	Female + Female
6	28, 27	12	1	Male + Female
7	25, 28	18	1	Male + Female
8	29, 30	37	1	Male + Female
9	27, 28	13	2	Male + Female
10	m.d., 24	29	1	Male + Female
11	32, m.d.	36	1	Male + Female
12	27, 31	34	1	Male + Female
13	24, 26	36	2	Male + Female
14	27, 24	32	1	Male + Female
15	23, 24	11	1	Male + Female
16	30, 31	12	1	Male + Female

* m.d. = missing data

dietary intake. The social networks and support theory of Berkman et al. (2000) was used to understand the complexity of social support concerning health and to define four subtypes of social support: emotional, instrumental, appraisal, and informational support. Because women with a supportive partner have been shown to feel empowered to deal with the difficulties of pregnancy (Firouzan et al., 2018), the three-step approach of empowerment evaluation was used to formulate the interview questions for part 4 (Fetterman et al., 2014). Research in the area of empowerment in relation to social support and dietary intake is limited (Bookari et al., 2017; Brandstetter et al., 2015), but it could support healthy behaviour changes during and after pregnancy. Therefore, identifying opportunities for partners to contribute to the empowerment of pregnant women concerning dietary intake was included in the interviews.

DATA ANALYSIS

To ensure anonymity, each participant was assigned a number (couple 1 → PW1 and P1, etc.). The audio recordings were transcribed verbatim and analysed using coding in Atlas.ti, a software for qualitative data analysis. Data were coded iteratively. The interview transcripts were coded inductively by HR. Parts 1, 2, and 3 of the interviews were coded descriptively to easily find the information needed. For example, all quotes

about what was eaten daily were coded as Diet_pattern and every complaint experienced during pregnancy was coded as Pregnancy_complaint. This way, an overview was created about pregnancy, diet, and general information such as occupation and age. Part 4 was coded *in vivo* to remain close to the participants' perspective. After coding four interviews, an analysis was conducted on the *in vivo* codes of part four to reveal the underlying structures of experiences or processes (Thomas, 2006), and create categories from the data based on these structures. When uncertainties occurred, for example under which codes certain results fit best, this was discussed by all authors to reach a consensus. Coding was discussed and agreed upon by all authors, resulting in a code list (**Annex 7.2**) upon which all 16 interviews were coded. During the process of coding all interviews, only a few new codes emerged. The analysis of the interviews was discussed four times with all authors to reach a consensus.

ETHICAL CONSIDERATIONS

Ethical approval was granted by the Social Sciences Ethics Committee of Wageningen University and Research on the 20th of October 2021. Participants provided written consent if the interview took place in person, and verbal consent if the interview took place online after they were explained the aim of the study, the procedure of data collection, issues of confidentiality, the voluntary nature of participation, and that they were free to withdraw from participating at any time. Oral permission for audio recording was obtained at the start of each interview.

7.3 RESULTS

The couples were relatively highly educated, seemed happy in their relationship, and felt excited about their pregnancy. The couples were talkative and sympathetic. The sphere of the interviews was open and intimate, which led couples to share personal details such as their health or bad experiences during previous pregnancies. Because the interviews were held with both the pregnant woman and her partner, the interaction between them could be observed, as couples often added to each other's stories and started asking each other questions. Example of such conversation between two partners:

P9: People often tell stories about men opening a bottle of wine for the pregnant woman to be like: "What about me? I'm pregnant!" Fortunately, we don't experience that.

PW9: That would not help me or feel as supported either.

P9: No, but if you felt like that, I would not have done that.

PW9: No? Then you would have just continued drinking?

P9: No, then I would not drink wine and stuff. Then I would have just stuck with beer.

PW9 [laughing]: Is that not alcohol as well?

P9: Yes, but I could also open a very nice bottle of white wine, making you feel something like: "I would also have liked that." However, that is something that I would not do.

When discussing the pregnancy and their complaints, the pregnant women did most of the talking. Some women mentioned not having something to complain about, whereas others experienced complaints such as tiredness, nausea, and vomiting. Partners often indicated that pregnancy was an exciting but difficult time because they empathised with the experience of the pregnant woman. When couples were asked about a rating between 0 and 10 (0 = very unhealthy and 10 = very healthy), they would assign to the healthiness of their diet: they graded this at about 7 out of 10 on average, ranging from 5 to 8.5. Only one couple scored their diet as low as a 5/10.

P13: With all snacks I eat... I think I am at a 5.

PW13: I think I also score 5 because I keep eating all day because I am hungry all the time.

P13: Yes, you will then grab a cookie or some candy..

PW13: Yes, to stop nausea, I just need to eat.

Dietary changes since pregnancy differed between couples. Almost half of the couples mentioned being more occupied with being healthy during the pregnancy than before. Some pregnant women consume more vegetables and fruits, while others consume more unhealthy snacks, often caused by pregnancy cravings. All pregnant women changed their diet by withholding unsafe foods such as raw meat, soft cheese, and alcohol.

"I noticed that when I found out I was pregnant, a switch flipped [to eat healthier]."

(PW16)

When discussing support, almost all couples agreed with one another regarding their provided dietary support. Sometimes it was difficult for couples to come up with examples of dietary support, but most of them would add to each other's previously made suggestions. For some couples, the pregnant women primarily supported their partner with a healthier diet, whereas in other couples the partner mostly supported the pregnant woman.

PARTNER SUPPORT

When the couples were asked what came to mind when talking about support during pregnancy, most of them started talking about non-dietary support. Partners were more involved in doing household chores since pregnancy by vacuuming, doing the laundry, or loading and unloading the dishwasher. In addition, partners expressed more empathy and encouragement towards pregnant women. These were either related to pregnancy complaints, such as being tired or feeling sick, or being interested in pregnancy itself.

INSTRUMENTAL DIETARY SUPPORT

The majority of pregnant women received a lot of instrumental dietary support, including the partner cooking, doing groceries, and withholding from foods that are unsafe during pregnancy. During pregnancy, partners cooked more often than before. This included preparing dinner together with the pregnant women or doing it more often by themselves. Partners also took more care of the pregnant women during the day, for example by preparing fruit, ensuring that she drank enough fluids, or bringing a cup of tea. Partners also went grocery shopping more during pregnancy. Some partners mentioned accompanying the pregnant women to the store to carry the heavy bags, whereas others said they took on the entire task of grocery shopping.

“You did a lot of cooking, you made sure that the groceries were done, that there was enough food in the house, and that there was plenty of vegetables and fruit.” (PW5)

Pregnancy-related complaints among pregnant women have caused their partners to increase instrumental dietary support (e.g., cooking or groceries). Complaints such as tiredness or nausea made it more difficult for pregnant women to cook or do groceries, so the partners felt that they needed to take on these tasks. Being available helped the partners provide support. Some partners, for example, mentioned that the COVID-19 regulations were beneficial for providing support since they were more at home to help around the house.

“You see, on days that she is really tired or that we did something, and we get home and she is out of energy, then I often cook.” (P12)

“There was also a phase when you couldn’t handle standing in the smell of cooking so during that phase I did it more often.” (P13)

All pregnant women withheld unsafe foods during their pregnancies. 15 of the 16 pregnant women used the Zwangerhap app of The Netherlands Nutrition Centre to determine what to eat during pregnancy. Partners supported pregnant women by also withholding themselves from unsafe foods and felt like it would not be solidary to eat them in the presence of pregnant women. Ten partners mentioned drinking no or significantly less alcohol in the presence of the pregnant women or withholding from eating unsafe foods, such as raw meats and unpasteurised cheeses because of pregnancy. Partners felt that it would make it easier for pregnant women to avoid certain foods if they withheld themselves as well, and felt that it was not fun to eat or drink these foods alone.

“I think it is the biggest support that you do not eat everything that I cannot eat right in

front of me, for example ordering sushi while I cannot have that.” (PW9)

“He says: I am not going to drink wine alone. You are sitting next to me, and I am drinking a glass of red wine by myself. That’s just not as nice.” (PW14)

“I understand that people do not want the smell of salmon in their nose when they cannot eat it” (P5)

APPRAISAL DIETARY SUPPORT

Appraisal support refers to providing support for self-evaluation, helping in decision making, and giving appropriate feedback. Over half of the partners gave appraisal dietary support to increase the pregnant women's consciousness of their dietary intake. Partners made comments about the pregnant women eating unhealthy food or steered them to eat healthier foods. Some partners were concerned about the amount of food consumed in a day and made comments regarding this.

“I once said that I really wanted to go to a snack bar and then he said; we are not going to do that, you will be grateful later.” (PW3)

“I can’t drink too much coffee. Only two cups a day, and sometimes when I say I would like another one, he says: you know you don’t need to drink more than two cups of coffee per day” (PW14)

In addition to increasing awareness of dietary intake, five partners specifically provided appraisal support for unsafe foods. For example, while doing groceries, partners asked which foods the pregnant women were allowed to eat and thus could be taken home, or while preparing meals which foods could be eaten. Some partners also commented on which foods should be eaten by the pregnant women or made suggestions about what to eat while being nauseous.

“He always asks something like: I am making fresh mint tea; can you have that?” (PW11)

“I try to say to her: you need to eat something light, like yoghurt, which includes a lot of protein so that you gain some strength back” (P15)

The importance of a healthy diet and avoiding unsafe foods were reasons for the partners to provide appraisal support for the health of both the mother and the baby.

“Raw meat is just something we are not going to do [...] why would you risk that?” (P4)

INFORMATIONAL DIETARY SUPPORT

Most informational support provided by the partner concerned foods that were unsafe during pregnancy. Partners informed themselves about these food products, discussed them with the pregnant women, and checked on food labels what could and could not be eaten by pregnant women. Some partners downloaded pregnancy- and dietary-related apps on their phones to inform themselves.

PW13: He makes sure that I do not eat something that I cannot have because of my pregnancy.

P13: Yes, with salmon, steak, or something like that.

PW13: Yes, like can you have that? So, you do not look at what is healthy, but you do look at what can be harmful to the baby.

In one interview, informational support regarding additional nutrients during certain period of pregnancy was provided.

“The app said, for example, that in this week the bones are being developed, so calcium is important. So, then I say: you need a bit more yoghurt.” (P5)

Informational support was often provided because the partner felt nervous about the pregnancy. Many of the partners expecting their first child felt uncertain in the first few weeks of pregnancy, since it was a new experience for them. Some partners were worried about the pregnant woman feeling sick. Information was sought to feel more confident and know what to eat during pregnancy. Similar to appraisal support, the health of the mother and baby underlies the reasons for providing this type of support.

“Especially in the beginning I was quite nervous about how it would all go up until 12 weeks, so then I asked many times whether she feels good and whether it wasn’t too heavy carrying certain things and all those kinds of things.” (P5)

EMOTIONAL DIETARY SUPPORT

Emotional dietary support was mentioned in four interviews and was thereby the least mentioned type of dietary support during pregnancy: partners supported pregnant women by expressing care and empathy regarding dietary difficulties.

“At moments that it gets difficult, I try to empathise even though it is difficult since you do not feel it yourself. And also, to talk about it helps a lot if she can just share her story.” (P15)

NO SUPPORT RECEIVED BY PREGNANT WOMEN

In some situations, dietary support was not received by the pregnant woman and was not provided by the partner. Examples of such situations were that the partners did not withhold themselves from eating pregnancy-unsafe foods, were not involved in the dietary intake of the pregnant women, or did not take on tasks such as doing groceries. The main reason for not providing dietary support was that it was not needed or appreciated by the pregnant woman, for example, because the pregnant woman was well aware of unsafe foods, was already eating healthy, or was not experiencing difficulties. Some partners did not feel comfortable telling the pregnant women what (not) to eat. Not consciously being occupied with pregnant women's dietary intake is also a reason why partners did not provide dietary support. Some partners expressed a lack of knowledge about what is healthy and what are the important nutrients during pregnancy. Lastly, pregnancy complaints, such as nausea, made it difficult for partners to provide dietary support because they did not know which foods to advise during nauseous periods or felt that pregnant women were less approachable. Partners also expressed that pregnant women should be able to enjoy (unhealthy) food during pregnancy without receiving comments about it.

SUPPORT ACCEPTANCE

In a minority of cases, the support provided by partners was not accepted by pregnant women. For all four types of support, there were examples of pregnant women accepting support and pregnant women not accepting support. For example, regarding instrumental dietary support, some pregnant women accepted that their partner did the groceries, while others did not want their partner to do so. Appraisal support was accepted by some pregnant women because they felt that it showed involvement. However, others did not like appraisal support as it felt like unwanted interference.

"He sometimes bought me brown bread and then I got irritated because I don't want brown bread – I want white bread! [...] The more people pay attention to things I should not do, the more I feel the urge to do them. [...] So I think; what are you meddling? As if I'm some dumbass who does not know how to take care of herself." (PW6)

REASONS FOR ACCEPTANCE OF SUPPORT BY THE PREGNANT WOMAN

Appreciation was the main reason for accepting support from their partners. In eight interviews, pregnant women appreciated getting support, from their partners or relatives. Multiple reasons can be identified as to why the given support has been accepted. One example is that support was accepted because it was helpful for pregnant women to take away some of the burdens of household chores. Another reason for support acceptance was that the support showed involvement and was perceived as being caring.

P8: I try to pay attention to what I eat. Because if I would eat crisps, or when I would get McDonald's, I know that she would want it too. It would not be fair to eat it alone, so I think that I would pull her into that unhealthy food if I did that.

PW8: Yes, I am happy about that because I cannot guarantee that I am strong enough to resist that.

"I think that's so sweet, that he is so involved in my health in that way" (P6)

The origin of support is relevant to whether it is accepted. Pregnant women more readily accept support when given by an expert, such as a midwife or a dietitian. Besides experts, support is also more willingly accepted by someone who is also pregnant or has been pregnant before. Two participants, for example, more readily accepted support from their mothers than from their partner.

PW8: I think it would be different if I received a dietary tip from a midwife. You can tell that they received training on how to transmit information. [...] It is their occupation, they have studied for it, and they have experience. I accept this information more willingly.

In addition to the importance of the person who provides support, the way support is communicated is important. For example, support should not be communicated with a know-it-all attitude or coercively but rather as advice to be accepted. The provided support should be clearly explained and come from a reliable source. Some pregnant women would like support to be given directly, but others prefer it more subtly.

"I always prefer that you just communicate directly to me" (PW12)

"I do need to communicate it subtle otherwise it will come across as an attack" (P14)

Support was more likely to be accepted if it was requested, not repeated constantly, and when provided at the beginning of the pregnancy rather than later or during a second pregnancy. This is because couples have gathered more information and experience later in pregnancy, reducing the need for support at later time points.

P3: Yes, I think support leads to healthier choices.

PW3: I think so too. I have quite some knowledge, so I do not need it as much. However, I do think that if you would have asked this question during my first pregnancy, I think I would have answered differently. I searched for a lot of information about the types of fish, etc. I was like a walking Google during my first pregnancy.

Finally, the content of the support was important. Pregnant women would receive

positive rather than negative feedback, and would therefore rather receive support about what is healthy than what is unhealthy. However, some support regarding what is unhealthy or what can be harmful to the baby is appreciated. Other dietary support provided by the partner was only accepted by the pregnant woman if they felt that it was relevant. For example, if the partner provided appraisal support regarding snack behaviour (e.g., eating too many biscuits), it was only accepted if the pregnant woman agreed that her snack behaviour was problematic. In addition, if the partner provides this kind of support, the partner should comply with the support they provide. Support regarding unhealthy snack behaviour will only be accepted by pregnant women if the partner has healthy snack behaviour.

I: So when he tells you 'This is healthy and I know you would like it', that would be nice and you will take the support into account, but if he says 'you should not eat this', it would be harder to accept?

PW15: It depends, if I would eat cookies all day, and he would say: maybe that is not clever to do, it would be different. However, if I just eat one cookie occasionally, I would just enjoy eating it.

REASONS FOR NON-ACCEPTANCE OF SUPPORT BY PREGNANT WOMEN

In the few cases of non-acceptance of support by pregnant women, some reasons were mentioned by both the pregnant women and their partners. Some characteristic traits of pregnant women have been mentioned as reasons for non-acceptance, such as stubbornness, recalcitrance, and being bad at receiving support. Partners find it more difficult to give support to pregnant women when they know it will not be appreciated by them, due to their character or previous experiences of failed attempts to provide support.

"I have a hard time letting go. I often think I can do it better. [...] Even if I should stop and lie down, I am stubborn. I usually only sit down if I am done doing everything around the house." (PW3)

"If I am being honest, I am really bad at receiving criticism or unwanted advice." (PW6)

Pregnant women may feel that their partners do not have the authority to decide what they can eat. Most pregnant women said they were able to decide for themselves what is good or not good to eat and indicated that they already had a healthy diet before pregnancy, so the involvement of the partner was not appreciated. Support was also not accepted because of acute urges such as pregnancy cravings. If pregnant women want to eat a certain thing, it does not matter how support is communicated: it would not be accepted by pregnant women anyway.

"I'm like, it is my life and my body, and I can decide what I eat or drink" (PW6)

Dietary support can also have negative outcomes. When partners, for example, gave appraisal support for improving snack behaviour, pregnant women felt more urged to eat snacks.

I: If your partner would say something like 'Maybe you should not drink the glass of chocolate milk.' What would you think?

PW14: I would then drink an extra glass of chocolate milk.

Support was not accepted when it felt as judgment or unwanted interference. Some pregnant women felt judged for their choices regarding unsafe foods. Trustworthiness and unclear advice were other reasons for not accepting support. Most couples indicated that it is important to follow dietary guidelines, and support is less likely to be accepted when it is not in line with these guidelines. In rare cases of someone providing advice that conflicts with these guidelines, such as 'one sip of alcohol will not harm the baby,' this was often not accepted and appreciated.

P5: My mother tried to give you alcohol, which was very weird. I was really confused because she is not a drinker at all. She usually feels disgusted with alcohol consumption.

PW5: But she did so because your dad made wine of its own.

P5: Yes, my dad made wine, but then I said: 'You will not feed alcohol to my baby, right Mom?'

Pregnant women mentioned that they should be able to follow the provided support for it to be accepted. One participant mentioned that she did not listen to the appraisal support of their partner regarding the amount of food she eats because she was unable to eat large amounts of food anyway because of her pregnancy. Support is also not accepted when it is about eating food products that they do not like. For example, if a partner advises a pregnant woman to eat more vegetables, even if she does not like vegetables, the support would not be accepted.

"At the beginning when you are pregnant and everything is new, you get a lot of recommendations. In addition to supplements and vitamins. After a while, I stopped taking them because I never took them in my life, and I found it weird to do it now. Besides, those pills were gross." (PW1)

SATISFACTION WITH DIETARY SUPPORT

Of the 16 couples, 11 were satisfied with the dietary support between the two; in two couples the pregnant woman and her partner were both not satisfied, and in three couples the pregnant women were satisfied but the partner was not satisfied with the support

they provided. PW2 mentioned that they stimulated each other into an unhealthy diet at times. When asked whether her partner could support her in eating healthier, she said the following:

"We are quickly inclined to pull each other into an unhealthy diet while in most cases we have plenty of time to cook and eat a healthy meal. [...] When I think about dinner, I would find it nice if he would stop me more often from eating unhealthy food." (PW2)

Between couple 13, the following conversation took place when talking about the dietary support provided by the partner:

P13: Our son eats fruit every day. I am more occupied with him eating fruit than you eating healthy.

PW13: Yes, I think you forget at times that I need to live healthily because I am pregnant.

P13: Yes, our son doesn't eat very well so I find it important that he eats fruit

PW13: And then you forget about me.

P13: Yes, I forget about you a bit, even though I am already busy preparing fruit, so I could also make you some. I may fall a bit short there.

PW8 stated that she was happy with the support she had received. However, while discussing support during the interview, she realised that she would have liked more informational support from her partner.

"We could have delved a little bit more in the information about what nutrients are good during the development of the baby in the womb." (PW8)

When partners were asked whether they were satisfied with the support they provided, five made suggestions for improvement. Some partners mentioned that they did not consciously think about the dietary patterns of the pregnant woman before, and that they could be more interested in this. Others mentioned that they could improve the provision of healthy meals and snacks. P15 was unsure about providing support because he did not know what to advise and what was healthy during pregnancy, so he mentioned that he could improve on this matter.

"I am partly happy with the support I provide. It could be improved, but I am often unsure about what the best choice is. I could give a lot of healthy suggestions, but I don't know if that is also healthy during pregnancy or in combination with nausea." (P15)

"I encourage her to keep eating well, but sometimes in a bit of a snappy way. [...] I could let go of that snapping a bit more... But at least I try to support her." (P16)

7.4 DISCUSSION

This study explored the perspectives of pregnant women and their partners on the role of the partner in the support of the pregnant women's dietary intake. To our knowledge, this is the first study to conduct couple interviews to explore the role of partners in supporting pregnant women with a healthy diet.

Partners provided all four subtypes of social support: emotional, instrumental, appraisal, and informational. The most provided type of support was instrumental dietary support, encompassing cooking, doing groceries, and withholding unsafe foods such as raw meats and alcohol. This is in line with findings about dietary changes of first-time parents in Belgium, as Versele, Stok, et al. (2021) found that social support by providing a healthy meal or doing groceries could help provide a healthy home food environment during pregnancy. When giving appraisal dietary support, partners in this research encouraged pregnant women to increase their awareness of a healthy diet and to stimulate their self-reflection about the healthiness of their diet, the amount of food consumed, or the use of unsafe foods during pregnancy. Informational dietary support is mostly provided for unsafe food. This was also found by Super and Wagemakers (2021), who explained that partner support could offer nutritional and practical tips for healthy eating during pregnancy.

Most of the pregnant women were satisfied with the dietary support they received from their partners, but no conclusions could be drawn on what type of support was better accepted or appreciated by pregnant women. Pregnant women differed in the ways they liked their partners to communicate support, such as a more subtle versus a more direct approach. In this study, pregnant women preferred the support they asked for, instead of unwanted interference with their diet. However, in the literature, having to ask for support may not be in line with the norms of intimate ties, as having to ask a partner for support may be viewed as the partner being uncaring or inattentive to one's needs (Rini et al., 2006). Heaney and Israel (2008) stated that more intimate ties, such as partners, are better at providing emotional support and more distant ties are better at providing informational support. Interestingly, there was barely any mention of emotional dietary support provided by partners when discussing dietary support in this research. However, the Dutch couples in this research mentioned emotional support often when discussing support in general. A possible explanation for this could be that it is common for Dutch men to view emotional support as a normal part of being in a relationship instead of seeing it as additional support. Providing emotional dietary support might be self-evident, and less worth mentioning. Related to this, partner support may fit multiple types of support and could overlap. For example, buying healthy food can be viewed as both informational and instrumental.

Partners of pregnant women can and do play a role in the change towards healthy behaviour by providing support. In line with previous research on partner involvement during pregnancy by Rhodes et al. (2021), the couples in this study appreciated partner support to form a team to achieve dietary goals. This study provides opportunities to improve the dietary support for a healthy diet for pregnant women. Based on the different perspectives on the support of the expecting couples and the differences in support acceptance, tailored support is needed to support and empower pregnant women towards a healthy diet. According to Rini et al. (2006), support can be of higher quality when it meets the receiver's needs, as even well-intended support can backfire if the wants and needs of the support receiver and support giver do not correspond. Super and Wagemakers (2021) stressed the importance of open dialogue with pregnant women to identify meaningful issues regarding healthy eating habits. However, many couples did not discuss matters such as dietary patterns or dietary support before the interview. Therefore, couples are advised to have a conversation about dietary intake and support, where pregnant women can express what their ideal dietary intake would look like and what is needed to achieve that. The couple can then discuss what dietary support is currently provided by the partner, whether that support is accepted, and how support should be communicated. These results suggest that support should be communicated in an advisory manner rather than coercively or know-it-all. The quality of support diminishes when it is received negatively on the efficacy or worthiness of the support receiver, in line with the research of Rini et al. (2006). As found in this study and as stated by the WHO (2016), nutritional support should be communicated positively. These findings show that partners should focus on what is healthy for the pregnant woman and what is going well regarding their diet.

Women empowerment is commonly believed to improve health, including during pregnancy and childbirth (Nieuwenhuijze & Leahy-Warren, 2019; Prata et al., 2017). If a population is empowered to be involved in health promotion regarding nutrition, dietary improvements are more likely to be sustainable and effective than top-down educational strategies (Brandstetter et al., 2017). Consequently, not only should women feel empowered, but also their partners should feel empowered to provide dietary support for pregnant women. Further research should investigate strategies that support partners in discussing dietary intake with pregnant women. Interventions that focus on healthy nutrition communication to improve empowerment, such as Power 4 a Healthy Pregnancy, could be promising to help facilitate these discussions between couples (Van Lonkhuijzen et al., 2022).

A study on the influence of the partner on the dietary intake of pregnant women, including couple interviewing, has never been conducted before. A strength of this study lies in the execution of the interviews with couples, which enriched the data by

them adding to each other's stories and asking each other questions about the subjects discussed (Valentine, 1999), which in itself is an example of how the interviews contributed to the empowerment of the couple. Bjørnholt and Farstad (2014) found in their research on couple interviewing that it can open up new and interesting knowledge and can place the researcher in an observing role as the partners have discussions among themselves, which also occurred in this research. Because couples challenge and correct each other's narratives, the data tends to be more realistic and less idealised (Bjørnholt & Farstad, 2014). However, couple interviews might prevent the collection of sensitive information that respondents do not want their partner to know (Reczek, 2014). Most interviews were carried out online due to COVID-19 regulations, which is positive because of health concerns and because it allows for interviewees and interviewer flexibility. However, limitations of online interviews could be technological problems, difficulty in ensuring that participants feel at ease, or a feeling of distance which could reduce their commitment to the process (Fielding, 2016). Limitations of the couple and online interviewing were not encountered in this study. The study sample originated from various parts of the Netherlands; however, although the level of education was not systematically collected, the interview results indicate a relatively highly educated sample. As educational level is related to diet quality, this could have resulted in a study population with better diet quality and food literacy than the average Dutch population. Gestations of pregnancy varied widely in the study sample, which is helpful for gaining a better understanding of the need for support throughout pregnancy. As this explorative, qualitative study did not aim to generate a generalisable result, but rather to gain an in-depth understanding of the situation, future research on partner dietary support among couples of diverse (educational) backgrounds could add further important insights to this study. Additionally, the possibilities for support in the various gestations of pregnancy can be explored further in future research.

7.5 CONCLUSION

Nutrition during pregnancy is important for both the mother and baby. An unhealthy diet can lead to negative health outcomes such as gestational diabetes and hypertension. This study explored the perspectives of pregnant women and their partners on the role of the partner in supporting pregnant women's dietary intake. Partners in this study were mostly involved in the pregnancy and diet of the pregnant women by providing instrumental support by doing groceries, cooking, and withholding from foods that are unsafe during pregnancy. Appraisal and informational dietary support were also provided by commenting on a healthy diet and foods that can be unsafe during pregnancy. Dietary support was provided by partners to be solidary to the pregnant woman because of pregnancy complaints or the importance of the health of the mother

and baby. Support was received and appreciated differently among pregnant women. Therefore, the suggestion for partners to make dietary support more effective is to personalise dietary support according to the needs and expectations of the pregnant woman. Communicating these needs as a couple has the potential to improve the empowerment of both pregnant woman and their partners.

Ethics approval and consent to participate: This research has been performed in accordance with the Declaration of Helsinki and has been approved by the Social Sciences Ethics Committee of Wageningen University and Research on the 20th of October 2021. Informed consent was obtained from all participants.

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ANNEX 7.1: INTERVIEW GUIDE

Research topic	Questions/topics	Theme/purpose
Background information about the couple and their pregnancy	Age	- Gain insight into the context, relationship, and living situation of the couple
	Family situation	
	Education	- Gain insight into the context and pregnancy of the couple
	Work	
	How long have you been together?	- Gain insight into the context and pregnancy of the couple
	How long have you been living together?	
	Number of weeks pregnant	
	Previous pregnancies	
	How is the pregnancy going so far? – <i>What's going well?</i>	
	<i>What have been difficult moments? Do you experience physical or mental complaints?</i>	
Diet of the pregnant woman and partner and change during pregnancy	Have you ever been referred to a dietitian during this or a previous pregnancy?	- Gain insight into images and ideas about healthy food.
	Are you focused on healthy food during pregnancy?	
	What do you think of when I talk about healthy food?	- Insight into the dietary pattern for the pregnancy of both pregnant woman and partner
	What do both of your diets look like? Can you describe what you generally eat on an average day?	
	Do you have a different diet now that you're pregnant?	- Understanding the change in diet since pregnancy
	What rating between 0 and 10 (0 = very unhealthy and 10 = very healthy) would you assign your diet if you were not pregnant? – <i>Why?</i>	
	Do you find it difficult to eat healthy during your pregnancy?	- Understanding the change in diet since pregnancy
	Did you receive nutritional advice during this pregnancy?	

Social support	<p>When I talk about social support, what do you think of? Could you tell us a bit about what kind of support you experience from your environment now that you are pregnant? – <i>In which areas do you experience support? How often? Do you accept this? What do you do with the received support? Do you experience the support as positive or negative? Why?</i></p> <p>Do you receive support regarding nutrition? – <i>How often? Do you accept this? Do you do something with the support? Do you adjust behavior based on support? Do you experience this support as positive or negative? Why?</i></p> <p>What do you experience in terms of support from your partner? – <i>In which areas? How often? Do you accept this support? Do you do something with this support? Do you adjust behavior based on the support? Do you experience this support as positive or negative? Why?</i></p> <p>Do you think you're more likely to take support from your partner or someone else?</p> <p>To partner: Do you feel that you are supporting your pregnant partner when it comes to nutrition? – <i>How? How often? Do you feel that your support is appreciated and accepted?</i></p>	<p>- Perspective on the definition of social support</p> <p>- Insight into what types of support are received by a pregnant woman (emotional, instrumental, appraisal, or information)</p> <p>- Gain insight into received (nutrition) support from partner (step 2 of empowerment approach)</p> <p>- Insight into support reception intimate ties vs. distant ties</p> <p>- Insight into the perspective of the partner in terms of giving and receiving support</p>
Possibilities to improve support	<p>Would you like to receive more or less support from your partner regarding nutrition? – <i>What does that look like? What kind of support would you like to receive? What makes support from your partner pleasant for you? What would help you to accept the support from your partner?</i></p> <p>To partner: Could you improve the support you provide? – <i>Why? How?</i></p> <p>Do you think getting support leads to healthier food choices? – <i>Why?</i></p>	<p>- Gain insight into the perspectives of the pregnant woman and partner on how support can be improved (plan for the future; step 3 empowerment approach)</p> <p>- gain insight into how the social environment can be navigated (Super and Wagemakers)</p>

ANNEX 7.2: CODE LIST

Code	Sub-code
Relation	Relation_livingtogether
	Relation_status
	Relationship_yearsofbeingtogether
Pregnancy	Pregnancy_complaint
	Pregnancy_differencebetweenpregnancies
	Pregnancy_experienceofpreviouspregnancy
	Pregnancy_firstchild
	Pregnancy_secondchild
	Pregnancy_specialmoment
	Pregnancy_status
	Pregnancy_weeks
Diet	Diet_beforepregnancy
	Diet_changesincepregnancy
	Diet_confusinginformation
	Diet_difficulties
	Diet_grade
	Diet_ideasabouthealth
	Diet_occupiedwithahealthydiet
	Diet_pattern
Support between couple	Diet_pregnancy craving
	P_givesdietarysupport_informational
	P_givesdietarysupport_instrumental
	P_givesdietarysupport_emotional
	P_givesdietarysupport_appraisal
	P_givesnondietarysupport
	PW_givesdietarysupport
	PW_givesnondietarysupport
Other support	Reasons_givingsupport
	Relatives_supportcouple
	Professionals_supportcouple
	Support_unhealthyeating
Amount of support	Support_notreceived
	Support_moreneeded
	Support_extrasought

Reactions to support	Support_accepted
	Support_dependanceofacceptance
	Reasons_supportaccepted
	Support_notaccepted
	Reasons_supportnotaccepted
	Support_notneededforPW
	Support_notneededforcouple
Perspective on support	Perspective_PWcontentwithsupport
	Perspective_Pcontentwithsupport
	Perspective_couplecontentwithsupport
	Perspective_PWwantsmoresupportfromP
	Perspective_Pnotcontentwithsupporttheygive
	Perspective_supportleadstobetterhealth
	Reason_perspectivesupportleadstobetterhealth
Codes later added	Reason_support not given
	Reason_support not received
	Reason_moresupportneeded
	Reason_supportnotneeded
	PW_notcontentwithsupport



Chapter 8

HEALTHCARE PROFESSIONALS' POSTPARTUM NUTRITIONAL COUNSELLING TO WOMEN;

A MIXED-METHODS APPROACH

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ABSTRACT

Background: Healthy maternal nutrition during the postpartum period is crucial for both maternal and child health. Yet, understanding the extent and content of nutritional support from healthcare professionals (HCPs) during this period is poorly understood. We investigated current practices of postpartum nutritional counselling by HCPs, its determinants, and HCPs' perspectives on digital nutritional counselling.

Methods: We employed a mixed-methods approach, using an explanatory sequential design involving both an online survey and elaborative semi-structured interviews based on the COM-B model. HCPs involved in postpartum care in the Netherlands were invited through social media and direct outreach via healthcare organizations.

Results: The online survey was completed by 69 HCPs. Additionally, 16 HCPs were invited for a semi-structured interview to further elaborate on their survey responses. Fifty-three HCPs (77%) provided postpartum nutritional counselling through verbal general advice (n=34, 49%), referral to a dietician (n=23, 33%), or referral to written information sources (n=21, 30%). Determinants of nutritional counselling were available time, HCPs knowledge, and perceived clients' characteristics and situation (e.g., culture and prior knowledge). Most HCPs (n=51, 80%) championed the development of an app to support women in making healthier food choices.

Conclusions: Most HCPs offer limited postpartum nutritional counselling. HCPs would highly benefit from refresher courses on the latest dietary guidelines and the development of protocols for delivering high quality nutritional counselling. Additionally, the development of an mHealth app – introduced by the HCP – was considered a valuable addition to support HCPs.

8.1 BACKGROUND

After childbirth, a woman experiences significant hormonal and physical challenges, as well as changes in daily routines, demanding great resilience and adaptation (World Health Organization, 1998). A healthy diet is known to support this resilience and adaptation by beneficially influencing a woman's breastmilk supply, nutrient status (Allen, 2012; Institute of Medicine, 1992; World Health Organization, 1998), body weight (Gross et al., 2018; Wilkinson et al., 2015), and on the long-term even the risk of cardiovascular disease, some cancers, diabetes, and arthritis (Hu et al., 2021; Jiang et al., 2011; Lauby-Secretan et al., 2016; Mokdad et al., 2003; Singh et al., 2013). Maternal nutritional status is also known to directly impact a child's health (Murray-Davis et al., 2019). Therefore, healthy dietary habits during the postpartum period and beyond are of utmost importance (World Health Organization, 1998).

However, many women struggle to implement healthy dietary habits postpartum (Murray-Davis et al., 2019); the time-consuming nature of caring for a newborn limits opportunities for maternal self-care (Murray-Davis et al., 2019). Moreover, women experience difficulties in obtaining reliable information on healthy food choices and lack of knowledge and/or financial resources to achieve and maintain healthy dietary habits (Super et al., 2021). Experienced barriers are most pronounced among women with a low socio-economic status compared to women with a middle or high socio-economic status (Super et al., 2021).

To improve postpartum dietary habits, healthcare professionals (HCPs) in different countries emphasise the need for postpartum nutritional counselling (Murray-Davis et al., 2019; 'Postnatal Care of the Mother and Newborn', 2013; World Health Organization, 1998, 2015; Zhao & Zhang, 2020). The World Health Organization (WHO) has long emphasized that: *"A woman needs information and counselling on multiple topics during the postpartum period, including taking care of the baby, breastfeeding, maternal (mental) health and maternal nutrition"* ('Postnatal Care of the Mother and Newborn', 2013; World Health Organization, 1998, 2015). Additionally, the WHO recommends improving the quality of tools and training for HCPs on counselling skills regarding postnatal nutrition (World Health Organization, 2015). Nevertheless, the Royal Dutch Organization of Midwives provides limited guidance on nutritional counselling for postpartum women (Koninklijke Nederlandse Organisatie van Verloskundigen, 2018). Similarly, the National Institute for Health and Care Excellence in the United Kingdom (National Institute for Health and Care Excellence, 2025) and Australian postnatal care offer minimal recommendations on postpartum nutrition (Brodribb et al., 2013). Limited availability or absence of postpartum nutritional guidelines may contribute to the lack of nutritional counselling (Bechthold et al., 2012; Health Council of the

Netherlands, 2015; Public Health England, 2016; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). While the WHO ('Postnatal Care of the Mother and Newborn', 2013; World Health Organization, 1998, 2015) and many HCPs (Murray-Davis et al., 2019; 'Postnatal Care of the Mother and Newborn', 2013; World Health Organization, 1998, 2015; Zhao & Zhang, 2020) recognise the importance of health eating and counselling during this period, it is unknown how Dutch HCPs provide nutritional counselling to postpartum women.

Digital applications offer a potential avenue for nutritional counselling, enhancing healthcare accessibility and affordability (Chow et al., 2016; Kabongo et al., 2021). Growing awareness of their benefits has led to the integration of mobile health (mHealth) applications into standard healthcare services (Chow et al., 2016; Hughson et al., 2018; Kabongo et al., 2021; Lupton & Pedersen, 2016; Wit et al., 2021). These mHealth applications have demonstrated improvements in postnatal care (Feroz et al., 2017) and maternal use (Watterson et al., 2015). However, very few digital platforms and apps exist specifically for postpartum nutritional counselling (Napolitano et al., 2021), with most focusing on baby care and breastfeeding (Dienelt et al., 2020; Koçak et al., 2021; Lupton & Pedersen, 2016; Musgrave et al., 2021; Napolitano et al., 2021; Park et al., 2022). Currently, no Dutch apps exist to assist HCPs in postpartum nutritional counselling.

Overall, there is a need for nutritional counselling during the postpartum period, but postpartum nutritional counselling guidelines are lacking. Therefore, we aimed to 1) examine how HCPs support postpartum women through nutritional counselling and 2) identify facilitators and barriers for HCPs to provide nutritional counselling postpartum. As mHealth applications are a promising, but lacking route of postpartum nutritional counselling, we aimed to 3) explore the acceptability and preferences of HCPs to use and refer to apps for nutritional counselling postpartum.

8.2 METHODS

SETTING AND STUDY DESIGN

An explanatory sequential design mixed-method design (Creswell & Clark, 2017; Ivankova et al., 2006) was used, consisting of 1) quantitative data collection through an online survey, and 2) qualitative data collection through semi-structured in-depth interviews. First, an online survey was distributed among HCPs to explore the topic and answer the research questions. Second, a subset of the survey respondents was interviewed to explain and elaborate on the quantitative results (Ivankova et al., 2006). The quantitative and qualitative data were analysed separately and two sets of

findings are presented. Subsequently, two researchers (S.M. & J.P.M.F.) merged the quantitative data and qualitative data to comprehensively answer the three research questions (Ivankova et al., 2006). This methodological triangulation was performed to confirm and discuss findings, provide comprehensive data, and increase validity and understanding of the current situation of postpartum nutritional counselling (Bekhet & Zauszniewski, 2012). This study was approved by the Social Sciences Ethics Committee of Wageningen University and Research on 02-12-2021.

SURVEY

RECRUITMENT

For the survey, we included a convenience sample of HCPs employed in the Netherlands providing postpartum care. The postpartum period was defined as up to one year after childbirth as studies show that women take six months to one year to return to the pre-pregnancy state (Mottola, 2002; Romano et al., 2010). To recruit HCPs, the online survey was distributed via the social media platform LinkedIn. Also, several professional healthcare organisations were contacted via email or phone for distribution among their members. Contacted organisations included hospitals, midwifery practices, maternity care organisations and child healthcare centres.

PROCEDURES

At the beginning of the online survey, the study was explained, and informed consent was obtained. Only HCPs who stated to work with postpartum women were invited to continue the survey. Questions were formulated 1) to assess current nutritional counselling by HCPs to postpartum women in the Netherlands, 2) to determine facilitators and barriers that influence nutritional counselling and 3) to understand acceptability and perspectives on app use in nutritional counselling postpartum. Nutritional counselling encompasses various methods to guide and support individuals in making healthier dietary choices. This includes not only verbal advice but also referral to other health care professionals, and the provision of digital or paper-based information sources. The questions for the online survey were formulated by using the Capability, Opportunity, Motivation - Behaviour model (COM-B model) (**Table 8.1**). The COM-B model is based on multiple behaviour change frameworks and was used to study what factors influence nutritional counselling and the use of apps in this (Michie et al., 2011, 2014). The survey contained fifteen closed questions with multiple choice options and three questions with open space for additional explanation and was designed in Qualtrics XM (Qualtrics, Provo, UT; used between December 2021 and June 2022). Examples of questions were *“Do you support women for a healthy nutritional intake in the year following their pregnancy? If so, in what way?”*, and *“Did you receive education on postpartum nutritional counselling?”*. The survey was distributed between December 2021 and June 2022.

TABLE 8.1. MAIN TOPICS OF THE SURVEY AND INTERVIEW BASED ON FACTORS COM-B MODEL (MICHIE ET AL., 2011)

Factors	Main topics of the survey and interview
COM-B model	
Capability	<ul style="list-style-type: none"> • knowledge on nutritional counselling for postpartum women • ability to communicate nutritional information • ability to motivate the woman • knowledge on available digital tools for postpartum nutritional advice • ability to work with digital devices
Opportunity	<ul style="list-style-type: none"> • having time and resources • having permission and motivation of the employer/workgroup • perceived clients' interest and ability to understand
Motivation	<ul style="list-style-type: none"> • awareness of current situation of provided nutritional counselling • perceived importance of nutritional counselling to postpartum women • willingness to provide nutritional counselling to postpartum women • openness to digital development • perception to usefulness of digital nutritional support

ANALYSIS

Data from the survey was depicted as frequencies and percentages for all categorical variables. Answers to the three open questions, asking for specific apps, webpages or brochures to which HCPs referred to, were counted and most frequent answers were mentioned in text.

INTERVIEWS

RECRUITMENT

The participants for the interviews were a convenience sample based on inclusion via the online survey and direct contact via email and phone call. At the end of the online survey, participants were asked if they were willing to participate in a subsequent interview. To recruit additional participants for the interviews, healthcare organisations and professionals were contacted directly via email and phone call as additional participants were required to achieve data saturation. All participants completed the survey before the interview, except for two HCPs participating in a duo-interview who ran the practice together and preferred a duo-interview.

PROCEDURES

Prior to the interview, participants provided written consent. In the semi-structured interviews, topics centred around the same topics as in the survey but included open-ended questions for elaboration (**Annex 8.1**). The individual answers to the survey were

used as starting points for elaboration during the interviews. Examples of questions were *'You mentioned to provide dietary advice to women when they have questions, what kind of questions do they have?'* and *'In the survey you mentioned apps to be helpful in providing support for a healthy nutritional intake postpartum, what should an app include or look like to be helpful?'* When the survey was not completed prior to the interview, the survey questions were asked during the interview. During the eleventh interview, data saturation was reached on the facilitators and barriers for HCPs to provide nutrition postpartum; data saturation on the other two research questions was reached during interview 15. Interviews lasted on average 34±9 minutes, were recorded, and transcribed intelligent verbatim using pseudonyms afterwards. In total, three HCPs requested the transcription of the interview and for one interview additional comments were added. These were in agreement with previous statement by that participant and did therefore not change the results.

ANALYSIS

Content analysis of the in-depth interviews (Hsieh & Shannon, 2005) was performed to systematically analyse the transcribed interviews using MAXQDA 2020. As the interviews were explorative, we applied inductive coding, meaning that the researcher added codes to parts of the interview text. During the first cycle of coding, via in vivo coding, labels were attached to segments of the interview by two researchers (SM, JPMF). This resulted in a summary of text segments in participants' own language. During the second cycle of coding, codes were combined and rephrased when consensus was reached among researchers (SM, JPMF). Lastly, the codes and sub-codes were linked to each of the three research questions (**Annex 8.2**). The results were interpreted and synthesised into a coherent narrative and illustrated with quotes.

8.3 RESULTS

SURVEY

In total 81 HCPs accessed the online survey, of whom 69 (85%) completed the survey. Twelve respondents were excluded due to: terminating the survey after introduction questions (n=8), unknown or no care provision to postpartum women (n=1), having a non-health related profession (n=2) and providing implausible contradicting answers (n=1). Except for two – all participants were women (**Table 8.2**). The most common professions were nurse (n=20, 29%), midwife (n=14, 20%), and employee of a child healthcare centre (n=13, 19%).

Postpartum nutritional counselling was provided by 54 HCPs (78%) and consisted of verbal general advice (n=36, 52%), verbal personal advice (n=30, 43%) (related to

specific needs or personal situation), referral to a dietician (n=25, 36%) and/or referral to a brochure, online information or an app (n=21, 30%). HCPs usually referred to their brochures or the brochures and website of the Dutch Nutrition Centre and the ZwangerHap app (i.e., an app informing women mainly on food safety aspects during pregnancy). More than half of the HCPs who provided nutritional counselling addressed dietary intake upon request by the client (n=31, 57%). Eleven HCPs (20%) discussed dietary intake with their clients on one or more fixed moments, and several HCPs regularly discussed dietary intake at random time points (n=15, 28%). HCPs particularly referred to a dietitian when specific questions or problems were raised (n=21, 84%).

Perceived importance and knowledge influenced HCPs to provide nutritional counselling. Forty-eight HCPs (69%) acknowledged the importance of postpartum nutritional counselling, and 56 HCPs (82%) considered nutritional counselling to positively influence the postpartum nutritional behaviour of women. Most HCPs (n=45, 67%) felt sufficiently knowledgeable to provide basic postpartum nutritional counselling, but many HCPs (n=44, 67%) also stated they would have liked to learn more. The 15 HCPs who did not provide postpartum nutritional counselling indicated that it was not part of their job (n=10, 67%) and/or that they did not feel sufficiently skilled (n=8, 53%).

HCPs were generally open to digital developments (n=40, 62%) and considered themselves well-skilled with computers and phones (n=43, 66%). Additionally, most of the HCPs (n=50, 77%) considered an app on postpartum maternal nutrition to be useful in providing nutritional counselling.

INTERVIEWS

Fifteen interviews were performed with 16 HCPs (15 women, 1 man) between January 2022 and June 2022 either online (n=12), in person (n=2) or via phone call (n=1). In total 5 were recruited via the survey and 11 via direct contact through phone or email. The profession, age group and sex of the sixteen participants are shown in **Table 8.3**.

CURRENT NUTRITIONAL COUNSELLING POSTPARTUM

In line with the survey, most HCPs provided some postpartum nutritional advice either during pregnancy and/or up to one year after birth depending on the role of the HCP. For some HCPs, healthy nutrition was a standard topic to address when guiding women during their postpartum period, but others only discussed healthy nutrition postpartum if the woman would ask about the topic. As dietary advice was generally not the primary purpose of the consult, the content of dietary advice differed per profession: to offer simple nutrition information (e.g., a maternity nurse), discuss nutrition more

TABLE 8.2. RESULTS OF THE ONLINE SURVEY

Demographic characteristics of the respondents (n = 69)		n (%)
	Nurse	20 (29)
	Midwife	14 (20)
	Employee child healthcare centre	13 (19)
	Dietitian	6 (9)
	Maternity nurse	5 (7)
	Lactation consultant	2 (3)
	Paediatrician	2 (3)
	Physiotherapist	2 (3)
	General practitioner	1 (1)
	Nutritional expert	1 (1)
	Maternal-life coach	1 (1)
	Gynaecologist	1 (1)
Age range	21-30	12 (17)
	31-40	22 (32)
	41-50	15 (22)
	51-60	13 (19)
	61-70	7 (10)
Sex	Women	67 (97)
	Men	2 (3)
Area*	Urban	32 (46)
	Rural	21 (31)
	Both	16 (23)
Current nutritional counselling postpartum by HCPs (n = 69)		
Provided nutritional counselling to postpartum women*	Verbal general advice	36 (52)
	Verbal personal advice	30 (43)
	Referral to dietitian	25 (36)
	Referral to brochure, online information, or app	21 (30)
	Other	5 (7)
	No nutritional counselling	15 (22)
➔ Referral to dietitian when*: (n=25)	In case of specific question /problems	21 (84)
	It concerns female nutrition postpartum	2 (8)
	HCP does not have time him/herself	2 (8)
	Other	4 (16)

Frequency and structure in nutritional counselling postpartum* (n=54)	At the request of the woman	31 (57)
	At one fixed moment	6 (11)
	At various fixed moments	5 (9)
	Regularly, but no fixed moments	15 (28)
	Other	10 (19)
Facilitators and barriers for nutritional counselling postpartum (n=68)		
Perceive postpartum nutritional counselling to be important	Yes	48 (69)
	Neutral	11 (16)
	No	10 (15)
Consider support to have a positive influence on dietary behaviour	Yes	56 (82)
	Neutral	7 (10)
	No	6 (8)
Reason no nutritional counselling postpartum* (n=15)	Not part of job	10 (67)
	Not enough knowledge/skills	8 (53)
	No time	4 (27)
	Not (that) important	0 (0)
	Other	3 (20)
Received education on female nutrition postpartum (n=66)	Yes	14 (21)
	Yes, but limited	26 (39)
	No (or do not remember)	19 (29)
Desired to have learned more (n=66)	Yes	44 (67)
Consider having enough knowledge to provide nutritional counselling postpartum (n=66)	Yes, basic counselling	45 (68)
	Yes, extensive counselling	14 (21)
Perspectives on app use in nutritional counselling postpartum (n = 65)		
Digital skills		
- Computer/Laptop	Well-skilled	43 (66)
	Moderately skilled	18 (28)
	Low-skilled	4 (6)
- Phone	Well-skilled	43 (66)
	Moderately skilled	19 (29)
	Low-skilled	3 (5)
- Smartwatch	Well-skilled	21 (32)
	Moderately skilled	10 (15)
	Low-skilled	34 (52)

Open to digital development	Yes	40 (62)
	Depends on situation	20 (31)
	No strong opinion on this	3 (5)
	No	1 (2)
	Other	1 (2)
Consider an app to be useful for nutritional counselling postpartum	Yes	50 (77)
	No	1 (2)
	Partly	2 (3)
	I do not know	12 (18)

* = Multiple answers possible

TABLE 8.3. CHARACTERISTICS OF THE INTERVIEW PARTICIPANTS.

Participant Number	Profession	Age group	Sex
1	Nutritionist	21-30	Female
2	Midwife	51-60	Female
3	Dietitian	21-30	Female
4	Obstetric life coach	51-60	Female
5	Physiotherapist	41-50	Female
6	Maternity nurse	31-40	Female
7	Lactation consultant	41-50	Female
8	Employee child healthcare centre	41-50	Female
9	Maternity nurse	31-40	Female
10	NFP	61-70	Female
11	NFP	31-40	Female
12	Nurse	51-60	Female
13	Lactation consultant	51-60	Female
14*	Paediatrician	51-60	Female
15*	Nurse	41-50	Female
16	Physiotherapist	41-50	Male

NFP=nurse-family partnership: Young, disadvantaged women receive periodical home visits during pregnancy and two years after pregnancy (Mejdoubi et al., 2013)

* = participated in one interview together.

in detail (e.g., a dietitian), or to provide parenting advice or to reassure the woman on nutrition or parenting (e.g., a nurse-family partnership (NFP) (Mejdoubi et al., 2013)). Most HCPs first provide general dietary information by informing their clients about the general guidelines for adults from the Dutch Health Council or Dutch Nutrition Centre and stress the importance of an adequate vitamin D concentration, drinking enough water, and eating fruits and vegetables. Personalised support is mainly provided in case of specific situations (e.g., high blood loss, diabetes, and cow's milk allergy of the baby), or when the woman has specific questions.

“Yes actually it is better for everyone, that is what makes it general advice, but you can make it personal advice and one has more complaints than others.” (Participant 2, midwife)

However, not all HCPs considered themselves sufficiently knowledgeable to provide nutritional counselling, especially in case of specific situations, problems, or questions. These HCPs would in those cases refer to a dietitian. Some HCPs had not provided any nutritional counselling yet but would provide verbal advice or refer to a dietitian if a woman asked for nutritional counselling, but so far that had not occurred.

“But still yes, depending on how people feel and whether they are breastfeeding, you are inclined to refer them to for example a dietitian to be certain that they consume everything they are supposed to consume. If that's the case, I lack sufficient knowledge to know for sure if their current diet is adequate.” (Participant 8, employee child healthcare centre)

FACILITATORS AND BARRIERS FOR HCPS TO PROVIDE NUTRITION POSTPARTUM.

All HCPs indicated that in general women did not prioritize counselling about maternal nutrition above their focus on the baby. When women are highly focused on the baby, interest in their own health was limited.

“I think most people have a baby standing there [raising hand up] and nutrition there [lowers hand down], when they have just given birth.” (Participant 12, nurse)

HCPs indicated that linking the baby's health with the mother's health could motivate women. For example, by explaining to the woman that she as a mother is a role model and thereby if she eats healthy, it is more likely that her child will eat healthy as well.

“We always say you have an exemplary function. It is also very helpful with toddlers that you enjoy eating yourself and say how good it tastes. Then the toddler will automatically become curious and participate.” (Participant 14, paediatrician)

Cultural or social influences, lack of knowledge about healthy nutrition, or lack of money were also considered by HCPs as important determinants of postpartum dietary intake. Nutrition questions mainly related to women's own diet as well as the baby's nutrition, and issues related to lactation; particularly to find reassurance or to stay in control. In general, HCPs felt that most women – though not all – are open to nutritional advice, particularly highly educated women, who also more often ask questions. Some HCPs used motivational interviewing to increase woman's interest in dietary advice. Lower educated women also showed interest but faced more challenges to understand and/or apply the advice. Therefore, some HCPs simplified their advice and used pictograms or photos to make the information more understandable.

“You try to make it a bit like ‘Jip and Janneke’ (easy/child book language), so that people put one or two rules in their head of first having a cup of water and making sure you’ve had two tea and one water and then see if you’re going to drink something else. You try to make that kind of lifestyle rules as ‘Jip and Janneke’ (simple) as possible.” (Participant 5, physiotherapist)

Moreover, HCPs considered that financial constraints hampered the application of the advice on a healthy nutritional intake in women's daily life. One of the HCPs referred women with limited finances to a specific organisation or professional to assist them in making cheap and healthy nutritional options. Most of the HCPs also provided nutritional counselling to women with a cultural background other than the Dutch culture. About half of the HCPs indicated that providing nutritional counselling to individuals from diverse cultural backgrounds required adaptations to their approach, due to language barriers and limited familiarity with foreign recipes and ingredients.

“Then you should not come up with the advice of the Dutch Wheel of four (general Dutch dietary guidelines), but you need to ask questions like: What kind of products are used in your food?” (Participant 12, nurse)

Some HCPs found it challenging to make these cultural adaptations and, as a result, tended to minimize the nutritional counselling offered in such situations.

Previous education on healthy postpartum nutrition was limited for most HCPs. Therefore, almost all HCPs felt insufficiently knowledgeable to provide detailed advice on healthy postpartum nutrition themselves. One HCP believed that highly educated women often know more about healthy nutrition postpartum than she does. Accordingly, most HCPs would have liked to learn more about healthy nutrition postpartum, i.e., related to dietary advice in case of specific situations or to whom or what they could refer to in case of specific situations.

In agreement with the barriers mentioned in the survey, a few HCPs did not provide nutritional counselling to women for several reasons; focus and duration of the consultation and perceived focus of the woman and her willingness to talk about nutrition.

ACCEPTABILITY AND PREFERENCES OF HCPs TO USE AND REFER TO APPS FOR WOMEN'S NUTRITIONAL COUNSELLING POSTPARTUM.

HCPs explained that many women used apps designed for pregnancy. Almost all HCPs responded positively to the development of a Dutch app for nutritional counselling postpartum and considered it easy for women to start using an app as many women use their phone a lot already, also during the postpartum period.

"They've all glued the phone to their hands anyway, so they're easy to stick with it, I think. We do laugh about it. But when the doctor comes to visit, you should ask them to put the phone down. It's that extreme already." (Participant 13, lactation consultant)

The HCP who responded less positive to the development of an app focusing on nutrition thought the app should not only include postpartum nutritional counselling, but also postpartum mental support.

HCPs considered apps to be useful in changing dietary behaviour if an app had certain appearances and functionalities. Firstly, app features and information should be simple in order to also serve women with a lower educational level. HCPs thought the app should show short pieces of text with optional links to more information, for the women who are interested in this. Secondly, HCPs thought that including easy healthy recipes would be appreciated by postpartum women, as they do not have a lot of time for cooking. For these recipes, some HCPs considered photos or videos useful besides textual instructions.

"I think especially if you know that people all learn differently that also a bit, well, auditory, visual and just reading... I think that's a nice combination. If you want to reach most people, you have to include all those aspects in it." (Participant 15, nurse)

Specific circumstances or cases that are common during the postpartum period should be included as well according to several HCPs, for instance; breastfeeding, specific diets such as vegetarian or vegan, or physical complaints such as flux or obstipation. A profile setting in the app could ensure only providing suitable information to the specific circumstances. Furthermore, HCPs considered a search function and contact details of HCPs useful for help with specific questions.

"I think that indeed if it is really specific for the year after delivery let's say, that it should clearly be something like, "is there a difference in breastfeeding and not breastfeeding?". Because it actually is, I can imagine this is an essential difference." (Participant 8, employee child healthcare centre)

Lastly, for HCPs to refer to the app, it should provide scientifically based information, clearly indicating the sources of the information. Additionally, referring women to the app could potentially be most optimal via HCPs having close contacts with the women according to some HCPs. For example, maternity nurses or nurses from the NFP are in close contact with the women as they regularly visit the women at home.

"Yes, scientific research. Yes, it should be based on solid literature, not just trivial matters of course. That's what I consider most important." (Participant 3, dietitian)

"I think that a logical route is via a maternity nurse also to start working with the app, because this person enters the living environment. And indeed it is low threshold and it can have high influence." (Participant 7, lactation consultant)

8.4 DISCUSSION

Using a mixed methods approach, the current postpartum nutritional counselling by HCPs and the influencing barriers and facilitators were studied, as well as the acceptability and preferences of app use in postpartum nutritional counselling. Most HCPs provided postpartum nutritional counselling either through verbal general advice (n=53, 49%), referral to a dietitian (n=25, 36%), or a material information source (n=21, 30%); though to a limited extent. Healthcare professionals (HCPs) identified limited time (25%, n=4) and inadequate nutritional knowledge (50%, n=8) as barriers to providing nutritional counselling. They also recognised clients' focus and individual cultural, social, intellectual and financial situations as factors that could either facilitate or impede the provision of such counselling. Although the majority (69%, n=48) deemed postpartum nutritional counselling important, ten HCPs expressed that it was not within their scope of practice. Generally, HCPs supported the use of an app to promote healthy eating postpartum provided that it contained scientifically sound, simple as well as detailed information and include healthy recipes, supported by photos and videos.

Consistent with previous studies (Murray-Davis et al., 2019; Slomian et al., 2021), approximately half of the HCPs in our study provided dietary information only when requested by the woman, and often, this information was basic. Despite limited

provision of nutritional counselling, HCPs acknowledged its importance in positively influencing women's dietary behaviour postpartum, identifying it as a key facilitator in providing such counselling. However, HCPs reported limited knowledge and receiving limited education on nutritional counselling, a concern also highlighted in three review studies (Crowley et al., 2019; Vasiloglou et al., 2019; Vrkatć et al., 2022). Around half of HCPs did not receive any education on postpartum nutrition and accordingly more than half of the HCPs were motivated to learn more on women's nutrition postpartum, e.g., where to find it and who to refer to. Previous studies in Canada and the Netherlands also showed that midwives generally lack more detailed knowledge on specific strategies towards healthy food choices (Murray-Davis et al., 2020; Wit et al., 2021). In the Netherlands, there are multiple national guidelines on healthy nutrition, but HCPs were not aware of any national guidelines on postpartum nutrition. Indeed, so far, the Dutch Health Council and Dutch Nutrition Centre published nutritional guidelines for the general Dutch population and pregnant women, but not for postpartum women. Similarly, multiple other Western countries lack specific guidelines on postpartum nutrition (Bechthold et al., 2012; Public Health England, 2016), while the USA provides some guidelines (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). To increase the ability of HCPs to provide postpartum nutritional advice, the WHO recommends 1) to have validated and easily accessible national guidelines on healthy nutrition for postpartum women, and 2) to educate HCPs on nutritional counselling to postpartum women (World Health Organization, 2015).

Women in the postpartum period are recovering from an extraordinary physical challenge and may strive for increased physical fitness and a healthy dietary intake (Asadi et al., 2022). As such, women are often open to nutritional advice which is also indicated in our study. Nevertheless, HCPs experienced several barriers related to the women to provide nutritional counselling. HCPs generally experienced that women have a strong focus on the baby's health in comparison to their own health. Additionally, HCPs perceive women's lack of knowledge and capability to implement nutritional advice as a barrier. Nutritional counselling may be more effective when communication is tailored to a woman's prior knowledge and capability to process information as stated by Nutbeam (Nutbeam, 2008). Specifically, a study among seventeen midwives in Sweden highlights a need of midwives to develop person-centred counselling skills (Wennberg et al., 2014). Further, our study indicated that cultural differences between the HCP and their client complicated nutritional counselling, i.e., related to dietary habits and language differences. Swedish midwives also experienced challenges in nutritional counselling in case of unfamiliar dietary habits (Wennberg et al., 2014). Comparably, a study by Garnweidner and colleagues mentions that Nordic pregnant women with immigrant backgrounds expressed to be confused by the provided nutritional counselling

(Garnweidner et al., 2013).

As pregnant and lactating women are in contact with multiple HCPs, it is important to align dietary recommendations among HCPs (van Stenus et al., 2020), e.g., through adequate communication about who to reach out to for more in-depth nutritional support as well as the development of standardised protocols. Currently, the availability of protocols on postpartum nutritional counselling appears to be limited. As indicated in the interviews, HCPs having close contact with the women, such as maternity nurses or NFP nurses, might be the best route to provide dietary assistance (Mejdoubi et al., 2013). Comparably, Ball and colleagues stated that general practitioners are well-suited to provide postpartum women with nutritional support due to their frequent contact with new mothers in Australia (Ball et al., 2022). In contrast, many HCPs stated nutritional counselling is not part of their job. This may be attributed to insufficient education, low prioritisation, and time constraints (Crowley et al., 2019; Krznarić et al., 2024), which could impede HCPs from delivering postpartum nutritional counselling.

An mHealth app may be a suitable tool to support HCPs, with limited time and nutritional knowledge, in providing understandable nutritional information during the postpartum period. In this study, most HCPs acknowledged the value of an app and indicated not to expect any issues related to the use of an app for nutritional counselling in the target population. HCPs observed that postpartum women regularly use phones, making it likely they will readily engage with nutritional counselling via an app. This consideration is crucial in user-centred design, as it takes into account the socio-technical system of the woman (Graham et al., 2019). Additionally, postpartum women value digital lifestyle information for its ability to offer structured guidance and support, particularly when used alongside face-to-face contact (Makama et al., 2022; Ryan et al., 2022). This study, as well as other studies (Vasiloglou et al., 2020; Wit et al., 2021), indicate that an app should be easy to use, accessible, and include easy-digestible information (Wit et al., 2021). In the study by Wit and colleagues, midwives also stressed the need of a validated and scientifically sound app (Wit et al., 2021). Vasiloglou and colleagues (2020) indicated that an international panel of HCPs considered validity as a key criterium for a nutrition and diet app and stressed the need of considering cultural differences in nutritional counselling. In this study, some HCPs were reticent about a postpartum nutritional counselling app, which could be explained by HCPs being overwhelmed by the digitalisation in their work field (Wit et al., 2021).

This was the first study inventorying current practices, facilitators and barriers of HCPs related to postpartum nutritional counselling in the Netherlands. The mixed methods approach – based on the COM-B model - used in this study provides quantitative insight in the current practices and perceived importance of nutritional counselling as

well as detailed qualitative insights in the barriers and facilitators to provide nutritional counselling. Questions in the interviews were based on answers to the survey thus interlinked between the quantitative and qualitative phase of this study. The profession of the interviewees was diverse, which did not enable us to draw conclusions per profession. Nonetheless, the focus of this study was not on a specific profession, but rather on all HCPs involved in care for postpartum women. Nevertheless, we cannot say with certainty that the answers of our respondents represent the general HCP population involved during the postpartum period; participants were mainly women and potentially more interested and experienced in postpartum nutritional counselling than the average HCP population. Moreover, these results might not be generalisable to other countries, e.g., related to deviating educational curriculum, protocols, as well as dietary guidelines. Given the limited number of studies on postpartum nutritional counselling, reproducing this study in other countries would be of great interest.

8.5 CONCLUSION

Over 75% of the Dutch HCPs included in this study provided postpartum nutritional counselling. While most considered it crucial for improving postpartum dietary habits, they also indicated limited knowledge and time for in-depth support. Our data indicate a need for the development of protocols and guidelines on postpartum nutrition as well as educating HCPs on postpartum nutritional counselling with special attention to clients' situation, such as culture, prior knowledge, and financial situation. In efforts to alleviate workload, interviewed HCPs expressed optimism regarding app usage and provided consistent opinions and design suggestions. HCPs indicated that the app could potentially best be introduced to postpartum women via HCPs who have close contact with the women, such as maternity nurses. The results of this study will be used to direct innovation of a nutritional counselling app for the postpartum period.

Ethics approval and consent to participate: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Social Sciences Ethics Committee of Wageningen University and Research on 17-05-2022. Written or Verbal informed consent was obtained from all subjects. Verbal consent was witnessed and formally recorded.

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ANNEX 8.1: INTERVIEW GUIDE

Ik zag dat u [beroep] bent. Kunt u mij vertellen wanneer en hoe u in contact komt met vrouwen na de zwangerschap?

In de enquête gaf u aan dat u vrouwen in het jaar na hun zwangerschap [soort] voedingsadvies geeft.

- Geeft u dat advies aan iedereen? Of is dat in specifieke gevallen?
- Wat houdt zo'n advies globaal in?

U gaf in de enquête ook aan dat u bij specifieke vragen/problemen verwijst naar een diëtist. Kunt u een voorbeeld geven van zo'n vraag of probleem?

U gaf in de enquête aan dat u zelf regelmatig begint over gezonde voeding of u ook op verzoek van de vrouw voedingsondersteuning geeft. Komt het wel eens/vaak voor dat vrouwen verzoeken om voedingsondersteuning?

Met wat voor een soort vragen komen vrouwen over voeding? (Dieet, afvallen, producten wel/niet eten)

- Ziet u tijdens uw werk een specifieke doelgroep vrouwen na hun zwangerschap? (Cultuur, leeftijd, of ze het breed hebben of niet, ...)
- Heeft u het idee dat u het belang van goede voeding over kan brengen op de vrouwen? Komt u wel eens problemen tegen daarbij? (Tijdsnood, taal/kennis barrière)
- Heeft u het gevoel dat de vrouwen uw advies over gezonde voeding accepteren?
- Denkt u dat vrouwen daarbij beïnvloed worden door persoonlijke omstandigheden en achtergrond? Of in hun omgang met voeding in het algemeen? Kunt u dat uitleggen? (Etniciteit, cultuur, leeftijd, sociale support, educatieniveau, financiële draagkracht)

U gaf aan dat u [wel/niet] meer had willen leren over voeding van de vrouw in het jaar na de zwangerschap. Wat had u graag nog geleerd?/Waarom niet?

Denkt u met de toevoeging van wat u net noemde u uitgebreidere ondersteuning zou kunnen geven of zijn daar nog andere informatie en/of vaardigheden voor nodig?

U gaf aan dat u denkt dat voedingsondersteuning positieve invloed kan hebben op het eetgedrag van de vrouw na de zwangerschap en dat een app hierbij handig zou kunnen zijn.

- Waar moet zo'n app volgens u aan voldoen zodat vrouwen deze gaan gebruiken en om voor positieve verandering in eetgedrag te zorgen? (Features, wanneer gebruikt, intensiteit van gebruik, soort adviezen, feedback, bediening)
- Qua vormgeving – in gebruik

- Qua inhoud
- Zijn er nog andere dingen waar een app voor u aan zou moeten voldoen zodat u deze zou adviseren? (Geen kosten, specifiek gericht op..., makkelijk in gebruik, activiteiten kunnen delen)
- Hoe denkt u dat de informatie in de app het beste kan worden overgebracht? (tekst, audio, video, interactief iets)

Dat was mijn laatste vraag. Heeft u zelf nog iets wat u zou willen toevoegen?

ANNEX 8.2: CODES AND SUB-CODES

Codes	Sub-codes
Current nutritional support postpartum	Consult purpose
	Content
	General advice
	Personal advice
	Moment
	Method
	Diary
	Example menu
	Respond to interest/question
	Influential factors for giving advice
	Referrals
	Lack of information
HCP's experience and perspective nutritional support postpartum	Work related experiences
	Non-work related experiences
	Capability HCP
	Knowledge HCP
	Desire to learn
	Importance nutritional support according to HCP
	(Self-)Reflection HCP
	Communication with clientele
	Behaviour women postpartum
	Focus
	Questions women
	Reason for questions
	Influences nutritional behaviour women postpartum
	Reaction to advice
	Acceptation of advice
	Adaptations
	Culture
	Education
	Finance
	Suggestions
App	Points of attention
	HCP's opinion about app (postpartum)
	Potential app use



Chapter 9

EMPOWERING POSTPARTUM PARENTS TO IMPROVE DIET QUALITY

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ABSTRACT

The postpartum period brings significant physiological, psychological, and social changes, yet dietary support for parents, particularly fathers, remains limited and often overlooked. This paper outlines preconditions for an empowerment-based strategy to improve diet quality among parents during the first year postpartum. The project comprised four interconnected substudies, totalling 61 interviews with 34 healthcare professionals (HCPs) and 35 parents or postpartum women. Each substudy was conducted and analysed separately, then integrated through three collaborative analytical sessions among the authors. The results revealed three overarching themes: (1) the current healthcare systems predominantly focuses on child health rather than parental nutrition, with reactive rather than preventive approaches; (2) while parents are motivated to maintain healthy dietary habits, they face substantial barriers, including time constraints, competing priorities, and sleep deprivation; and (3) effective interventions require continuity of care from pregnancy through the postpartum period, with group-based approaches such as CenteringParenting showing particular promise. A family-centred approach that includes both parents and addresses nutrition in phases emerged as a central recommendation to improve their dietary quality throughout the postpartum period. Initially, this means strengthening the social environment to assist parents with nutrition, followed by more direct support from HCPs as the family routine stabilises.

9.1 INTRODUCTION

The postpartum period represents a critical transition for mothers and fathers, with significant physiological, psychological, and social changes (Fahey & Shenassa, 2013; Martin et al., 2022). Several barriers unique to this period, such as childcare, childbirth recovery, fatigue, and time constraints, make it challenging to maintain a healthy lifestyle (Makama et al., 2021). Despite these challenges, adequate nutrition is vital for both parents, supporting maternal recovery, lactation, disease prevention, and overall health (Hart et al., 2022; Prell & Koletzko, 2016). For instance, a nutritious diet contributes to the vitality necessary for the demanding tasks of newborn care, helping mothers and fathers cope with sleep deprivation and emotional changes (Hagen et al., 2013; Saxbe et al., 2018). Additionally, the father's nutritional status during this period impacts paternal health and well-being, as research shows that fathers undergo physiological changes during the transition to parenthood that may affect their dietary needs and patterns (Saxbe et al., 2018).

The postpartum period offers a window of opportunity for establishing healthy dietary patterns within the family. Parents serve as primary role models for their children's eating behaviours, making this period crucial for developing habits that will influence long-term family health (Scaglioni et al., 2018). However, both parents commonly experience weight changes postpartum, with mothers retaining 0.5–4.0 kg one year after birth and fathers often gaining weight during their partner's pregnancy and beyond (Gallagher et al., 2019; Goldstein et al., 2017; Gore et al., 2003; Saxbe et al., 2018). This highlights the need for nutritional support for both parents, as they jointly shape the family food environment, which influences long-term health outcomes (Scaglioni et al., 2018).

Previous research indicates that postpartum women often abandon healthy dietary habits developed during pregnancy (Fowles & Walker, 2006; Wiltheiss et al., 2013). In one study, less than 30% of mothers met the daily recommended intake of fruits and vegetables for postpartum women six months after giving birth (Olson, 2005). In the broader population, most Dutch women aged 18–79 don't meet dietary recommendations: only 29% meet guidelines for vegetables, 19% for fruit, 8% for unsalted nuts/seeds, and 28% for weekly fish consumption (van Rossum et al., 2023). Additionally, legumes are consumed on average only 0.4 days per week, far below the recommended weekly consumption (van Rossum et al., 2023). Despite the importance of nutrition during this period and widespread inadequate intake, postpartum dietary counselling remains limited, with most healthcare professionals focusing on infant development rather than parental nutrition.

There is a clear need for comprehensive approaches that empower both mothers and

fathers to improve their diet quality during the postpartum period. Empowerment has demonstrated potential in improving nutritional outcomes during pregnancy (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen, Prins, et al., 2025), but its application in the postpartum context requires further investigation. Building on the success of the Power 4 a Healthy Pregnancy programme (Van Lonkhuijzen, de Vries, et al., 2025; Van Lonkhuijzen et al., 2022; Van Lonkhuijzen, Prins, et al., 2025), we explored the perspectives and needs of healthcare professionals (HCPs) and parents to inform the development of an effective empowerment strategy for the postpartum period. This research aims to provide evidence-based recommendations for an empowerment strategy that acknowledges parents' unique needs and experiences during the postpartum period, supporting them in establishing healthy dietary patterns that benefit the entire family.

9.2 METHODS

STUDY DESIGN

This research employed a qualitative design comprising four sequential substudies conducted between 2021 and 2025, each building on previous findings to create an integrated understanding of empowerment strategies for improving postpartum nutrition. This iterative approach allowed for the triangulation of findings from different stakeholder perspectives and methodologies, enhancing the validity and applicability of the results. It also ensured that each phase directly addressed gaps identified in earlier stages.

Substudy 1 provided foundational insights into postpartum women's dietary experiences and needs. Substudy 2 built upon this by exploring HCPs' perspectives on the feasibility and challenges of providing nutritional support. Substudy 3 expanded the focus by examining parents' dietary experiences and needs, particularly of fathers, who were underrepresented in previous research. Finally, substudy 4 addressed the key question from earlier findings: how can empowerment strategies for postpartum nutritional support be effectively integrated into existing healthcare systems? All substudies received ethical approval from the Social Science Ethics Committee of Wageningen University & Research, with informed consent from all participants. Data were processed anonymously.

PARTICIPANTS AND RECRUITMENT

In total, 61 interviews were conducted with 34 HCPs and 35 parents or postpartum women across all substudies. Some interviews were conducted individually, while others involved multiple HCPs. Each substudy used purposive, convenience and snowball sampling strategies to recruit participants. Recruitment methods included professional

networks, social media platforms, healthcare organisations, child health centres, and snowball sampling. **Figure 9.1** provides an overview of all substudies' recruitment processes and participant characteristics. Several HCPs in substudies 2 and 4 held additional roles that enhanced their expertise. For example, one youth healthcare nurse was also a lactation consultant and a designated nutrition officer. See **Table 9.1** for detailed participant characteristics.

Study	Substudy 1: Postpartum women's experiences and needs for empowerment in dietary choices <i>Study execution: Q4 2021/Q1 2022</i>	Substudy 2: HCPs' perspectives on postpartum nutritional support and empowerment strategies <i>Study execution: Q4 2023/Q1 2024</i>	Substudy 3: Parents' perspectives on nutritional support needs during the first postpartum year <i>Study execution: Q1/Q2 2024</i>	Substudy 4: HCPs implementation opportunities and barriers to integrate postpartum dietary empowerment strategies in healthcare <i>Study execution: Q4 2024/Q1 2025</i>
Recruitment methods	Contacts of the researcher or university (n=9) Social media (n=5) Snowball sampling (n=1)	Directly approached HCPs (n=5) Contacts of the researcher or university (n=4) Flyer distribution (n=4) Snowball sampling (n=4)	Recruited via child health centres (n=6) Contacts of the researcher or university (n=6) Social media (n=5) Snowball sampling (n=3)	Directly approached HCPs and child health centres (n=14) Social media (n=1) Contacts of the researcher or university (n=1) Snowball sampling (n=1)
Main participant characteristics	15 postpartum women Age range: 25-38 years	17 HCPs Dietitian (n=3), maternity care assistant (n=3), midwife (n=3), youth healthcare nurse (n=2), lactation expert (n=2), GP (n=1), gynaecologist (n=1), manager maternity care company (n=1), manager child health centre (n=1)	20 parents 11 mothers, 9 fathers Age range: 22-44 years	17 HCPs Dietitian (n=6), youth healthcare nurse (n=6), youth healthcare physician (n=3), lactation expert (n=1), midwife (n=1)
Main interview characteristics	15 interviews Average interview duration: 49 minutes (range 23-73 minutes) Face to face (n=9) and online (n=6)	16 interviews Average interview duration: 46 minutes (27-70 minutes) Face to face (n=10) and online (n=6)	14 interviews Average interview duration: 33 minutes (20-58 minutes) Face to face (n=7) and online (n=7)	16 interviews Average interview duration: 39 minutes (27-73 minutes) Face to face (n=8) and online (n=8)

FIGURE 9.1: PARTICIPANT RECRUITMENT AND MAIN CHARACTERISTICS PER SUBSTUDY

TABLE 9.1: PARTICIPANT CHARACTERISTICS
SUBSTUDY 1

Participant #	# children	Months after delivery	Education	Occupation	Age	Location	Socioeconomic status (determined by occupation and highest attained education)
Participant 1	2	12	HBO	Family therapist	34	Arnhem	High
Participant 2	1	9	HBO	Nursing teacher	27	Arnhem	High
Participant 3	1	12	HBO	Education-consultant hair brand	36	Arnhem	High
Participant 4	1	8	HBO	Case and complaint handler health insurances	29	Meppel	High
Participant 5	1	1	MBO 2	Cleaner	26	Schijndel	Low
Participant 6	2	7	MBO 4	Airbnb owner/owner nail studio	35	Doesburg	High
Participant 7	3	5	W/O	Self-employed project leader social projects	38	Arnhem	High
Participant 8	1	3	HBO	Primary school teacher	31	Velp	High
Participant 9	2	3	HBO	Accountant IT company	29	Dordrecht	High
Participant 10	1	7	HBO	Legal secretary	32	Mierlo	High
Participant 11	2	5	MBO 4	Stewardess	33	Heerhugowaard	Mid
Participant 12	3	3	HBO	Primary school teacher	29	Arnhem	High
Participant 13	1	12	W/O	Teacher Social Work Hogeschool Utrecht	33	Arnhem	High
Participant 14	2	4	MBO 4	Currently unemployed (choice)	30	Arnhem	High
Participant 15	1	7	MBO	Reception employee agricultural park	25	Groningen	Mid

SUBSTUDY 2

Participants	Age in years	Work experience in the current profession in years	Province of work location
Dietitian 1	35-50	18	Gelderland
Dietitian 2	50+	40	Gelderland
Dietitian 3	35-	1	Gelderland
Maternity care assistant 1	50+	8	Flevoland
Maternity care assistant 2	35-	3	Noord-Holland
Maternity care assistant 3	35-	3	Zuid-Holland
Midwife 1	35-50	15	Gelderland
Midwife 2	35-50	28	Gelderland
Midwife 3	35-	2	Limburg
Youth healthcare nurse 1	35-50	6	Gelderland
Youth healthcare nurse 2	50+	42	Noord-Brabant
Lactation expert 1	35-50	11	Gelderland
Lactation expert 2	50+	15	Limburg
General practitioner	50+	24	Zuid-Holland
Gynaecologist	50+	20	Zuid-Holland
Manager maternity care company	50+	8	Zuid-Holland
Manager child health centre	50+	34	Zuid-Holland

SUBSTUDY 3

Participant number(s)	Age in years	Education level	Province of living	Number of children	Age of the child(ren)
Mother 1, Father 1	27, 29	University, Higher Vocational	Gelderland	1	9 months
Father 2	35	University	Limburg	2	3.5 years, 10 months
Mother 3, Father 3	n.d. ^a , n.d.	n.d., n.d.	Gelderland	1	9 months
Mother 4	29	University	Utrecht	2	2.5 years, 8 months, 3 months pregnant with 3 rd child
Mother 5, Father 5	37, 31	Both University	Gelderland	1	5 months
Father 6	26	Secondary Vocational	Gelderland	1	11 months
Mother 7	27	University	Limburg	1	6 weeks
Mother 8	n.d.	University	Zuid-Holland	1	4 months
Father 9	44	University	Zuid-Holland	3	N.d., n.d., 6 months
Mother 10, Father 10	34, 34	Both University	Gelderland	3	5 years, 3 years, 3.5 months
Mother 11, Father 11	30, 33	Both Higher Vocational	Gelderland	1	11 months
Mother 12	32	Secondary Vocational	Noord-Brabant	2	2.5 years, 8 months
Mother 13, Father 13	26, 22	Secondary Vocational, Pre-university	Gelderland	1	2 months
Mother 14	34	Higher Vocational	Utrecht	2	N.d., 10 months

SUBSTUDY 4

Participants	Age in years	Profession (work experience in years)	Province of work location
Participant 1	35-50	Chairwoman Centering (8), trainer Centering (10), midwife (21)	-
Participant 2	35-50	Designated nutrition officer (5), youth healthcare nurse (10), lactation consultant (municipal health services) (5)	Gelderland
Participant 3	35-	Dietitian (8)	Gelderland
Participant 4	35-50	Dietitian (20)	Gelderland
Participant 5	50+	Dietitian (33)	Gelderland
Participant 6	50+	Youth healthcare physician (30), trainer youth healthcare physicians (18), project manager (5)	Noord-Holland
Participant 7	50+	Lactation consultant (municipal health services) (29), chair breastfeeding council (4)	Noord-Holland
Participant 8	45-55	Dietitian (13)	Gelderland
Participant 9	50+	Youth healthcare nurse (8) & facilitator CenteringParenting (1)	Noord-Holland
Participant 10	35-50	Youth healthcare physician (6)	Noord-Holland
Participant 11	35-	Youth healthcare nurse (2)	Drenthe
Participant 12	35-	Youth healthcare physician (7)	Drenthe
Participant 13	35-50	Youth healthcare nurse (3)	Drenthe
Participant 14	35-	Dietitian (12)	Gelderland
Participant 15	50+	Dietitian (10)	Gelderland
Participant 16	35-50	Youth healthcare nurse (8) & facilitator CenteringParenting (2)	Noord-Holland
Participant 17	45-55	Youth healthcare nurse (18), trainer Centering (3), chair nurse council (2)	Groningen

DATA COLLECTION AND ANALYSIS

Semi-structured interviews were conducted either face-to-face or online across all substudies, employing various methodological approaches: mind-mapping in substudy 1 and appreciative inquiry principles in substudies 2-4 (Whitney & Cooperrider, 2007). The interview guides were developed based on previous research and theoretical frameworks, covering postpartum experiences, dietary changes, barriers and facilitators to healthy eating, support, and empowerment needs. All substudies used thematic analysis with deductive and inductive coding approaches (Boeije, 2009; Braun et al., 2019). Interviews were transcribed verbatim and analysed using Atlas.ti. The analysis was guided by two theoretical frameworks: the empowerment framework by Super and Wagemakers (2021a), which provided insights into opportunities for empowerment for promoting healthy eating, and the Behaviour Change Wheel by Michie et al. (2011), which offered a comprehensive understanding of the capability, opportunity, and motivation factors that influence dietary and care provision behaviours. Detailed code lists for the substudies can be found in **Annex 9.1**, and **Figure 9.2** presents the main themes from the analysis of each substudy.

After individual analyses, the research team conducted three collaborative sessions to synthesise findings: two one-hour sessions by RL and AW and one half-day meeting with all authors. The integration process involved initial individual reflection on key findings and collaborative categorisation into central themes. Small group discussions further elaborated on specific themes, and a plenary session allowed for comprehensive analysis and synthesis to identify overarching findings. The integration of findings from the four substudies led to the identification of three major themes related to empowerment strategies for improving parental diet quality during the postpartum period: (1) Limitations of the current healthcare system, (2) Parental motivation in the face of barriers, and (3) Opportunities for creating continuity of care.

9.3 RESULTS

LIMITATIONS OF THE CURRENT HEALTHCARE SYSTEM

The current healthcare system prioritises reactive rather than proactive approaches to nutrition support for postpartum parents. Nutrition concerns are typically addressed only when medical issues arise, rather than when preventive guidance is provided. HCPs often engage with postpartum parents about nutrition only when specific health conditions emerge or parents explicitly request dietary guidance. Additionally, the structure of the postpartum healthcare system is predominantly child-centred, with limited attention to parental nutrition. Maternity care assistants were the only HCPs who regularly discussed nutrition with parents postpartum. In contrast, midwives,

Substudy 1: Postpartum women's experiences and needs for empowerment in dietary choices	Postpartum circumstances Health issues (physical/mental) Changes in daily routines Breastfeeding difficulties Fatigue and emotional challenges Nutrition barriers & facilitators Lack of time and shifting priorities Cost constraints and cravings Body image and health motivations Quality breastmilk as motivator Support needs Information on breastfeeding nutrition Guidance on foods to boost energy Practical meal preparation support Support from maternity care valued Interest in nutrition apps and reading Targeted resources and courses	Substudy 2: HCPs' perspectives on postpartum nutritional support and empowerment strategies	Current support practices Proactive: dietitians, maternity care Reactive: midwives, youth health nurse Limited knowledge about nutrition Insufficient time for discussions Empowerment approaches Woman-centered approach Not pushing toward healthy eating Creating open dialogue Supporting social navigation Intervention suggestions Start during pregnancy, continue after Group settings for discussions Strengthen intersectoral collaboration Integration into Centering Parenting Need increased knowledge and time Consider cultural responsiveness	Substudy 3: Parents' perspectives on nutritional support needs during the first postpartum year	Diet quality satisfaction and knowledge Average self-rating of diet quality: 7.2/10 Sufficient knowledge about healthy diet Gap between knowledge and practice Equal rating between mothers & fathers Social support dynamics Instrumental support most valued Mothers: support from multiple sources Fathers: support only from partners Partner support crucial for mothers Intervention suggestions First 4 months: environmental focus After 4-6 months: direct parent focus Mobile app with recipes and information Integration with consultation office Different approaches for different needs Quick and practical solutions valued	Substudy 4: HCPs implementation opportunities and barriers to integrate postpartum dietary empowerment strategies in healthcare	Current nutrition role Child-focused approach Parent nutrition rarely addressed Problem/medically-driven interventions Dependent on parent initiative Capability, opportunity & motivation Limited time during consultations Competing priorities in visits Motivational interviewing skills present Concern about appearing judgmental Recognition of parent influence on child Implementation opportunities Centering Parenting as promising format Group dynamics facilitate discussions Strategic consultation moments Open consultation hours with dietitians Continuity of care from pregnancy
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FIGURE 9.2: MAIN THEMES/RESULTS PER SUBSTUDY

youth healthcare nurses, youth healthcare physicians, lactation consultants, general practitioners, and gynaecologists generally provided minimal nutritional support to parents. As a maternity care company manager noted: *“Currently, it [nutrition for postpartum women] does not have priority because there are other things which are far more important. I mean, what we really care about is that the baby has a good start in life. A promising start. We have to make sure the mother is capable of caring for her baby”* (Substudy 2, Manager maternity care company).

HCPs identified several systemic barriers to providing nutrition support, including insufficient time, knowledge, and resources. Midwives, youth healthcare nurses, and gynaecologists reported a lack of nutritional knowledge specifically for postpartum women. Financial constraints within the healthcare system further impede comprehensive dietary support. HCPs noted that specialised nutrition services, such as consultations with dietitians, often require additional funding or out-of-pocket expenses. Additionally, the current financing model prioritises illness treatment over preventive care, making implementing systematic nutrition support programmes as part of standard care difficult. One midwife stated, *“We keep getting more [work tasks], but we do not receive more money... If we are the profession expected to accomplish this [discussing nutrition with women], they should invest in us”* (Substudy 2, Midwife 2). The absence of intersectoral collaboration, particularly between child health centres and dietitians, was identified as another significant limitation.

PARENTAL MOTIVATION IN THE FACE OF BARRIERS

Parents demonstrated clear motivation to maintain or improve their diet quality postpartum, despite healthcare limitations. Several motivating factors emerged across the substudies, including the desire to enhance breastmilk quality, serve as positive role models for their children, improve personal health and well-being, and manage postpartum weight. For many mothers, breastfeeding was a primary motivator for maintaining healthy eating habits, although it sometimes created additional dietary challenges. Some mothers reported feeling excessively hungry during breastfeeding, which led to weight gain. One participant shared: *“I was very hungry all the time while breastfeeding, so I ate a lot, and that eating pattern stayed the same. When I stopped breastfeeding, I had gained a lot of weight.”* (Substudy 1, participant 3). The desire to be a positive role model for their children also emerged as a significant motivator. One mother stated: *“I think it’s important that my children learn that you shouldn’t eat snacks all day, but instead eat at set times. I hope they don’t experience the same yo-yo effect I’ve been dealing with for a long time”* (Substudy 1, participant 12).

However, parents faced numerous barriers to healthy eating during the postpartum period. Time constraints represented a significant challenge, as parents often prioritised

infant care over their nutritional needs. One mother explained: *“Now with breastfeeding, I notice that, per day, I spend about an hour in between breastfeeding or pumping. You lose extra time, where normally I might take that time to have lunch or sit down with a cup of tea and something”* (Substudy 1, participant 7). Sleep deprivation further complicated dietary choices, as many parents experienced fatigue that affected their capacity to plan and prepare healthy meals. Additionally, the financial burden of healthy food was a noticeable barrier across different socioeconomic groups. One participant noted: *“Well, if you look at the financial picture, when I walk through the supermarket and want to make healthy choices, my groceries are much more expensive”* (Substudy 1, participant 4).

Social support emerged as a critical facilitator for healthy eating, with instrumental support from partners or maternity care assistants providing particular benefits. Partners who prepared meals or assisted with grocery shopping empowered mothers to maintain healthier eating patterns. However, a partner could also play a disempowering role, as one postpartum woman noted: *“I would have liked him [her partner] to do that [helping with eating healthy] a bit more, but he does not have much interest in food at all. He would rather have a biscuit than anything else. I am the one who makes sure there are always enough vegetables during dinner and so on”* (Substudy 3, Mother 7). The substudies showed that social support for healthy eating was primarily directed towards mothers, with less attention given to the needs of fathers. Additionally, substudy 3 noted that fathers received minimal nutritional support from HCPs, highlighting a gap in current practice.

OPPORTUNITIES FOR CREATING CONTINUITY OF CARE

A consistent recommendation across the substudies was the importance of establishing a continuous care pathway from pregnancy through postpartum. Both HCPs and parents emphasised that pregnancy represents an optimal period to establish healthy dietary habits, which can be reinforced postpartum. They also recognised the value of preparing for the postpartum period during late pregnancy. One midwife explained: *“I think you should focus on pregnancy, as women are very willing to critically assess what they eat and how they live during this period. (...) And I think the postpartum period is a good period to reinforce it [the healthy habits established during pregnancy].”* (Substudy 2, Midwife 1). The findings suggest that an effective empowerment strategy should adopt a phased approach: during the first four months postpartum, the focus should be on supporting the social environment to assist parents with nutrition, followed by more direct parent-focused strategies as family routines become established. HCPs identified child health centres as a strategic setting for reaching nearly all parents. Parents recognised the value of integrating nutritional support into existing healthcare services, particularly after the first few months postpartum when they had established more routine. Furthermore, all substudies emphasised the importance of a family-centred approach that involves both

parents rather than focusing exclusively on mothers.

Centering programmes were consistently identified as promising platforms for implementing nutrition support. CenteringPregnancy during gestation, followed by CenteringParenting in the postpartum period, could provide the continuity needed for sustained dietary improvements. HCPs highlighted several advantages of group-based approaches, including peer learning, increased time for discussion, and empowerment through shared experiences. One midwife explained: *“I really believe in care provided in groups. (...) You have much more time, you do it together, you talk about nutrition together. In an individual setting, I think it is often just a HCP giving advice, and I do not think that impact would be very large. I believe in the interactive component of groups. (...) And it is also empowering, as you discuss things together, you do things together”* (Substudy 2, Midwife 1).

A youth healthcare nurse, who was also a Centering trainer, particularly emphasised the power of peer influence in group settings: *“When you’re in a group, and someone shares what they eat, and another person says ‘But that’s not very healthy for you or your baby’, people accept that more than when a professional says ‘Well, that’s not healthy.’ Then, they feel more like they’re being scolded. No matter how well you communicate this as a professional, using conversation techniques, or how hard you try, you’re still the professional. But when another parent, a peer with a baby, mentions something or asks a question about it and someone else answers... In a group, that has much more impact.”* (Substudy 4, Participant 17)

While digital tools, such as apps, were recognised as potentially valuable supplements to in-person support, stakeholders emphasised that technology should complement, rather than replace, professional guidance. The postpartum women were generally positive about using nutrition apps but preferred apps that emphasised allowed foods rather than restrictions. They also valued apps that provided quick, easily accessible information and practical meal-planning support.

9.4 DISCUSSION

This research aimed to provide recommendations for an empowerment strategy to improve diet quality among postpartum parents. The findings from this integrated research reveal valuable insights into the challenges and opportunities for developing such strategies. Our results highlight three interrelated domains that require attention: systemic healthcare limitations, parental motivation in the face of barriers and complex experiences, and the potential for continuity of care across the perinatal journey.

The current healthcare system's reactive approach to nutritional support presents a significant barrier to effective dietary interventions. This finding aligns with previous studies indicating that preventive nutrition counselling is often neglected in postpartum care (Kavle, 2023; Olson, 2005). The child-centred nature of postpartum healthcare services further accentuates this issue, as parental nutrition is rarely prioritised unless it is directly linked to infant health outcomes. This structural focus reflects findings from international studies showing that postpartum care remains predominantly oriented toward infant health rather than maternal recovery and well-being (Eberhard-Gran et al., 2010; Tully et al., 2017). Additionally, resource constraints, such as insufficient time, knowledge, and funding, further impede comprehensive nutritional support. Our findings regarding HCPs' perceived limited nutritional knowledge align with research by Lucas et al (2020), who identified similar capability limitations among primary care providers supporting postpartum women. Kavle's (2022) comprehensive gap analysis underscores that inadequate provider training on maternal diet, weight gain during pregnancy, and physical activity significantly contributes to suboptimal maternal nutrition counselling worldwide (Kavle, 2023).

Our research revealed significant parental motivation to maintain healthy dietary habits postpartum. The motivational factors identified in our study – enhancing breastmilk quality, role modelling, health improvement, and weight management – align with previous research on parental motivation for health behaviour change (Bassett-Gunter et al., 2013; Moura & Aschemann-Witzel, 2020). However, these motivations are influenced by the complex postpartum context, which includes time constraints, sleep deprivation, and competing priorities. The literature consistently highlights these barriers (Makama et al., 2021; Ryan et al., 2022), suggesting they represent universal challenges. This disconnect between parental motivation and systemic barriers raises a critical question: what good is motivation when supportive structures are absent? The importance of social support in overcoming constraints to dietary improvement emerged as a key finding across our substudies. This aligns with research by Versele, Debekker, et al. (2021), who identified social influence as one of the most significant determinants of dietary changes during the transition to parenthood. Our research further extends this understanding by highlighting the unequal distribution of nutritional support between mothers and fathers, suggesting a need for more inclusive approaches that engage both parents.

Perhaps most promising is our finding regarding the potential for continuity of care from pregnancy through postpartum. Identifying pregnancy as a critical window for establishing healthy dietary habits that can be reinforced postpartum aligns with literature on habit formation and maintenance (Aschemann-Witzel, 2013; Versele et al., 2022). HCPs identified group-based approaches like CenteringPregnancy and

CenteringParenting as promising platforms for implementing continuous nutritional support. These approaches offer benefits such as peer learning, increased time and contact with HCPs, community building, and group accountability – all evidence-based approaches for fostering postpartum behaviour change (Versele et al., 2022). However, nutrition in Centering programmes currently focuses primarily on infant feeding rather than parental nutrition, discussed only when participants raise specific questions.

Perhaps most concerning in our findings is the gap between motivated parents and a healthcare system primarily structured to address problems rather than prevent them. This critical gap must be addressed by systematically integrating maternal nutrition into pregnancy and postpartum healthcare. Our findings suggest that strengthening the nutritional components within both Centering programmes could create an effective support continuum throughout pregnancy and postpartum. Based on these insights, we recommend a phased approach to nutritional support, focusing initially on the social environment and later shifting toward direct parental empowerment. This approach aligns with the Institute of Medicine’s (1992) emphasis on “patient-centred, individualised care” and “family involvement” as foundational principles for nutrition services. Healthcare providers can enhance intervention effectiveness by acknowledging the challenges of the early postpartum period while strategically timing interventions to coincide with increased parental readiness for change as family routines stabilise. Digital tools can complement professional guidance, with postpartum women expressing a preference for positive, practical nutrition apps that emphasise allowed foods over restrictions. Ultimately, these findings underscore the need for empowerment strategies that address multiple levels of influence: healthcare system constraints, individual parental factors, and social environment dynamics. Therefore, researchers and HCPs should design future interventions with a comprehensive approach that bridges pregnancy and postpartum care, actively engages both parents and leverages existing healthcare structures.

STRENGTHS AND LIMITATIONS

A significant strength of this study lies in its comprehensive approach using four complementary substudies that enhanced validity through triangulation. The involvement of different researchers across substudies contributed methodological pluralism and reduced investigator bias. The collaborative analysis process brought researchers together from each substudy to cross-check information and formulate joint recommendations, ensuring greater reliability and validity.

However, a limitation relates to the sampling techniques, which may have introduced selection bias. Parents who volunteered to participate might have had higher baseline nutrition awareness or motivation than the general postpartum population. Similarly,

participating HCPs may have had more interest in nutrition than typical among their colleagues. This selection bias could have influenced our findings, potentially underestimating challenges faced by parents with less nutritional interest and obstacles experienced by HCPs with limited nutrition focus.

9.5 CONCLUSION

Our findings highlight essential preconditions for developing empowerment strategies to improve diet quality among postpartum parents. We identify three key areas that require attention: (1) healthcare system limitations that prioritise child health over parental nutrition with a reactive rather than a preventive approach; (2) parental motivation amid significant barriers, including time constraints and competing priorities; and (3) opportunities to create continuity of care from pregnancy through the postpartum period. We recommend a family-centred approach implemented in phases – initially supporting the social environment during the first four months when parents are most overwhelmed, followed by direct, parent-focused strategies as family routines stabilise. Group-based settings like CenteringParenting show promise for effective implementation. Future efforts should strengthen collaboration among healthcare providers while acknowledging the complex realities of the postpartum period to support both parents in establishing healthy dietary patterns that benefit the entire family.

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ANNEX 9.1: CODE LISTS

SUBSTUDY 1

Healthy			
- Recovery from delivery			
- Previous health conditions			
- Iron deficiency			
Changes in daily life			
- A lot of (new) tasks			
- Time distribution			
- Different priorities			
Breastfeeding			
- Duration breastfeeding			
- Breastfeeding problems			
Emotions			
- Hormones			
- Feeling alone			
- Maternity tears			
Fatigue			
First baby			
Quick recovery			
- Mental			
- Physical			
Experience			
- Older children			
- Over time			
Support			
- Social environment			
- HCPs			
Connection to baby			

Negative circumstances

Positive circumstances

Circumstances of the postpartum period

Time			
Different priorities			
- Putting self second			
- Forgetting to eat			
- Difficult with young child			
Price	↑	Barriers healthy diet	↑
Cravings			
Family preferences			
Knowledge			
Not too strict during this period			
Body image			
Health			
- More energy			
- Mental health			
- Recovery from birth			
Nutrients for baby through breastmilk			
Role model for child	↑	Facilitators healthy diet	↑
Conscious eating			
Experimenting with cooking			
Increased appetite			
- Resolved			
- Not resolved			
Changed nutritional needs			
- Nutrition for self			
- Nutrition for baby			
Sufficient water	↑		
			Breastfeeding

Social environment - Providing information - Preparing foods Healthcare professionals - Providing information - Preparing food	↑	Received nutritional support	↑	Nutrition support in the postpartum period
	↑	Searched for nutritional support	↑	
	↑	Needs for nutritional support	↑	
	↑	Preferred way of nutritional support	↑	
Maternity nurse Midwife Dietitian Reading material Courses	↑			
Schedules Nutritional value of foods Quick information Focus on what is allowed Continuous effort Focus on what's not allowed Too strict	↑	Positive	↑	Apps
	↑	Negative	↑	

SUBSTUDY 2

Theme or topic (theme in bold)	Code	Explanation code	Frequency of code	Present in number of interviews	Type of code	Framework of deductive codes
The current conversation about nutrition for postpartum women	The current conversation about nutrition	The content and frequency of the current conversation between HCPs and PPW about nutrition for PPW	63	16	Inductive	
	Knowledge of HCPs	The knowledge of HCPs about nutrition for PPW	37	16	Deductive ¹	Behaviour
	- Education		16	12	Deductive ²	Change Wheel
	- Training	- The education of HCPs on nutrition for PPW	27	16	Deductive ³	
	- Guidelines	- The training of HCPs on nutrition for PPW	20	16	Deductive ⁴	
		- The guidelines HCPs used for nutrition of PPW				
Suggestions Use a women- for healthcare centred professionals approach	Available time of HCPs	The available time of HCPs to discuss nutrition of PPW with PPW	38	16	Deductive ⁵	Behaviour
	Moments of contact	The frequency and duration of contact between HCPs and PPW	22	10	Inductive	Change Wheel
	Motivation of HCPs	The motivation of HCPs to discuss nutrition of PPW with PPW	30	16	Deductive ⁶	Behaviour
	Responsibilities of HCPs	The perspectives of HCPs on the responsibility to discuss nutrition in their profession and/or in other professions	39	10	Inductive	Change Wheel
	Personalised approach	The personalised way in which HCPs approached PPW	37	12	Inductive	
	Holistic approach	The holistic way in which HCPs approached PPW	35	11	Inductive	
	Demand-driven	HCPs worked based on the demand of PPW	33	11	Inductive	

Do not push postpartum women towards healthy nutrition	Not pushing women towards healthy nutrition	HCPs were not pushing PPW towards healthy nutrition	35	12	Inductive
Healthy nutrition	Responsibilities of HCPs	The perspectives of HCPs on the responsibility to discuss nutrition in their profession and/or in other professions	39	10	Inductive
	Barriers for a healthy diet	The barriers of PPW to consume a healthy diet	46	14	Deductive ⁷
	Sensitive subject	HCPs identified nutrition of PPW as a sensitive subject to discuss with PPW	7	6	Inductive
	Establish and hold trust relationship	HCPs wanted to establish and hold a trust relationship with PPW	12	6	Inductive
	Perspectives of PPW	HCPs cared about and wanted to know the perspectives of PPW	26	12	Inductive
	Nutrition is not a priority for HCPs	HCPs had other priorities than nutrition for PPW	15	5	Inductive
Create an open dialogue	Open dialogue	The experience of HCPs of the conversation as an open dialogue or not	25	11	Deductive ⁸
Support women in navigating their social environment	Navigating social environment	HCPs supported PPW in navigating their partners, the individualistic society and cultural differences considering nutrition of PPW	49	12	Deductive ¹⁰
Deal with different motivations	Dealing with different motivations	HCPs supported PPW in navigating their motivations and barriers to consume a healthy diet	7	6	Deductive ⁷
	- Motivations for a healthy diet	The motivations of PPW to consume a healthy diet	34	14	Deductive ⁷
	- Barriers for a healthy diet	The barriers of PPW to consume a healthy diet	46	14	Deductive ⁷

Suggestions for strategies	Suggestions for strategies	Suggestions for strategies addressing nutrition of PPW	74	16	Inductive
Start during pregnancy and continue postpartum	Timing of strategy	The timing of a strategy addressing nutrition of PPW	26	11	Inductive
	Start during pregnancy and continue postpartum	Suggestion to start a strategy addressing nutrition of PPW during pregnancy and to reinforce the strategy during the postpartum period	28	14	Inductive
Create a group setting	Group setting	Suggestions for strategies addressing nutrition of PPW in a group setting	18	6	Inductive
	Intersectoral collaboration	The collaborations between different professions in postpartum care	58	16	Deductive ⁹ Empowerment framework
Strengthen intersectoral collaboration in postpartum care					
Centering Parenting	Centering Pregnancy / Centering Parenting	Suggestions of Centering Pregnancy and/or Centering Parenting as a strategy addressing nutrition of PPW	11	9	Inductive
	Responsibilities of HCPs	The perspectives of HCPs on the responsibility to discuss nutrition in their profession and/or in other professions	39	10	Inductive
Preconditions in a strategy	Perspectives of postpartum women	The perspectives of PPW on a strategy addressing nutrition of PPW	26	12	Inductive
	Increasing knowledge of HCPs	Suggestions for strategies increasing knowledge of HCPs about nutrition for PPW	12	7	Inductive
	Finances of strategy	Preconditions regarding finances to implement a strategy addressing nutrition of PPW	13	5	Inductive
Hard to reach population	Hard to reach population	Preconditions regarding the hard-to-reach populations in a strategy addressing nutrition of PPW	11	6	Inductive
	Cultural differences	Preconditions regarding cultural differences in a strategy addressing nutrition of PPW	13	8	Inductive

HCP = healthcare professional, PPW = postpartum women

- ¹ = Psychological capability as a source of behaviour in the Behaviour Change Wheel of Michie and colleagues (2011).
- ² = Education as intervention function in the Behaviour Change Wheel of Michie and colleagues (2011).
- ³ = Training as intervention function in the Behaviour Change Wheel of Michie and colleagues (2011).
- ⁴ = Guidelines as policy category in the Behaviour Change Wheel of Michie and colleagues (2011).
- ⁵ = Physical opportunity as a source of behaviour in the Behaviour Change Wheel of Michie and colleagues (2011).
- ⁶ = Motivation as a source of behaviour in the Behaviour Change Wheel of Michie and colleagues (2011).
- ⁷ = Acknowledge and tap into different motivations in the Empowerment framework of Super and Wagemakers (2021).
- ⁸ = Create an open dialogue in the Empowerment framework of Super and Wagemakers (2021).
- ⁹ = Strengthen intersectoral collaboration in antenatal care in the Empowerment framework of Super and Wagemakers (2021).
- ¹⁰ = Support in navigating the (social) environment in the Empowerment framework of Super and Wagemakers (2021).

SUBSTUDY 3

Theme	Code	Explanation code	Type of code	The framework of deductive codes
Current diet	Interest in (healthy) nutrition	Interest from parents in (healthy) nutrition	Inductive	
	Grades	Parents' grades for their current diet.	Inductive	
	Current diet	The current diet of parents	Inductive	
Changes during the first year	Change since having kids	The things that changed for parents during the first year and the effects on their diet	Inductive	
	Sleep	The influence of sleep on the parents' diet	Deductive (Physical opportunity)	Behaviour Change Wheel*
	Example for child	Parents want to be a good example for their children.	Inductive	
	Focus on child	The parents do not prioritise themselves and focus on the child.	Inductive	
	Work	The work environment concerning eating healthy	Deductive (Physical opportunity)	Behaviour Change Wheel*
Time and structure	Time & routine	The available time parents had to focus on their diet and the effect of a routine on the parents' diet.	Deductive (Physical opportunity, reflective motivation)	Behaviour Change Wheel*
	Breastfeeding	The effects of breastfeeding on the mother's diet	Deductive	
Diet of the mother	Recovery of the mother	The mother has to recover from giving birth	Deductive (Physical capability, psychological capability)	Behaviour Change Wheel*
	Support	The support of the social environment about nutrition for the parents	Inductive	
Dietary support	- Instrumental	- The provision of tangible assistance and services		
	- Informational	- The provision of information, advice, and suggestions		
	- Emotional	- The provision of expressions of love, trust, care, and empathy		
	- Appraisal	- The provision of information for self-evaluation purposes		

Suggestions for strategies	Suggestions for strategies addressing parents' diet quality	Inductive
Timing of the strategy	At which moment during the postpartum period (a part of) an empowerment intervention can take place	Inductive
Combining with existing interventions	Suggestions of other interventions to combine with the nutrition of parents	Inductive
Specific examples	Specific ideas on how the empowerment intervention should look like	Inductive
Knowledge/information	The content of the empowerment intervention	Inductive
Healthcare professionals	The role of healthcare professionals in an empowerment intervention	Inductive

* (Michie et al., 2011)

SUBSTUDY 4

SECTION 1: THE CURRENT SITUATION

Theme	Code	Type of code	Framework of code
(Child) healthcare system as reactive	Discussing nutrition – (medical) problem child	Inductive	
	Discussing nutrition – (medical) problem parent	Inductive	
	Parent asks for help when (medical) problem	Inductive	
	Child healthcare centres – strengths: signalling problems	Inductive	
	Reimbursement when medical problem	Deductive	Behaviour Change Wheel* (<i>Policy categories – fiscal measures</i>)
Focus on child health	Child nutrition main responsibility of child healthcare centres	Deductive	Behaviour Change Wheel* (<i>Motivation + Policy categories - Guidelines</i>)
	Current role of nutrition in child healthcare – mostly child focused	Inductive	
	Current role nutrition of parents – child related	Inductive	
Minimal collaboration between different sectors	Child healthcare centres as starting point	Inductive	
	Child healthcare centres – collaboration with dietitians	Deductive	Empowerment framework^ (<i>Intersectoral collaboration</i>)
	Child healthcare centres – collaboration with dietitians - referral	Deductive	Empowerment framework^ (<i>Intersectoral collaboration</i>)
	Barriers for intersectoral collaboration	-Deductive	-Behaviour Change Wheel* (<i>Motivation</i>)
	-(negative) image of dietitians		-Behaviour Change Wheel* (<i>Motivation + Opportunity</i>)
	-limited accessibility of dietitians		-Behaviour Change Wheel* (<i>Motivation + Opportunity</i>)
	-parental motivation	-Deductive	
		-Deductive	
	Referring to dietitian and parent contacted by dietitian	Inductive	
	Current/past projects	Inductive	
	Initiative of project	Inductive	

Nutrition support for parents dependent on the initiative and motivation of parents	GlZ	Inductive	
	Help request/need parent central	Inductive	
	Voluntary and professional framework	Deductive	Behaviour Change Wheel* (<i>Policy categories – Guidelines</i>)
	Nutrition support reliant on initiative of parents	Inductive	
	Child healthcare centre – facilitating: aligning with parents' needs	Inductive	
SECTION 2: FACTORS THAT INFLUENCE FEASIBILITY OF INTEGRATING NUTRITION EMPOWERMENT IN CURRENT HEALTHCARE SYSTEM			
Theme	Code	Type of code	Framework of code
Only partial responsibility for and importance of integrating nutrition empowerment for parents in current healthcare system	Child healthcare centre as starting point	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Child healthcare centres motivation – parental nutrition (-parents' own vitality)	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	-role model function		
	-care taking		
	-breastfeeding		
	Motivation child healthcare centre discussing nutrition – relevance for child health	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Parents as part of a child's system	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Motivation dietitians supporting parents regarding nutrition	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	-parents' own vitality		
	-role model function		
	Attention for topic because of this research	Inductive	

Limited practical feasibility to discuss parents' diet in current healthcare system	Barriers child healthcare centres discussing nutrition	Deductive	-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
	-child related prevention: broad range of responsibilities		-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
	-limited time		-Behaviour Change Wheel* (<i>Capability + motivation</i>)
	-lack of nutritional knowledge		-Behaviour Change Wheel* (<i>Motivation + opportunity</i>)
	Barriers dietitians supporting parents		-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
	-limited reimbursement by insurance	Deductive	-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
	-deductible		-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
	-difficulty motivating/recruiting parents		-Behaviour Change Wheel* (<i>Opportunity + motivation</i>)
Nutrition as a sensitive topic	Systems thinking/seeing limitations	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Tension between taking initiative and intrusiveness	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Barriers motivation child healthcare centre – focus on child, not primarily for parents	Deductive	Behaviour Change Wheel* (<i>Motivation + opportunity</i>)
	Negative image of child healthcare centre	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Barriers motivation child healthcare centre – fear of damaging relationship of trust	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Discussing nutrition - dependent on parental motivation	Deductive	Behaviour Change Wheel* (<i>Motivation + opportunity</i>)
	Voluntary framework / help request/needs parents central	Deductive	Behaviour Change Wheel* (<i>Motivation + opportunity; policy categories – guidelines</i>)
	Obesity/overweight	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)

Environmental factors hinder healthy eating and pose challenges for healthcare professionals aiming to support behaviour change	Limiting environmental factors -unhealthy food environment -lack of affordability healthy food -social media -individualist culture	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
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SECTION 3: POSSIBILITIES FOR INTEGRATING NUTRITION EMPOWERMENT

Theme	Code	Type of code	Framework of code
Group meetings such as Centering more suitable for discussing nutrition of parents	Advantages Centering -more time -flexibility -group dynamics Disadvantages regular consultations -hierarchy -communication less effective	Deductive	Behaviour Change Wheel* (<i>Opportunity</i> + <i>motivation</i>) Behaviour Change Wheel* (<i>Opportunity</i> + <i>motivation</i>)
	Motivation dietitians for Centering	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Motivation Centering nutrition of parents	Deductive	Behaviour Change Wheel* (<i>Motivation</i>)
	Opportunity discussing nutrition in Centering	Deductive	Behaviour Change Wheel* (<i>Opportunity</i>)
	-Themes, introduction/closure		
	Capability Centering nutrition of parents	Deductive	Behaviour Change Wheel* (<i>Capability</i>)
	-Different methods		
	-Training		

Child healthcare centre - ideas discussing nutrition	Inductive
Ideas dietitians collaboration	Inductive
Specific ideas of healthcare professionals on integrating nutrition (empowerment) in healthcare	

SECTION 4: NEEDS FOR IMPLEMENTING NUTRITION EMPOWERMENT

Code	Type of code	Framework of code
Dietitians – conditions for collaboration	Deductive	-Behaviour Change Wheel* (<i>Intervention functions: incentivisation + policy categories: fiscal measures</i>)
-Financial compensation		-Behaviour Change Wheel* (<i>Opportunity</i>)
-Timing		-Behaviour Change Wheel* (<i>Opportunity</i>)
-Decent participation rate		
Needs related to capability child healthcare centres for discussing nutrition	Deductive	Behaviour Change Wheel* (<i>Intervention functions: education</i>)
-Nutrition related education		Behaviour Change Wheel* (<i>Intervention functions: enablement</i>)
-Document on nutrition		
Needs related to opportunity child healthcare centres for discussing nutrition	Deductive	-Behaviour Change Wheel* (<i>Policy categories: guidelines</i>)
-Making nutrition a key priority at child healthcare centres		-Behaviour Change Wheel* (<i>Policy categories: fiscal measures</i>)
-Financial compensation		-Behaviour Change Wheel* (<i>Policy categories: service provision</i>)
-Time		
-Addressing personnel shortage		-Behaviour Change Wheel* (<i>Policy categories: service provision</i>)

Needs related to motivation child healthcare centres for discussing Deductive nutrition	-Behaviour Change Wheel* (<i>Training + education + persuasion</i>)
-Nutrition education	
Expanding Centering	Deductive -Behaviour Change Wheel* (<i>Motivation</i>)
-Motivation for Centering	-Behaviour Change Wheel* (<i>Policy categories: service provision + guidelines</i>)
-Implementation plan	
Thinking in possibilities	Inductive
Connections	Deductive Behaviour Change Wheel* (<i>Policy categories: service provision + communication; intervention functions: enablement</i>)
Initiative of project	Deductive Behaviour Change Wheel* (<i>Intervention functions: enablement</i>)
More attention for parents	Inductive
Systematic approach	Inductive
Shared responsibility	Deductive Behaviour Change Wheel* (<i>Motivation</i>)

* = (Michie et al., 2011)
^ = (Super & Wagemakers, 2021)



Chapter 10

GENERAL DISCUSSION

This thesis systematically investigates the 'Power 4 a Healthy Pregnancy' (P4HP) programme. The primary objective of this dissertation was to design, implement, and evaluate the P4HP programme from various complementary perspectives. Specifically, it sought to 1) assess the programme's impact on improving the diet quality and empowerment of pregnant women, 2) explore pregnant women's experiences with the P4HP programme, 3) evaluate midwives and dietitians' perspectives on the P4HP programme focusing on its impact, interprofessional collaboration, facilitators and barriers, and 4) examine additional factors that may influence dietary behaviour during pregnancy and the postpartum period.

The participatory development process identified four core principles that guided the programme: early intervention during pregnancy, ongoing nutrition communication, a positive, empowering approach, and the combined expertise of midwives and dietitians. The results from this evaluation provide evidence for the effectiveness and value of the P4HP programme. The cluster randomised controlled trial (C-RCT) demonstrated significant improvements in overall diet quality among pregnant women in the intervention group compared to those receiving standard care in the control group, with particular enhancements in fish consumption, iodine, and vitamin D intakes. Qualitative results showed that pregnant women made several dietary improvements because of participation in the P4HP programme, including increased consumption of dairy products, fish, fruits, vegetables, whole grain bread, unsalted nuts, water, nutrient supplements, and a reduced intake of risky foods during pregnancy. Women particularly valued the personalised consultations with dietitians, which provided tailored guidance that raised their awareness, provided reassurance about dietary choices, and boosted their confidence in making informed decisions throughout pregnancy. Midwives and dietitians reported enhanced interprofessional collaboration, gaining a deeper understanding of each other's roles in providing nutritional care. Additionally, the study highlighted the significant role of supporting dietary choices during pregnancy, as well as the fact that postpartum nutritional counselling tends to be limited and reactive rather than proactive.

This thesis makes a unique contribution to the field through several aspects. First, it demonstrates the effective application of empowerment theory within a practical antenatal nutrition programme, moving beyond traditional educational approaches to enhance women's agency in making dietary choices. Second, the interprofessional collaboration between midwives and dietitians offers an innovative approach to antenatal care that utilises the complementary expertise of both professions. Third, the mixed-methods design provides a comprehensive evaluation, capturing both quantitative outcomes and qualitative experiences. Finally, the active participation of key stakeholders throughout the development and research process embodies empowerment principles and ensures

relevance, feasibility, and acceptability for all involved.

This chapter provides an overview of the research questions and the main findings of each chapter (§10.1). These findings are then synthesised and reflected upon using five key critical insights (§10.2). Thereafter, the methodology used in this thesis is reviewed (§10.3), followed by recommendations for Dutch antenatal care and policy (§10.4). The chapter concludes with a take-home message (§10.5)

10.1 SUMMARY OF MAIN FINDINGS

Table 10.1 presents an overview of the research questions and the main findings per chapter.

TABLE 10.2: SUMMARY OF MAIN FINDINGS

Thesis chapter	Research question	Main findings
2	What is the effectiveness of the P4HP programme regarding diet quality, empowerment, Sense of Coherence (SOC), Quality of Life (QOL), and Self-Rated Health (SRH), and how is the programme evaluated in terms of multidisciplinary collaboration, facilitators, and barriers?	<ul style="list-style-type: none">• The P4HP programme consists of four extra consultations for pregnant women to discuss nutrition with their midwife and dietitian, embedded within standard antenatal care.• Four core principles guided programme development: 1) early intervention during pregnancy, 2) repeated nutrition communication, 3) a positive, empowering approach, and 4) combined expertise of midwives and dietitians.• The programme implemented a women-centred empowerment approach, prioritising women's individual needs as defined by the women themselves, focusing on choice and control.• A visual conversation tool was developed to facilitate discussions about nutrition, allowing participants to guide conversations toward topics most relevant to their individual circumstances.• The protocol specified a cluster randomised controlled trial methodology with intervention and control midwifery practices, designed to evaluate both effectiveness and feasibility.• Primary outcomes were diet quality and empowerment, and secondary outcomes were SOC, QOL, and SRH.• A mixed-methods approach integrated quantitative outcome measures with qualitative process evaluation to comprehensively assess the programme's impact, multidisciplinary collaboration, and implementation barriers/facilitators.

3	What are the outcomes of participation in the P4HP programme, primarily in terms of diet quality and empowerment, and secondarily in terms of SRH, QOL, and SOC?	<ul style="list-style-type: none">• Total diet quality significantly improved in the intervention group compared to the control group (4.28 points; 95% CI: 1.00 to 7.56; $p = 0.011$).• The improvement in total diet quality was primarily driven by three specific components: higher intake of fish (0.55; 95% CI: 0.07 to 1.03; $p = 0.025$), higher intake of iodine (0.40; 95% CI: 0.20 to 0.61; $p < 0.0001$), and lower decrease in vitamin D intake (0.48; 95% CI: 0.02 to 0.95; $p = 0.043$).• The last Observation Carried Forward (LOCF) analysis provided a more precise estimate than the standard analysis while confirming the significant improvement in diet quality (2.75; 95% CI: 0.76 to 4.72; $p = 0.007$).• Between groups with below and above-average total diet quality scores, the greatest differences were observed in the consumption of nuts, legumes, vegetables, fruit, fat and oils, and processed meat.• Women at all empowerment levels expressed uncertainty about appropriate gestational weight gain, with a significant improvement observed in this domain in the intervention group (0.69; 95% CI: 0.14 to 1.36; $p = 0.045$).• No significant differences were observed between the intervention and control groups in secondary outcomes, including QOL, SRH, and SOC.• The improvement in diet quality varied considerably across midwifery practices in the intervention group ($n=9$) (ranging from -11.3 to +14.0 points).
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4	<p>What are the reported changes in diet quality among pregnant women, the factors influencing these changes, and pregnant women's perceptions of the P4HP programme?</p> <ul style="list-style-type: none"> • Pregnant women reported enhanced awareness, reassurance, and confirmation of their dietary intake quality through the P4HP programme, which boosted their confidence in making informed dietary decisions. • Women made multiple specific dietary improvements, including increased consumption of dairy products, fish, fruits, vegetables, whole grain bread, unsalted nuts, water, supplements, and a reduced intake of unsafe foods during pregnancy. • Women particularly appreciated the personalised nutritional guidance from dietitians, which provided them with specific, actionable advice tailored to their circumstances. • Consultations with the midwife helped women stay motivated to maintain dietary improvements throughout pregnancy, serving as important reminders and reinforcement for the changes initiated during dietitian consultations. • Women largely viewed their dietary intake as their personal responsibility, though some acknowledged the shared nature of this responsibility with their partners, particularly regarding shared meals and grocery shopping. • The postpartum period presented unique dietary challenges that were often underestimated by women, including increased appetite due to breastfeeding, sleep deprivation, time constraints, and irregular schedules. • Most women avoided consuming unsafe foods during pregnancy and used the Zwangerhap app from The Netherlands Nutrition Centre to guide their food safety decisions. 	<p>How is the implementation of the P4HP programme evaluated by midwives and dietitians in terms of impact, interprofessional collaboration, facilitators and barriers?</p> <ul style="list-style-type: none"> • Healthcare professionals (HCPs) reported enhanced interprofessional collaboration between midwives and dietitians, with both groups gaining a deeper understanding of each other's roles in providing nutritional care during pregnancy. • Midwives gained confidence in discussing nutrition and recognising when to refer to dietitians, while dietitians developed a better understanding of the specific nutritional challenges women face throughout different stages of pregnancy. • Key facilitators for implementation included clear programme procedures, implementation flexibility, and HCPs' commitment to promoting healthy eating during pregnancy. • Primary barriers to implementation identified were time constraints and limited staff availability among midwives, as well as the financial burden of dietitian consultations outside the research context. • The perception of HCPs of the programme shifted from initial scepticism about its effectiveness to support after observing positive outcomes in pregnant women's dietary behaviours.
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6	<p>How was an empowerment-based programme, aiming to improve the diet quality of pregnant women, developed through participatory methods within the Dutch antenatal care system?</p>	<ul style="list-style-type: none"> • The development of the P4HP programme followed a participatory approach across four phases: exploratory research, iterative programme development, pilot implementation, and full-scale implementation and evaluation, with continuous stakeholder involvement throughout the process. • A visual conversation tool was created to facilitate empowerment by allowing women to steer conversations toward nutrition topics most relevant to their individual needs. • The pilot implementation demonstrated positive experiences across all stakeholder groups. • The development process revealed that successful implementation required balancing the standardisation of core programme elements with flexibility for local adaptation to different practice contexts. • Time constraints within midwifery practices and financial barriers to dietitian consultations were identified as the main challenges to integrating P4HP into routine antenatal care. • The development process demonstrated the value of stakeholder engagement in creating effective health interventions, with the co-creation process embodying the empowerment principles that the programme sought to promote.
7	<p>What are the perspectives of Dutch pregnant women and their partners on the role of the partner in supporting the healthy diet of pregnant women?</p>	<ul style="list-style-type: none"> • Pregnant women generally reported positive experiences with the support they received from their partners during pregnancy. • The most common form of support provided by partners was instrumental, including tasks such as cooking, grocery shopping, and helping pregnant women avoid consuming unsafe foods. • As a gesture of solidarity, some partners refrained from consuming foods unsafe for pregnant women (such as alcohol, raw meats, and unpasteurised cheeses), to make it easier for them to maintain dietary restrictions. • Appraisal support, where partners provided feedback to increase pregnant women's consciousness about their dietary intake, was commonly provided but received with mixed acceptance, depending on how it was communicated. • Informational support is primarily focused on foods considered unsafe during pregnancy, with partners informing themselves about dietary restrictions and checking food labels to ensure safety. • Emotional dietary support was the least mentioned type of support, with only four couples reporting expressions of care and empathy regarding dietary challenges. • Support from partners was more willingly accepted when perceived as helpful, showing involvement, and delivered positively, rather than when perceived as judgmental or intrusive. • How support was communicated by partners influenced the acceptance by pregnant women, who preferred support that was clearly explained, based on reliable sources, and delivered without a "know-it-all" attitude. • Support was more readily accepted when requested by the pregnant woman, provided early in pregnancy rather than later, and focused on positive reinforcement rather than criticism.

8	<p>What are current nutritional counselling practices by healthcare professionals for postpartum women, and what are the perspectives of healthcare professionals on digital nutritional counselling during this period?</p>	<ul style="list-style-type: none">• Most HCPs (77%) provided some form of postpartum nutritional counselling, primarily through verbal general advice (49%), referrals to a dietitian (33%), or referrals to written information resources (30%).• The extent of nutritional counselling was limited, with more than half of HCPs providing dietary information only when women explicitly requested it, often restricted to basic advice.• Key determinants influencing the provision of nutritional counselling included available time, knowledge of HCPs, and perceived client characteristics and situations (e.g., culture and prior knowledge).• HCPs reported a lack of specific training in postpartum nutrition, with approximately half not receiving any education on this topic.• Women's strong focus on their baby's health rather than their own was identified as a significant barrier to engaging them in nutritional counselling for themselves during the postpartum period.• Cultural differences between HCPs and clients complicate nutritional counselling, particularly due to unfamiliar dietary habits and language barriers, especially when serving diverse populations.• Most HCPs (80%) supported the development of a mobile health (mHealth) app to assist in providing nutritional counselling to postpartum women, viewing it as a valuable complement to their care.• HCPs emphasised that an effective app should offer scientifically sound, simple yet detailed information, healthy recipes supported by photos and videos, and be adaptable to specific circumstances common during the postpartum period.
9	<p>What preconditions are necessary for an empowerment strategy to improve diet quality among parents in the first year postpartum?</p>	<ul style="list-style-type: none">• Current healthcare systems primarily focus on child health rather than parental nutrition during the postpartum period, with support being mostly reactive rather than preventive.• Parents demonstrate clear motivation to maintain healthy dietary habits postpartum but face barriers, including time constraints, competing priorities, sleep deprivation, and limited professional support.• A family-centred approach that includes both parents and addresses nutrition in phases is recommended – first supporting the social environment during the first months, followed by direct parent-focused strategies as family routines stabilise.• Continuity of care from pregnancy through the postpartum period is essential, with group-based approaches such as CenteringParenting showing particular promise for implementation.• Effective interventions should bridge the gap between pregnancy and postpartum care, engage both parents actively, and leverage existing healthcare structures such as child health centres.

10.2 SYNTHESIS OF AND REFLECTION ON KEY FINDINGS

Synthesising the key findings across the chapters highlights five critical insights that enhance our understanding of empowerment-based approaches to improving diet quality during pregnancy and postpartum: 1) The effectiveness of the P4HP programme, 2) The empowerment approach: Theoretical insights and practical implications, 3) Building bridges across stakeholders and professions: Participatory development and interprofessional collaboration, 4) The social context of dietary choices during pregnancy and postpartum, and 5) The future of health promotion in an era of data and personalisation.

10.2.1 THE EFFECTIVENESS OF THE P4HP PROGRAMME

This section addresses the P4HP programme's impact on maternal nutrition and health outcomes. First, it examines the specific nutritional improvements achieved through the P4HP programme. These findings are then interpreted through the prevention paradox framework, followed by an exploration of how the P4HP programme's empowerment approach manifested across individual, interpersonal, and professional domains. Finally, the positioning of these findings within the current literature on prenatal nutrition interventions is described.

The effectiveness of the Power 4 a Healthy Pregnancy (P4HP) programme in improving diet quality provides valuable insights for maternal health interventions, because of the importance of a healthy diet during pregnancy and postpartum for maternal health (Ho et al., 2016; Marshall et al., 2022). The C-RCT demonstrated significant improvement in overall diet quality among women in the intervention group, with a between-group difference of +4.3 units (out of a maximum of 200) on the Dutch Healthy Diet for pregnant women (DHD-P) compared to the control group (Chapter 3). This improvement was especially noticeable in vitamin D, iodine, and fish intake. These findings are particularly relevant, given the importance of adequate vitamin D intake during pregnancy (Palacios et al., 2024), the critical role of iodine for foetal brain and nervous system development (Harding et al., 2017; Ramakrishnan et al., 2012), and the benefits of fish consumption, which provides essential omega-3 fatty acids that support foetal brain development and may help reduce the risk of preterm birth and low birth weight (Coletta et al., 2010; Middleton et al., 2018).

While the absolute magnitude of these improvements may appear modest, interpreting them through the lens of the prevention paradox reveals their potential significance for population health. The prevention paradox is a concept formulated by epidemiologist Geoffrey Rose (Rose, 1981, 2001), where interventions that bring large benefits to the population might offer relatively little to each participating individual. Recent modelling

research by Duan et al. (2025) demonstrates the significance of such incremental dietary changes for the population's health. Their study showed that even small shifts toward better adherence to dietary guidelines can lead to substantial long-term health benefits. For instance, they found that partial improvements in fruit consumption patterns at the population level could prevent 382 stroke cases per 100,000 women (17.7% reduction), and eliminating processed meat could reduce coronary heart disease cases by 18.5% in women (Duan et al., 2025). Therefore, even modest dietary improvements, such as those achieved in the P4HP programme, could significantly reduce disease risk over time, especially as these dietary patterns can persist postpartum and influence long-term family eating patterns (Versele, Debekker, et al., 2021).

The relationship between incremental improvements in diet quality during pregnancy and maternal and child health outcomes remains underexplored. However, even modest improvements in nutrient intake during pregnancy could have meaningful biological effects, given the critical role of maternal nutrition in foetal development (Marshall et al., 2022). This suggests that the benefits of improving diet quality during pregnancy may extend beyond immediate maternal and foetal health, potentially shaping family health over the long term. This aligns with the concept of the prevention paradox, where small individual improvements can collectively yield substantial public health benefits when scaled across populations. The findings on diet quality support literature suggesting that structured dietary interventions during pregnancy can improve nutritional outcomes (Gresham et al., 2016). Previous interventions often focused primarily on weight management (Skouteris et al., 2016; Thomson et al., 2016) and often used educational approaches (Zinsser et al., 2020). In contrast, the P4HP programme approached nutritional antenatal care more broadly, employing an empowerment framework. Examining how empowerment manifested across individual, interpersonal, and professional levels reveals the pathways through which the P4HP programme achieved nutritional improvements.

At the **individual level**, the empowerment approach resulted in notable outcomes. While the quantitative analysis showed limited changes in most empowerment measures, a significant improvement was observed in women's confidence regarding appropriate gestational weight gain (The statement "*I know if I am gaining the right amount of weight during my pregnancy*") (Chapter 3). The qualitative findings provided a deeper understanding of how empowerment manifested in the lives of pregnant women and across multiple interconnected levels. Pregnant women reported increased nutritional awareness, greater confidence in their decision-making, and a stronger sense of agency in managing dietary challenges (Chapter 4). The P4HP consultations played a key role in raising awareness, providing reassurance and affirming the quality of their dietary choices, which ultimately boosted women's confidence. Furthermore, the programme

offered practical strategies tailored to each woman's circumstances. This empowered them to feel more capable of overcoming dietary challenges throughout pregnancy.

These findings are important, as a recent review by Albarracín et al. (2024) showed that interventions enabling individuals to navigate obstacles may be more effective than those focusing solely on knowledge and beliefs. Therefore, gaining insight into the content of P4HP consultations is valuable. Midwives and dietitians followed a standardised manual to deliver the P4HP consultations, yet tailored their approach to address the specific needs of each pregnant woman. In an unpublished study, we analysed all consultation notes from midwives and dietitians (**Box 10.1**), which provided valuable insights into the interactions during these consultations. In line with the process evaluations (Chapters 4 and 5), it is clear that while the goals and motivations of pregnant women often follow common patterns, they also vary widely. Women across all socio-economic backgrounds experienced barriers to healthy eating and benefited from the nutritional support provided during the P4HP programme. O'Halloran et al. (2025) discuss "the missing middle" – normal-weight pregnant women who often lack nutritional support. Their results reinforce our own, showing that even generally healthy pregnant women can benefit from targeted dietary advice.

Using a framework analysis, consultation notes from four consultations of 169 women who followed the P4HP programme were analysed. The Social Ecological Model provided the theoretical framework for understanding how various factors influence dietary behavior. The primary motivations for healthy eating among participants were the baby's health and maternal health. Common goals included eating more balanced meals, maintaining body weight, increasing intake of vegetables, fish, and calcium, and improving water intake.

Women across all socioeconomic backgrounds experienced several barriers to healthy eating. The most frequently documented barriers were changed eating patterns due to cravings, nausea, and changed appetite; physical health issues including pregnancy-related discomforts; psychological factors such as body image concerns; lack of social support; fatigue; and unwillingness to change habits. For some women, financial constraints limited their access to healthy foods. The key facilitating factors included social support from partners and HCPs, access to structured nutritional information, improved planning and structure, having motivators to stay on track, and viewing personal health as a priority.

BOX 10.1: KEY FINDINGS FROM AN UNPUBLISHED STUDY ANALYSING THE P4HP CONSULTATION NOTES FROM MIDWIVES AND DIETITIANS

At the **interpersonal level**, the results show how empowerment extended into family dynamics, with partners playing crucial roles in supporting or hindering dietary improvements through various forms of support (Chapters 4, 5 and 7). This interpersonal aspect of empowerment demonstrates that dietary change during pregnancy is not an isolated process but is deeply embedded within family systems and relationship dynamics. Empowerment has been identified as a mechanism for enhancing family well-being, which aligns with Zinsser et al.'s (2020) scoping review. This review suggests that empowering pregnant women to improve their diet quality can positively affect their family's health. In a small-scale longitudinal study of 38 women in the United States, Yao et al. (2024) found significant associations between maternal empowerment during pregnancy, the quality of mother-infant relationships, and parental stress. These findings suggest that HCPs should explicitly recognise and address the role of partners in nutrition interventions during pregnancy.

At the **professional level**, the P4HP programme resulted in the organisational empowerment of HCPs by clarifying their roles, boosting their confidence in delivering nutritional guidance, and fostering their collaborative capabilities (Chapter 5) (Zimmerman, 2000). As highlighted in the process evaluation (Chapter 5), midwives gained confidence in discussing nutrition by collaborating with dietitians. This interprofessional collaboration represents an innovative aspect of the programme, combining the midwives' trusted relationship with pregnant women and the dietitians' specialised nutritional expertise to create a complementary care model. The P4HP programme empowered both pregnant women and HCPs, as it enhanced HCPs' competencies while respecting women's autonomy in determining which dietary changes were most relevant to their circumstances. This multi-level manifestation of empowerment aligns with Tengland's (2008) conceptualisation of empowerment as both a process and an outcome, operating simultaneously at different levels. Furthermore, this collaborative relationship between HCPs addresses limitations identified in previous research, where midwives reported insufficient time and specialised knowledge to provide comprehensive nutritional guidance (Beulen et al., 2021; Super et al., 2021).

Pregnancy is a key opportunity to develop or maintain healthy behaviours. Having examined how empowerment operated at multiple levels in the P4HP programme, we can now better understand why pregnancy represents a window of opportunity for nutritional intervention. From a life course perspective, the unique psychological and motivational characteristics of this life stage create a context that enhances receptivity to dietary guidance. For instance, research by Szwajcer et al. (2012) showed that Dutch pregnant women were significantly more aware of their dietary intake than women not trying to conceive. As Marshall et al. (2022) argue, initiating interventions before conception or early in pregnancy can help prevent later health problems for both mothers

and their children. Certain life moments, often triggered by unexpected events, such as illness, can spur motivation to improve health behaviours. However, few life stages present such a clear and promising opportunity for behaviour change as pregnancy. Nowadays, many women contact midwifery practices early in their pregnancy, often shortly after missing a menstrual cycle. This presents a missed opportunity to invest in women's health and support the health of both mother and child.

In conclusion, the P4HP programme effectively improved diet quality among pregnant women, particularly for specific components such as fish, vitamin D, and iodine. While the absolute clinical relevance of these improvements may be debated, their significance can be understood through the lens of the prevention paradox: modest dietary enhancements at the population level can yield substantial long-term health benefits (Duan et al., 2025; Rose, 2001). Even small improvements in nutrient intake during this critical period can have meaningful biological effects on foetal development and maternal health. The P4HP programme demonstrates how empowerment-based approaches to prenatal nutrition can foster meaningful improvements at individual, interpersonal, and professional levels. This underscores the potential of behaviour change programmes incorporating empowerment elements (Zinsser et al., 2020). It also highlights the value of structured yet flexible nutritional support that recognises and engages pregnant and postpartum women as active agents in their own healthcare decisions. Therefore, the results should be interpreted not only as individual-level changes but also as potential contributors to broader population health improvements.

10.2.2 THE EMPOWERMENT APPROACH: THEORETICAL INSIGHTS AND PRACTICAL IMPLICATIONS

In this section, it is examined how empowerment theory contributed to the theoretical understanding and practical implementation of the P4HP programme. First, it contrasts empowerment with traditional education-focused approaches. Next, it explores the tensions between individual empowerment and structural barriers that influence dietary choices during pregnancy. Finally, it evaluates how the P4HP findings align with and extend Super and Wagemakers' (2021) wheel-shaped empowerment framework.

This research contributes to the theoretical understanding of empowerment in the context of pregnancy and nutrition. Although empowerment-based approaches are conceptually promising for promoting health behaviour, there remains little empirical evidence supporting their effectiveness in nutrition promotion (Brandstetter et al., 2015; Zinsser et al., 2020). Our findings help bridge this gap between theory and practice. While the C-RCT showed only modest improvements in quantitative empowerment scores (Chapter 3), the qualitative process evaluation with pregnant women (Chapter 4) revealed more nuanced and meaningful expressions of empowerment.

The P4HP programme adopted a distinct approach to empowerment, setting it apart from conventional educational interventions. While many dietary interventions appropriately use motivational interviewing (MI) techniques and support personal goal-setting, they often originate from a disease-focused framework or specific nutritional concerns that shape the direction of the consultation. In contrast, the P4HP programme placed women at the centre of decision-making, enabling them to determine the focus of each consultation based on their own priorities and motivations for change, rather than adhering to a predefined nutritional agenda. This woman-led approach allowed discussions to be highly individualised, ranging from practical meal planning for one participant, to addressing food safety concerns for another, or managing pregnancy cravings for a third, guided by each woman's self-identified needs rather than a clinical assessment of nutritional deficits.

This shift from provider-driven to woman-driven consultations aligns with the current understanding that effective behaviour change interventions must extend beyond mere information provision. As Albarracín et al. (2024) note, effective interventions enable individuals “to circumvent obstacles to enacting desirable behaviours” rather than only targeting knowledge. The results revealed that this empowerment approach manifested differently across participants. Pregnant women reported distinct empowerment outcomes (Chapter 4): some gained confidence in making dietary choices, others developed skills to resist social pressures around eating, and several improved their ability to adapt dietary goals to pregnancy's evolving demands. This diversity confirms that empowerment operates as an individualised process rather than a standardised outcome, shaped by each woman's unique circumstances, needs, and capabilities. To understand how this individualised approach worked in practice, it is helpful to examine how established empowerment theories guided the P4HP programme.

The P4HP programme's implementation demonstrated how Tengland's (2008) theoretical conceptualisation of empowerment could be operationalised in practice, with HCPs as facilitators rather than directors of change. As Koelen and Lindström (2005) argue, empowerment requires HCPs to move beyond the expert role and facilitate individuals in developing their own solutions – a principle incorporated into the P4HP consultations. Our process evaluation revealed that HCPs did not experience the P4HP programme's empowerment approach as a radical departure from their existing practice (Chapter 5). Rather than adhering to a traditional top-down model, many HCPs have already integrated elements of client-centred, empowering approaches into their routine care. After all, patient participation in healthcare has long been advocated, and the paternalistic view of healthcare has been widely challenged (Bissell et al., 2004; Coulter, 1999; Holmström & Röing, 2010). However, the P4HP programme provided a framework for consistently using empowerment principles, addressing the variability

in how woman-centred care is interpreted and implemented (Fontein-Kuipers et al., 2019). The ease with which professionals adapted to the programme's empowerment framework underscores how closely this approach aligns with current healthcare values.

A tension exists between individual empowerment and structural determinants of health. While the P4HP programme focused on enhancing women's agency, it may inadvertently place too much responsibility on individuals when structural barriers are the primary obstacles. To address this, the P4HP consultations encouraged women to discuss the social, economic, and environmental contexts that influence their dietary choices. This approach aligns with Nieuwenhuijze and Leahy-Warren's (2019) distinction between internal factors (such as self-efficacy and knowledge) and external factors (such as access to resources and supportive environments) in the empowerment process. However, the effectiveness of empowerment approaches is ultimately constrained by these structural barriers. This tension illustrates the socio-ecological model's explanatory power (Bronfenbrenner, 1979; McLeroy et al., 1988). While the P4HP programme addressed intrapersonal factors (knowledge, attitudes, self-efficacy) and interpersonal dynamics (partner support, healthcare relationships), its impact was necessarily limited by broader community, institutional, and public policy factors that shape food environments and healthcare access. As depicted in the socio-ecological model adapted by Beulen et al. (2020) (**Figure 1.3** in Chapter 1), these outer layers – including socioeconomic neighbourhood characteristics, food availability, and healthcare system structures – create the conditions that either facilitate or constrain individual empowerment. This raises important questions about whether true empowerment is achievable for all individuals without addressing systemic inequities in healthcare access and the broader social determinants of health.

Building on this systematic operationalisation of empowerment theory, the P4HP programme's alignment with Super and Wagemakers (2021) wheel-shaped empowerment framework both reinforces the theoretical foundations of our approach and highlights areas for further development. This framework visualises pregnant women's perspectives on food and eating in the inner circle, opportunities for empowerment in the middle circle, and suggestions for HCPs in the outer circle. The P4HP programme expanded the frameworks' application to real-world antenatal settings, with findings strongly supporting its core elements: women's diverse nutritional perspectives (inner circle), opportunities for personalised information-seeking and strategy development (middle circle), and the importance of open dialogue and context-specific support (outer circle).

However, our findings extend beyond the original framework. While Super and Wagemakers' (2021) framework acknowledges the importance of strengthening intersectoral collaboration in its third circle, it primarily conceptualises this as a general

relationship between pregnant women and healthcare providers. In contrast, the P4HP programme underscores that structured interprofessional collaboration between midwives and dietitians should be recognised as a distinct and critical empowerment mechanism. The effectiveness of this collaborative approach suggests that empowerment during pregnancy is significantly enhanced when different HCPs work together, leveraging their complementary expertise.

Therefore, based on our findings regarding the critical role of interprofessional collaboration in facilitating empowerment, we propose extending Super and Wagemakers' (2021) framework by adding a fourth circle dedicated to “strengthening interprofessional collaboration” (**Figure 10.1**). While the original framework effectively captures perspectives, opportunities, and suggestions for support, our



FIGURE 10.1: REVISED VERSION OF THE WHEEL-SHAPED EMPOWERMENT FRAMEWORK BY SUPER AND WAGEMAKERS (2021)

modification emphasises that collaboration between midwives and dietitians deserves specific attention as a distinct dimension of empowerment rather than merely being one suggestion among many. Our extension emphasises the complementary roles of midwives (trusted relationship-builders providing continuity of care with knowledge of pregnancy-specific concerns) and dietitians (offering specialised nutritional expertise, evidence-based knowledge, and practical advice). This addition reflects our key finding that collaborative care between these professions creates a more comprehensive support system than either could provide independently.

In conclusion, our research demonstrates that empowerment in prenatal nutrition requires more than knowledge transfer: it involves supporting women's agency within their social contexts. Healthcare interventions that recognise women as active agents can achieve meaningful health outcomes. By extending the wheel-shaped empowerment framework to include interprofessional collaboration, our findings highlight the value of combining the expertise of midwives and dietitians in fostering better health outcomes.

10.2.3 BUILDING BRIDGES ACROSS STAKEHOLDERS AND PROFESSIONS: PARTICIPATORY DEVELOPMENT AND INTERPROFESSIONAL COLLABORATION

The P4HP programme offers valuable insights into two complementary approaches that enhanced its effectiveness: participatory stakeholder involvement throughout its development and structured interprofessional collaboration during implementation. This section first examines how engaging diverse stakeholders in co-creation is empowerment in itself. It then analyses how the collaboration between midwives and dietitians created a comprehensive support system while identifying key facilitators and barriers to effective implementation.

The development of the P4HP programme embodied the empowerment principles it aimed to promote through a participatory approach (Chapters 2 and 6). This approach extended into the evaluation process, where pregnant women, HCPs, and partners actively participated as co-evaluators through interviews and surveys. In line with previous research (Morton et al., 2017), this thesis found that stakeholder engagement throughout the research cycle was integral to developing an effective public health programme. The programme's participatory development followed a four-phase process: exploratory research, iterative programme development, pilot implementation, and implementation and evaluation. Co-creation emerged as a cornerstone of the P4HP programme, supporting the idea that effective interventions require input from those who will ultimately use or be affected by them (Voorberg et al., 2015). As Lowes et al. (2011) observed in their DEPICTED study, involving both lay and professional stakeholders creates a sense of ownership that facilitates subsequent implementation. While stakeholders were extensively involved in both programme development and evaluation

through interviews and surveys, future research might explore more collaborative evaluation approaches, such as participant-led data interpretation or co-analysis sessions (Cargo & Mercer, 2008; Cousins & Whitmore, 1998). Additionally, a systematic review by Lindacher et al. (2018) emphasised that empowerment interventions benefit from precisely the elements incorporated into the P4HP programme's development and evaluation: a mixed-methods approach, target group participation, and reflective loops within the research team. This demonstrates how co-creation processes can translate theoretical empowerment principles into effective real-world healthcare programmes. Based on these findings, we strongly recommend conducting comprehensive preliminary research before intervention development, actively listening to the target population rather than imposing predetermined solutions, and engaging the target group as an equal partner throughout the development process.

A significant contribution of this research is its demonstration of how structured collaboration between HCPs can enhance antenatal nutritional care. The complementary expertise of midwives and dietitians formed a comprehensive support system that neither profession could provide independently (Chapter 5). This collaboration represents an innovative approach to addressing the nutritional needs of women during pregnancy. Midwives and dietitians brought distinct yet complementary strengths to the P4HP programme. Midwives contributed their trusted relationships with pregnant women, continuity of care throughout pregnancy, and a holistic understanding of pregnancy-related concerns. Dietitians, on the other hand, provided specialised nutritional expertise, personalised dietary guidance, and evidence-based strategies for addressing specific nutritional behaviour changes. Together, these professionals created a more comprehensive approach to antenatal nutritional care than either could deliver independently. As one midwife noted during an evaluation interview (Chapter 5): *"What I enjoyed about this study is that it gave a clearer picture of the value of what women gain from dietitian consultations."* This quote reflects how participation in the P4HP programme helped midwives develop a more nuanced understanding of the dietitian's role in antenatal care.

Mutual professional development was facilitated by the collaborative nature of the P4HP programme. Midwives have long been recognised as an impactful force for public health and as effective contributors to health systems (Europe, 2000). While midwives play an important role in influencing pregnant women's behaviour through their trusted relationships, they are rarely involved in behaviour change programmes (Zinsser et al., 2020). The P4HP programme leveraged midwives' existing approach to care, which emphasised self-efficacy and shared decision-making, which already aligns with principles of empowerment and behaviour change. For dietitians, the collaboration provided valuable insights into midwifery care pathways and the timing of nutrition-

related concerns during pregnancy. This enhanced understanding allowed dietitians to tailor their consultations more effectively, ensuring their advice aligned with women's evolving needs throughout pregnancy.

Several factors emerged as important facilitators of successful collaboration. During evaluation interviews (Chapter 5), midwives and dietitians often naturally used these sessions as opportunities to brainstorm future collaborative initiatives, suggesting that in-person meetings facilitated immediate connection and easier collaboration. However, it is noteworthy that these discussions typically required external facilitation and did not always occur spontaneously. Our findings align with research by van Stenus et al. (2020) on factors influencing the continuity of care, such as the use of protocols, teamwork, mutual trust, and personal connections. The P4HP programme incorporated many of these elements, particularly through its structured protocol for consultations and its support for relationship-building between midwives and dietitians.

Despite promising results, the research also identified several challenges to effective implementation and collaboration: logistical challenges, time constraints, limited nutritional knowledge, and reimbursement issues (Chapter 5). Logistical barriers included scheduling difficulties, particularly in aligning P4HP consultation timing with existing midwifery appointments. Time constraints were frequently cited by midwives as barriers, who struggled to incorporate additional nutrition-focused discussions into already packed consultations. Additionally, our study showed that midwives sometimes experience insufficient nutritional knowledge to provide comprehensive guidance, which limits their confidence in addressing complex dietary questions. Reimbursement issues created another significant obstacle to the broader implementation of the P4HP programme, as the current healthcare system does not routinely cover dietitian consultations during pregnancy without specific medical indications. Similarly, research by O'Halloran et al. (2025), using a systems thinking approach with midwives, confirms the challenges observed in our research. Their study identified limited nutrition knowledge among midwives, time constraints during consultations, and unclear referral pathways to dietitians as key barriers to providing effective nutritional guidance. In addition, these challenges align with findings from van Stenus et al. (2020), which highlighted structural obstacles to integration in antenatal care, such as working across multiple locations and using different documentation systems, which complicate information sharing and continuity of care. In the P4HP programme, similar challenges were observed between midwives and dietitians. Implementation science principles emphasise that overcoming these challenges requires both practice-level adjustments and broader policy reforms to facilitate interprofessional collaboration, as context and systems play a critical role in determining intervention effectiveness (Fixsen et al., 2005).

Together, the participatory development process and interprofessional collaboration offer complementary strategies to enhance healthcare interventions. First, they ensure that interventions are both relevant and feasible by incorporating diverse perspectives during the development phase. Second, they optimise implementation by leveraging the complementary expertise of different professionals.

10.2.4 THE SOCIAL CONTEXT OF DIETARY CHOICES DURING PREGNANCY AND POSTPARTUM

In this section, it is examined how social relationships and cultural contexts influence dietary behaviours during pregnancy and postpartum. First, it analyses the role of partners in (dis)empowering pregnant women's dietary choices. Next, it explores the tension between individual responsibility and social support. Finally, it considers how healthcare systems could better incorporate social support networks into perinatal nutritional care.

The research conducted for this thesis highlighted the significant influence of social context on dietary choices during pregnancy and the postpartum period. Specifically, our findings revealed the multifaceted role that partners play in shaping pregnant women's dietary choices (Chapter 7). However, partner involvement varied considerably, with some partners actively supporting dietary changes while others were minimally engaged or, in some cases, unintentionally hindered dietary improvements. Our research also revealed that the effectiveness of partner support depended on how it was delivered. Women were more receptive to support that was perceived as helpful, involved, and expressed positively rather than judgmentally. This finding aligns with the broader literature on social support effectiveness, which emphasises that the way support is provided significantly influences its reception (Uchino, 2009).

Thus, partners play a crucial role in facilitating dietary changes, with the potential to either empower or disempower women's efforts to improve their diet quality. This pattern reflects growing evidence of the broader impact of partner support during the perinatal period. For example, research by Parker et al. (2025) demonstrated that when fathers take at least two weeks of parental leave after childbirth to provide crucial support, their infants are 31% more likely to be breastfed at eight weeks. These findings highlight the importance of viewing partners not just as supporters but as key contributors to the family's health behaviours and outcomes.

Notably, our research found that despite partners' significant influence on family health behaviours, they were rarely present during nutritional consultations (Chapters 5 and 7). This represents a missed opportunity for HCPs to engage partners as active participants in supporting healthy dietary behaviours during pregnancy and the postpartum period. Recent research affirms this gap between intention and implementation in partner

inclusion. While midwives report a desire to involve fathers in prenatal appointments and identify strategies for doing so, they face significant barriers, including insufficient knowledge, inadequate educational materials, limited training, time constraints, and financial limitations (Aarntzen et al., 2025). Further research reveals a discrepancy between maternity care providers' self-reported positive attitudes and support toward fathers and fathers' actual experiences of support. This suggests that good intentions alone are insufficient to meet fathers' support needs (van de Beek et al., 2025). This evidence underscores the need to move beyond viewing partners solely as sources of support to recognise their shared responsibility in pregnancy and child health outcomes.

Current health messaging about nutrition, alcohol consumption, and other lifestyle factors during pregnancy primarily targets women, despite growing evidence that paternal health behaviours and exposures significantly impact foetal development and child health (Bhadsavle & Golding, 2022; Lismer & Kimmins, 2023). For instance, paternal alcohol consumption affects sperm quality and potentially influences offspring development (Finelli et al., 2022; Roach et al., 2024), but prenatal alcohol messaging rarely addresses men (Smith et al., 2022). This gendered approach places disproportionate responsibility on women and misses opportunities to improve child health outcomes through paternal behavioural changes. Creating effective family-centred antenatal care requires a paradigm shift toward recognising pregnancy and postpartum as a shared responsibility of both parents in creating optimal conditions for child development.

The tension between individual responsibility and social support emerged as a key theme in our findings. Women in our studies generally viewed their dietary intake as primarily their personal responsibility, although some acknowledged that this responsibility was shared with their partners (Chapter 4). While this sense of personal responsibility can be empowering, it can also become burdensome when women lack adequate support systems. This emphasis on individual responsibility is rooted in Western cultural ideals of “the good mother”, which have historically emphasised maternal self-sacrifice and individual accountability for child outcomes (Schmidt et al., 2023). These cultural narratives shape how pregnant and postpartum women approach nutritional behaviours and interact with healthcare systems.

The individualistic approach prevalent in Western societies contrasts sharply with more communal traditions found in many other cultures. For example, “maternal confinement” practices – common across East Asian, Middle Eastern, and Mediterranean societies – provide structured postpartum support systems where extended family members assume responsibility for maternal nutrition and care (Dennis et al., 2007; Ding et al., 2018; Withers et al., 2018). In these traditions, such as the Chinese “zuò yuèzi” (坐月子), pregnancy, birth, and postpartum are viewed as collective experiences that require

community involvement rather than individual management (Chien et al., 2006; Gao et al., 2010). While compulsory confinement practices may not align with contemporary Western values of autonomy, the underlying principle of shared responsibility offers valuable insights for improving maternal support systems.

This cross-cultural comparison demonstrates how industrialised, individualistic societies have fundamentally reshaped the experience of pregnancy and early parenthood. The often-cited African proverb “it takes a village to raise a child” reflects communal wisdom about child-rearing that has existed across cultures. Hrdy’s (2009) research documents this pattern, showing that humans evolved with communal child-rearing systems. This evolutionary history suggests that the isolated nuclear family model common in Western societies represents a significant departure from the supportive family networks that historically facilitated reproduction. The geographical separation from extended family, which is common in modern Western societies, removes natural support systems at a time when they are most needed. Recent data from the ‘Staat van Gezinnen 2025’ study, which surveyed 8,729 Dutch parents, provides compelling evidence of increasing parental stress and inadequate social support (Voor Werkende Ouders, 2025). The study revealed that despite 94% of respondents considering the Netherlands a pleasant country for families, parents report feeling isolated in their parenting responsibilities and unsupported by broader social structures. Notably, participants expressed concern about the absence of community support, what they referred to as the “village” needed to raise children, with many indicating they have retreated into small social bubbles seeking safety and support. This social fragmentation appears particularly pronounced among lower-income families, who consistently scored below average on measures of perceived support and experienced less family-friendliness in their environments (Voor Werkende Ouders, 2025). These findings align with our observations regarding the importance of comprehensive support networks for parents during both the pregnancy and postpartum periods. Research by Bedaso et al. (2021a) underscores this concern, finding that 7.1% of pregnant women report low social support, with risk factors including mental health problems, stress, low socio-economic status, and lack of a partner. These findings highlight how social determinants extending beyond immediate family influence maternal well-being and dietary choices. Bedaso et al. (2021a) emphasise the critical role that broader socio-economic factors play in shaping the support systems available to pregnant women and their ability to make healthy dietary choices during pregnancy.

Importantly, HCPs cannot – and perhaps should not – attempt to fulfil all support roles traditionally provided by social networks. While clinical expertise is essential for addressing specific health concerns, everyday challenges related to nutrition and lifestyle could benefit more from accessible social support. This suggests that meaningful improvements in maternal nutrition may require addressing structural factors that have

eroded traditional support systems. While personal responsibility remains important, recognising the inherently social nature of pregnancy and early parenthood could improve strategies for supporting healthy dietary behaviours during these critical periods.

A comprehensive understanding of maternal nutrition necessitates acknowledging its position within a broader ecological framework of well-being. Nutrition represents only one dimension within a complex system of factors affecting maternal health during pregnancy and postpartum. These interconnected determinants include, for example, quality of social support networks (Bedaso et al., 2021b), sleep patterns (Sedov et al., 2018), cultural engagement (Warran et al., 2023), workplace conditions (Okorn et al., 2025; Pedersen et al., 2021), psychological stress (Bergeron et al., 2024), parental leave policies (Heshmati et al., 2023), physical activity (Gascoigne et al., 2023), and socioeconomic circumstances (Taylor et al., 2021). The findings from Chapters 4 and 7 provide an example of this ecological perspective, demonstrating how stress levels, time constraints, and partner dynamics significantly influenced women's capacity to implement and maintain dietary improvements.

In conclusion, dietary choices during pregnancy and postpartum are deeply influenced by social relationships and cultural contexts. The effectiveness of the P4HP programme could be further enhanced by explicitly engaging partners and social networks in nutritional support.

10.2.5 THE FUTURE OF HEALTH PROMOTION IN AN ERA OF DATA AND PERSONALISATION

The P4HP programme primarily relied on face-to-face interactions between HCPs and pregnant women. However, digital technologies are increasingly transforming the delivery of nutritional guidance during pregnancy. In this section, it is examined how digital technologies are transforming maternal nutrition care, and critical considerations for their implementation are identified. First, it analyses current digital health initiatives in the Netherlands for perinatal care. Next, it explores the ethical tensions in digital health implementation. Finally, it considers how future technologies might be integrated with interpersonal care to create comprehensive, life-course approaches to maternal nutrition.

Digital technologies are increasingly influencing healthcare delivery, including antenatal care, and they offer several advantages (Mohamed et al., 2025; Park et al., 2025). These technologies provide cost-effective solutions that enable broad population reach, enhance accessibility across geographic and socioeconomic barriers, and allow for personalised, on-demand information delivery (Overdijkink et al., 2018; Sherifali et al., 2017). Our research revealed that pregnant and postpartum women frequently use mobile applications and digital resources to access nutritional information (Chapters

4, 8 and 9). The “ZwangerHap” app (Voedingscentrum, n.d.-b) was commonly mentioned by participants, though they noted its limitations, particularly its focus on food safety rather than providing comprehensive nutritional guidance. Similarly, several notable mobile health initiatives have emerged in the Netherlands for preconception and perinatal care. For example, Smarter Pregnancy (“Slimmer Zwanger”), developed by Erasmus MC, provides personalised nutritional guidance for reproductive health during preconception and pregnancy and has shown promising results (Van Dijk et al., 2016; van Dijk et al., 2017). Another digital initiative, Pregnant Faster (“Sneller Zwanger”), also developed by Erasmus MC, focuses on preconception care for women with vulnerable health statuses using behavioural nudging techniques (Smith et al., 2023, 2024). The upcoming PRISTA app aims to provide personalised nutritional guidance for pregnant and postpartum women (*PRISTA App*, n.d.). It is worth noting that funding in this field often prioritises app development, leading to considerable resources being directed to digital solutions. As a result, innovation in health promotion may increasingly lean toward technological approaches, potentially overlooking other forms of support or intervention.

However, the P4HP programme underscores the irreplaceable value of human connection in antenatal care. Technology should serve to complement, not replace, personalised counselling. The value of face-to-face consultations with midwives and dietitians cannot be substituted by digital tools. Therefore, digital resources should be designed to enhance rather than replace these human connections (Mohamed et al., 2025; Willcox et al., 2020). In the P4HP evaluations, women expressed a strong preference for personalised consultations with dietitians, which provided tailored guidance and boosted their confidence in making dietary choices. This personal approach allowed HCPs to better understand women’s specific financial, social, and cultural circumstances in ways that automated systems cannot replicate. Other research confirms that while digital technologies offer convenience, pregnant women still value the “intimacy” and personalised guidance of direct healthcare interactions (Lupton, 2016). Personalised consultations create a level of commitment and connection that digital interactions alone cannot achieve. Setting goals with a midwife or dietitian through direct eye contact and conversation establishes accountability and trust, which fundamentally differs from interacting with digital technology (Ahlers-Schmidt & Hervey, 2023; Fatemi et al., 2023; Tunçalp et al., 2017). Thus, the P4HP research demonstrated the lasting value of interpersonal connections between healthcare providers and pregnant women.

Despite their potential benefits, digital health tools present several risks and ethical challenges. First, while personalised digital tools may improve engagement and accessibility, they risk exacerbating health disparities if they primarily benefit those with digital literacy, financial resources, and technological access. Second, many current

apps target pregnant and postpartum women exclusively, potentially increasing pressure on them to individually manage their health without adequate support systems. This approach may inadvertently reinforce the disproportionate responsibility placed on women for pregnancy outcomes rather than promoting shared responsibility with partners and healthcare systems. Third, the collection and use of personal health data raise significant privacy concerns as health apps gather increasingly sensitive information. Digital health tools that utilise algorithms may perpetuate existing biases in healthcare if they fail to account for factors such as cultural dietary practices or socio-economic circumstances. Finally, as noted by 56% of HCPs in the Vasiloglou et al. (2020) study, apps that focus too heavily on calorie counting and specific nutrients, rather than promoting overall health behaviours, may inadvertently encourage disordered eating patterns.

Looking ahead, digital technologies have the potential to fundamentally reshape maternal nutrition care through integrated, personalised approaches that span the entire life course. Emerging technologies such as wearable devices, artificial intelligence, and predictive analytics could transform nutritional health promotion in pregnancy by providing real-time feedback on dietary choices, tailoring recommendations based on individual profiles, and identifying early warning signs. However, future digital solutions should not focus solely on maternal responsibility, but should also engage partners and support networks, to foster shared responsibility and promote family-based health. While digital tools can provide continuous support beyond periodic clinical visits, the future of health promotion in maternal nutrition lies not in technology alone but in thoughtfully designed systems that combine the benefits of digital personalisation with the essential value of human connection.

In conclusion, the increasing role of digital technologies in maternal nutrition care brings both opportunities and challenges. This research demonstrates that while digital tools offer valuable resources for information and monitoring, they should complement, not replace, the trusted relationships and personalised guidance offered by healthcare providers. Future innovations should aim to integrate technological advances with the proven benefits of human connection, creating hybrid approaches that maintain equity, respect privacy, and promote shared responsibility.

10.3 METHODOLOGICAL REFLECTIONS

This section critically examines the methodological approaches used throughout this dissertation research, considering their generalisation and representativeness, strengths, limitations, and implications for the interpretation of findings.

10.3.1 PARADIGMATIC FRAMEWORK

Upon reflection, critical realism offers a more suitable paradigmatic framework for this research than my initial positioning with the positivist and interpretivist paradigms. Critical realism's three-tiered framework – empirical (what we can directly observe), actual (what happens whether we observe it or not), and real (the deeper structures that cause things to happen) – provides a more fitting approach for this research than the initial division between positivist and interpretivist perspectives (Bhaskar, 2008; Danermark et al., 2019). Critical realism combines the biomedical understanding of nutrition with the social-ecological understanding of dietary behaviour by acknowledging both the objective reality of physiological needs and the socially constructed nature of food choices. This paradigm aligns well with the mixed-methods approach, allowing me to examine whether the P4HP programme improved diet quality (the empirical level) and also to identify the underlying mechanisms through which empowerment facilitated these changes (the real level). In addition, critical realism aligns with empowerment, as both frameworks recognise individuals as agents capable of transformation while acknowledging structural constraints that shape their choices.

In practice, my research already aligned with critical realist principles by examining dietary improvements (empirical level), empowerment processes and interprofessional collaboration (actual level), and the underlying mechanisms of behaviour change (real level). While I believe my initial paradigmatic positioning would have yielded the same research design and methods, critical realism better encapsulates the integrated nature of my investigation. The framework naturally supports research that explores not just whether interventions work, but how, why, and under what conditions they work. This is precisely what this thesis achieved through its comprehensive evaluation of the P4HP programme's effectiveness, mechanisms, and contextual factors. For future research, adopting critical realism from the onset would provide a clearer theoretical foundation for studying empowerment-based interventions, helping other researchers understand that examining multiple facets of a problem simultaneously is not just a random mixing of methods, but a coherent theory-driven approach (Pawson & Tilley, 2010).

10.3.2 METHODOLOGICAL STRENGTHS

A key strength of this dissertation is its comprehensive mixed-methods design, which provides multiple perspectives on the P4HP programme. The quantitative effect evaluation (Chapter 3) established the programme's effectiveness in improving diet quality, while the qualitative process evaluations (Chapters 4 and 5) revealed the nuanced mechanisms and experiences underlying these improvements. This integration of methods was particularly valuable in examining empowerment. Although quantitative measurements showed limited changes in overall empowerment scores, qualitative interviews showed impacts on women's confidence, awareness, and decision-making capabilities.

A second strength of this research is its focus on centring women's experiences. The 'First 1,000 Days' approach has gained significant traction in public health, but some argue that it overlooks women's health. Kinshella et al. (2021, 2025) argue for reframing the discourse on maternal nutrition to address health problems and outcomes specific to women. By examining diet quality improvements not only for foetal outcomes but also for maternal wellbeing, this research acknowledges women as individuals with their own health needs, rather than solely as vessels for foetal development. By prioritising women's needs and experiences, this study promotes ethical practice and has the potential to identify more effective interventions that benefit both mother and child.

A third strength of this dissertation lies in my personal experience of pregnancy and postpartum during the research process, further detailed in **Box 10.2**. This coincidental timing provided me with a unique form of embodied knowledge that enriched the research in several ways. First, it allowed me to develop a deeper understanding of the physical, emotional, and social complexities that pregnant and postpartum women face when making dietary choices. Second, my dual role as both researcher and pregnant/postpartum woman allowed me to establish a stronger connection with study participants. This shared position possibly contributed to more honest and detailed responses during qualitative interviews, as participants may have felt more comfortable discussing challenges with someone they perceived as having relevant lived experience. Third, experiencing pregnancy while studying it provided ongoing opportunities for reflexive practice, which allowed me to repeatedly examine how my personal experiences might influence my interpretation of the qualitative data. Rather than presenting a limitation through potential bias, this simultaneous experience created valuable opportunities for critical self-examination and reflexivity that enhanced qualitative research quality (Finlay, 2002). This experience exemplifies what Haraway (1988) called "situated knowledge": the understanding that all knowledge development is partial and never fully objective. By acknowledging my embodied experience, I embrace the strengths that such positioning can bring to research while maintaining methodological rigor through continuous reflexive practice.

*During the course of this research I experienced pregnancy and postpartum while researching it, which was an immersion that shaped my research journey. I experienced firsthand how overwhelming physically **pregnancy symptoms** can be. Morning sickness wasn't just an inconvenience but altered my relationship with food. Some days, keeping anything down was an achievement. Later on in pregnancy came phases of intense hunger that seemed insatiable. Both experiences gave me a deeper understanding of the challenges that the pregnant study participants faced.*

*What struck me was the weight of **responsibility** I noticed among pregnant women on many aspects, diets included. For some women, every food choice feels heavily consequential for themselves and their baby. I found myself grateful for the empowerment principles at the heart of our research: women should be supported and free to navigate these choices in ways that work for their individual circumstances.*

*My experience with **CenteringPregnancy** was valuable as a source of new social connections with people going through the same transformative life phase. It resulted in new friendships and, because my husband and I attended all consultations together, strengthened our relationship and our bond as parents. This experience highlighted the potential value of integrating nutrition guidance into such group settings.*

*In addition, my diagnosis with **gestational diabetes** was eye-opening. Despite having all the nutritional knowledge from years of research and largely following recommended guidelines already, I still developed this condition. This experience reinforced my belief that knowledge alone isn't the solution. What I needed wasn't more information but compassionate, non-judgmental support from HCPs to navigate this challenge.*

*The **postpartum period** proved to be challenging for maintaining healthy eating habits as well. Despite extensive meal preparation, the demands of breastfeeding coupled with sleep deprivation made healthy nutrition sometimes difficult. When family members brought meals while they were visiting, it demonstrated how a small gesture can offer important support during this time.*

This personal experience deepened my appreciation for the broader context of maternal wellbeing. Nutrition is just one factor among many to profoundly influence a mother's experience; e.g. physical activity, emotional support, workplace accommodations, parental leave policies, financial security, changing facilities in public spaces (why are they rarely in toilets accessible for men?), and comfortable spaces for pumping and breastfeeding (why are these rooms often in the most hidden space of a building?). This experience therefore didn't change my research direction, but rather reinforced my belief that empowering approaches that respect women's autonomy while providing supportive guidance are essential for meaningful, sustainable improvements in maternal nutrition.

BOX 10.2: PERSONAL EXPERIENCES WITH PREGNANCY, POSTPARTUM, AND THE P4HP PROGRAMME

10.3.3 METHODOLOGICAL LIMITATIONS

Despite efforts to include diverse participants, self-selection of participants likely resulted in the inclusion of women and HCPs with a higher-than-average interest in healthy eating, potentially limiting the generalisability of our findings to other populations. Our C-RCT sample had a disproportionately high number of women with relatively high socioeconomic status and education levels, which affects the representativeness of our sample and limits the applicability of our findings to more diverse populations. Additionally, we did not collect data on the history or incidence of gestational diabetes mellitus, which could influence dietary behaviours during pregnancy. However, the likely small numbers in our population would have limited the potential for meaningful analysis. In addition, although the P4HP programme was initially designed with a focus on supporting women from lower socioeconomic status (SES), who typically face more barriers to maintaining a healthy diet during pregnancy, recruiting and retaining pregnant women with lower SES proved to be challenging. While targeting this group could have provided valuable insights, ethical considerations made this approach problematic. This limitation is significant because lower SES populations often experience poorer pregnancy outcomes and might benefit most from empowerment-based nutritional interventions. Furthermore, our recruitment methods and inclusion criteria (requiring Dutch language proficiency and following a traditional Dutch dietary pattern) may have further limited diversity in our sample. Future research could consider using dialogue support tools, as suggested by Bitar et al. (2025), to help overcome language barriers and increase participation from a broader range of socioeconomic groups.

A methodological challenge in evaluating the P4HP programme stems from its intentional design flexibility. By allowing women to set personalised dietary goals based on their individual needs, the programme creates implementation variability, which complicates outcome measurement. While this diversity in intervention targets is essential for the empowerment aspect, it poses challenges in detecting statistically significant effects through traditional quantitative approaches.

Another significant limitation was the high rate of missing data at follow-up (T1). Despite implementing various strategies to maximise retention, including multiple reminders via email and phone, and engagement with midwifery practices to help reconnect with participants, we still experienced considerable loss to follow-up. This pattern may reflect a decline in motivation to participate in research as pregnancy progresses, with women's focus shifting toward preparation for childbirth in the third trimester. To address the missing data, we used the LOCF analysis method, which provided more precise estimates and confirmed the significant improvement in diet quality. This conservative approach assumes that participants' diet quality remained unchanged from baseline if follow-up data were missing.

Several measurement tools presented limitations that may have affected our findings. First, while the DHD-P provided a comprehensive assessment of dietary intake over a month, which can be an advantage for capturing occasional food consumption like fish, completing it may have inadvertently increased participants' awareness of their diet, potentially influencing their behaviour. We deliberately disabled the feedback function that normally accompanies this tool to minimise this effect, but some influence cannot be ruled out. Second, though the validated Pregnancy Related Empowerment Scale (PRES) includes both external and internal attributes of empowerment, it lacks certain dimensions such as control over resources (Leahy-Warren & Nieuwenhuijze, 2023; Nieuwenhuijze & Leahy-Warren, 2019). This may have limited our ability to capture all aspects of empowerment relevant to pregnant women's dietary choices and health outcomes during pregnancy. Third, the three-item Sense of Coherence scale may not have been sufficiently sensitive to detect changes in this complex construct. A more comprehensive SOC measurement might have revealed the impacts of the P4HP programme that remained undetected.

The absence of significant differences between intervention and control groups in our secondary outcomes (QOL, SRH, and SOC) requires methodological reflection. Despite the theoretical connections between empowerment, diet quality, and these health-related measures established in previous literature (Bravo et al., 2015; Koelen & Lindström, 2005; Super et al., 2016), our study failed to detect significant intervention effects. Several methodological explanations may account for this finding. First, the instruments used to assess these constructs may have lacked sufficient sensitivity to detect subtle changes during the relatively short intervention period. Second, these more general health outcomes might require longer follow-up periods to manifest measurable changes. Third, pregnancy itself is a time of great physical and psychological change, which could have produced background 'noise' that masked the effects of the intervention on these secondary outcomes. Finally, it is possible that the P4HP programme was not sufficiently robust to influence these health outcomes.

The COVID-19 pandemic affected the research trajectory, causing adaptations to the original research design. Most notably, we had planned to implement the P4HP programme in both individual and group settings within CenteringPregnancy, but with most groups operating online due to COVID-19 restrictions, we decided to focus solely on individual implementation. This was particularly unfortunate given the substantial benefits group prenatal care can offer through peer support and collective learning. CenteringPregnancy has demonstrated promising outcomes, including less need for obstetric interventions, increased breastfeeding initiation, and higher overall satisfaction with prenatal care compared to individual approaches (Rijnders et al., 2019; Wagijo et al., 2023). In addition, women who participated in CenteringPregnancy are more likely

to continue healthy behaviour from pregnancy to postpartum (Wagijo et al., 2023). How group settings enable unique peer-to-peer learning that HCPs cannot replicate is illustrated by an anecdote shared by a CenteringPregnancy facilitator (collected for Chapter 9). She explained that in one group session, a pregnant woman expressed her struggle with craving energy drinks, particularly missing the sensory experience of opening and smelling the can. Another group member then shared her solution: opening the can for sensory satisfaction but diluting the contents with water to significantly reduce intake from multiple cans to just one throughout the day. While not aligning perfectly with nutritional ideals, this peer-supported harm reduction approach represented meaningful progress and demonstrated how group dynamics can generate practical, relatable solutions that women find more implementable than expert advice alone. The empowering aspects of CenteringPregnancy, which allow women to take measurements and actively participate in their care while building community with peers experiencing similar challenges, would have complemented the P4HP programme's empowerment approach. This missed opportunity reinforces my belief that future iterations of the programme should incorporate group-based implementation to maximise the benefits of both professional guidance and peer support in improving maternal nutritional outcomes.

10.4 RECOMMENDATIONS

This section offers recommendations resulting from the research findings for Dutch antenatal care and policy. These recommendations aim to translate the insights gained from the P4HP programme into actionable strategies for improving maternal nutrition support during pregnancy and the postpartum period.

10.4.1 RECOMMENDATIONS FOR DUTCH ANTENATAL CARE

The findings from this research offer several practical implications for healthcare providers implementing dietary interventions in antenatal care. One key implication is the integration of empowerment approaches when providing nutritional guidance to pregnant women. The P4HP programme demonstrated that empowerment is not just a theoretical concept, but a practical strategy that can be applied in real-world settings. For example, it involves focusing on building women's capacity to make informed choices rather than prescribing strict dietary rules, and recognising women as experts in their own lives and circumstances. Recent empirical research by Woofter et al. (2025) provides quantitative validation of empowerment as a measurable construct in perinatal care. Their study of 265 postpartum participants demonstrated that person-centred care scores were significantly associated with empowerment to advocate with healthcare providers (adjusted OR 1.11, 95% CI 1.06-1.16), supporting the operationalisation of

empowerment in structured interventions like the P4HP programme.

Translating these empowerment principles into routine antenatal care requires consideration of healthcare provider preparedness and support needs. While our process evaluation revealed that most HCPs did not feel the need for formal training to implement the P4HP programme (Chapter 5), some healthcare providers may still benefit from additional training in empowerment-based approaches such as MI techniques. These techniques have been shown to effectively support optimal nutrition and weight gain during pregnancy (Jevitt & Ketchum, 2024). Additionally, HCPs, particularly midwives who may feel less confident discussing diet quality, could benefit from utilising validated tools such as the DHD-P. This provides a systematic, low-effort method for assessing diet quality and offering personalised nutritional guidance based on objective scores. The WE-Study from Leiden University Medical Center currently investigates complementary tools for HCPs that provide structured approaches to facilitate meaningful conversations about healthy living and parenting (*WE-STUDY: Supporting at-risk women before and during pregnancy through an integrated, autonomy- and identity-based approach*, n.d.). These WE-Study tools are being developed in collaboration with HCPs and (expectant) parents, aimed at midwives, youth nurses and paediatricians who work with (expectant) mothers in vulnerable circumstances. Future research will reveal how professionals value these tools and how their implementation is evaluated in practice.

A second implication is the need to enhance interprofessional collaboration between midwives and dietitians. Several strategies could facilitate this collaboration in routine care, such as 1) creating physical proximity between midwives and dietitians (e.g., offering dietitian consultations within midwifery practices), 2) establishing regular opportunities for midwives and dietitians to meet and discuss cases, and 3) implementing shared documentation systems to streamline information exchange. Collaborative approaches use the trusted relationship midwives have with pregnant women while incorporating the specialised nutritional expertise of dietitians. The effectiveness of such collaboration in the P4HP programme suggests that integrated care models could significantly enhance antenatal nutritional support.

A third implication is the need to extend nutritional support from pregnancy into the postpartum period. Developing a continuous care pathway that bridges pregnancy and postpartum nutritional support is essential. Particularly, breastfeeding women expressed a need for structured postpartum nutritional assessment and guidance. Additionally, both parents should be actively engaged in nutritional discussions, recognising the shared responsibility for family dietary patterns. CenteringParenting offers a promising framework for integrating postnatal care, child health services, and parental involvement.

It fosters collaboration between parents and healthcare providers in group settings, supporting the health and well-being of mothers, children, and families (Gresh et al., 2025; Horn et al., 2025). Peer support is promising and may have particular benefits for ethnic minority women, recent migrants, and those facing multiple disadvantages (McLeish & Redshaw, 2017).

10.4.2 RECOMMENDATIONS FOR POLICY

The findings from this research have significant implications for healthcare policy and systems, extending beyond individual clinical practice to broader structural issues affecting maternal nutrition support.

First, a fundamental issue identified in this research is the undervaluation of preventive care despite its long-term benefits (AbdulRaheem, 2023; Gebreslassie et al., 2020), causing a need to reimagine preventive care funding. How we approach maternal and reproductive healthcare reveals and reflects the broader values, priorities, and structural issues of the entire healthcare system. The reluctance to invest in nutrition counselling during pregnancy exemplifies the prevention paradox: society readily pays for treating complications but hesitates to invest in preventing them. The current healthcare system in the Netherlands, as in many countries, functions more as a disease management system than a health promotion system.

This structural bias toward treatment over prevention represents a significant barrier to implementing effective nutritional support during pregnancy. While the Netherlands has made notable strides with initiatives like the National Prevention Agreement in 2018, targeting smoking, obesity, and problematic alcohol consumption, and more recently the Gezond en Actief Leven Akkoord (GALA), which provided additional stimulant for municipal health promotion, current policy developments signal a potential retreat from these preventive approaches (Dierx, 2025). The May 2024 headline agreement (“hoofdlijnenakkoord”) of the governing coalition reveals concerning cutbacks to public health budgets, with reductions of €300 million for public health and an additional 10% reduction to municipal funds that typically support local public health services and health promotion (Dierx, 2025). A particular challenge for preventive interventions lies in demonstrating their value through key performance indicators. While curative interventions can often show immediate effects, the benefits of health promotion and prevention might only become apparent after many years, if they can be definitively attributed at all. This creates a fundamental mismatch with the metrics-driven approach of health insurers, who may see limited direct benefit from investing in prevention for their specific client base (Dierx, 2025). To address this barrier, 1) there needs to be a shift from reactive to proactive funding models that recognise the value of preventive interventions, 2) new payment structures should be developed to incentivise prevention

rather than treatment alone, and 3) value-based care approaches must be implemented that prioritise long-term health outcomes over immediate costs.

Following this, a second implication addresses financial barriers to dietitian access. This research identified the costs of dietitian consultations as a significant barrier. These financial barriers create inequities in access to specialised nutritional care during pregnancy, particularly affecting women with lower SES who may benefit most from such support. Research demonstrates socio-economic gradients in dietary quality during pregnancy (Fowles et al., 2011; Fowles & Fowles, 2008), highlighting how financial resources can significantly constrain or enable healthy eating. The current policy inconsistency, where children under 18 receive coverage for dietitian consultations without applying the deductible, while the same coverage is not extended to unborn children, lacks logical justification and contributes to fragmented care. This aligns with broader critiques of out-of-pocket costs in Dutch maternity care as reported in a RIVM publication (Achterberg et al., 2020). The report identifies how financial barriers create inequitable access and can lead to suboptimal care utilisation, particularly among vulnerable populations. Similar to how out-of-pocket costs for pre- and postnatal care are described as “undesirable, counterproductive, and limiting to freedom of choice and efficient care,” financial barriers to dietitian consultations during pregnancy create unnecessary obstacles to preventive care. Just as the RIVM report notes that out-of-pocket costs for postnatal care “stand in the way of use for those who need it most,” our research shows that these costs for dietitian consultations similarly limit access for those who could benefit most from nutritional guidance (Achterberg et al., 2020). Thus, dietary support during pregnancy and postpartum should be recognised as a form of selective prevention for a high-risk group during a high-risk period, justifying dedicated resource allocation. Therefore, I plead to eliminate out-of-pocket costs for pregnancy and postpartum-related dietitian consultations by including them in the basic insurance package, similar to the approach for other pregnancy-related care. This addresses the bureaucratic barrier related to the unborn child not having a citizen service number, which creates an artificial distinction between prenatal and postnatal care coverage.

The Netherlands has already taken steps toward more integrated care through the “Integrale Geboortezorg” initiative, which aims to provide continuous care from preconception through the first six weeks postpartum. However, the effects have been limited, and maternity care organisations indicate that they lack insight into which effective interventions are available and when they are beneficial in their specific regional context (Struijs et al., 2024). In addition, the need for integrated care approaches is further reinforced by the Kansrijke Start knowledge synthesis, which documents how effective interprofessional collaboration has become a cornerstone of successful implementation (Bastiaansen et al., 2025). The synthesis shows particularly promising results when healthcare initiatives connect with social welfare domains to

address underlying determinants of health, such as financial insecurity. The knowledge synthesis reveals that 87% of Dutch municipalities have now established local Kansrijke Start coalitions and that several municipalities have established successful initiatives linking Kansrijke Start coalitions directly with poverty reduction strategies, creating comprehensive support systems for vulnerable families. This cross-domain integration exemplifies the same principles we observed in our research, suggesting that addressing financial barriers through coordinated policy approaches could significantly enhance access to specialised nutritional care during pregnancy and postpartum. The findings from the P4HP programme could inform the further development of these approaches by demonstrating the value of empowerment-based nutritional support and interprofessional collaboration between midwives and dietitians.

10.5 TAKE-HOME MESSAGE

The first 1,000 days represent a critical window of opportunity for establishing the foundations of lifelong health, with pregnancy offering a unique opportunity for targeted nutritional guidance. This dissertation shows that empowerment-based approaches to maternal nutrition can lead to significant improvements in diet quality when implemented through structured interprofessional collaboration between midwives and dietitians. By bridging professional expertise, addressing social support systems, and extending nutritional care from pregnancy through postpartum, healthcare systems can more effectively support women's dietary well-being during this pivotal life transition. Nutritional support during pregnancy and postpartum benefits both mother and child, underscoring the importance of nutritional health promotion despite existing healthcare barriers. Future maternal nutrition support should balance individualised guidance from HCPs with family-centred support, such as from partners, while preserving the irreplaceable value of human connection as digital technologies evolve.



SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL 1: HANDBOOK FOR THE POWER 4 A HEALTHY PREGNANCY PROGRAMME

IMPLEMENTATION IN THE MIDWIFERY PRACTICE MANUAL FOR MIDWIVES AND DIETITIANS



INTRODUCTION

This document serves as a manual for implementing the Power4HealthyPregnant programme in the midwifery practice. This manual is intended for midwives and dietitians. There are two types of practices in this study: intervention practices and control practices. In this document you will find the most important information for **intervention practices** to implement the programme. There is a separate document for control practices.

The **structure** of this manual is as follows: In Chapter 1 you will find information about the background of the Power 4 a Healthy Pregnancy programme. Chapter 2 outlines the programme. Chapter 3 deals with the recruitment of pregnant women and Chapter 4 with the implementation of the programme. Chapter 5 describes what participation means for midwives and dietitians in terms of time investment, collaboration and administration. Chapter 6 describes the questionnaires completed by participating women. The final chapter 7 elaborates on a case study on the use of the conversation card. The appendix contains the conversation card.

Do you have a question to which you cannot find the answer in this document? Do not hesitate to contact the researchers; we will be happy to help you.



[contact details]

CONTENT

1. Why Power 4 a Healthy Pregnancy?
 2. What does the Power 4 a Healthy Pregnancy programme look like?
 3. Roadmap for the recruitment of participants
 4. Roadmap of the Power 4 a Healthy Pregnancy consultations
 - 1st moment: Early information by the midwife
 - 2nd moment: consult with the dietitian (~12 weeks of pregnancy)
 - 3rd moment: Reflection with the midwife (~22 weeks of pregnancy)
 - 4th moment: Reflection with the midwife (~32 weeks of pregnancy)
 5. What does participation in Power 4 a Healthy Pregnancy mean for midwives and dietitians?
 6. Description of conversation card
 7. Example case study
- References
- Appendix 1: Conversation card

WHY POWER 4 A HEALTHY PREGNANCY?

Nutrition affects maternal and child health across the life course¹. Research shows that healthy nutrition in the first thousand days from conception (until the child's second birthday) is also important for the child's health in (late) adulthood². Pregnancy is a promising time for lifestyle changes because women see the importance of healthy eating for their own health and that of their child³. On the other hand, especially during pregnancy, women experience challenges around nutrition, such as food aversions and nausea⁴.

Power 4 a Healthy Pregnancy is a programme in which midwives and dietitians, and pregnant women work together on healthy eating. Nutrition is discussed in the programme at four points during pregnancy. The goal of the Power 4 a Healthy Pregnancy programme is for pregnant women to improve their nutritional quality during pregnancy through empowerment.

Empowerment is the ability of individuals or groups to enhance capabilities, critically analyse situations and take actions to improve these situations⁵

The relationship of trust between the midwife and the pregnant woman plays an important role here. The programme was developed in co-creation with pregnant women, midwives and dietitians and other stakeholders^{6,7}.

WHAT DOES THE POWER 4 A HEALTHY PREGNANCY PROGRAMME LOOK LIKE?

What does the Power 4 a Healthy Pregnancy programme look like? The study has an intervention group and a control group, as shown schematically in **Figure 1**. This paper is about the relevant papers for the intervention group - the group working with the Power 4 a Healthy Pregnancy programme. This chapter gives a brief overview of the research design and materials you can use. Chapter 4 provides a more detailed description of the interviews.

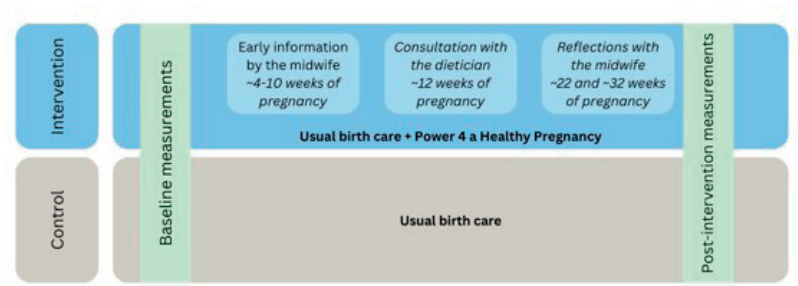


FIGURE 1: STUDY DESIGN OF POWER 4 A HEALTHY PREGNANCY

Baseline measurements (T0)

When a woman decides to participate in Power 4 a Healthy Pregnancy and has signed the informed consent form, she completes some questionnaires on nutritional quality and psychosocial health before the programme. An explanation of these questionnaires can be found in Chapter 6.

During the programme, the pregnant women have a conversation about nutrition with the midwife or the dietitian on four occasions. The first meeting with the midwife takes place in the first trimester of pregnancy. Exactly when that is depends on how your practice works. The conversation lasts 10-15 minutes.

The second conversation about nutrition takes place with the dietitian around the 12th week of pregnancy. As a nutrition expert, the dietitian can go deeper into what the pregnant person is struggling with, such as nausea or fatigue. This conversation takes 30-45 minutes.

Around 22 weeks and 32 weeks, the pregnant woman reflects with the midwife on her nutritional intake over the past weeks. The midwife supports and encourages the pregnant woman to come up with her own solutions and possibilities that suit her and her abilities. This increases a woman’s own effectiveness. These reflection moments last about 10 minutes.

Post-intervention measurements (T1)

At the end of the programme, women again complete the questionnaires on nutrition and psychosocial health. We compare the outcomes with those of the control group. This allows us to see if anything has changed because of the programme.

MATERIALS

In the Power 4 a Healthy Pregnancy programme, you can use the following materials. These materials will be covered and explained throughout this manual.

For the midwife/dietitian:

- Manual for midwives and dietitians (this handbook).
- Flow chart for recruitment and implementation of the intervention (**Figures 2 and 3**)
- The interview card (found in the General Documents folder in your practice's Microsoft Teams environment and also in Appendix 1 of this handbook)
- The registration and peer communication document (found in the participant folders in the Teams environment of your midwifery practice)
- Sample case study for the first interview (Chapter 7)

For the pregnant woman:

The conversation card (Appendix 1)

- After the consultation, you can give the completed discussion card. On it are noted goals, and on the back are tips on where the pregnant person can find more information.
 - o The back of the conversation card refers to the following information:
ZwangerHap: The Nutrition Centre's app on eating safely during pregnancy
 - o Women can find information on healthy eating during pregnancy here: www.voedingscentrum.nl/zwanger
 - o Prefer to watch a video? Here you will find information on healthy and safe eating during pregnancy, breastfeeding and also recipes: www.youtube.com/c/voedingscentrum

ROADMAP FOR THE RECRUITMENT OF PARTICIPANTS

Recruitment of subjects for Power 4 a Healthy Pregnancy is done by midwifery practices. From our conversations with practices, it appears that each practice operates differently. Discuss with your colleagues which method best suits your practice. The flow chart below (**Figure 2**) can help you find the right process for recruitment. Have questions? Let us know, we'd love to think along with you.

WHAT IS IMPORTANT IN THE RECRUITMENT PROCESS?

- The woman should have the opportunity to ask questions about the study
- The woman must have time for reflection to decide whether or not to participate in the study
- The consent form and questionnaires must be able to be completed before the first interview about nutrition

WHAT IS IMPORTANT DURING RECRUITMENT?

- Explain that the practice is participating in scientific research and that this is the intervention group.
- Explain what participation means for the woman.
- Provide the trial information and consent form, or send it digitally.
- Come back to the study at the next contact. Ask if the woman has thought about whether she wants to participate and if she has any questions. Discuss with your colleagues whether to do this face-to-face, by phone or by mail.

- Does the woman decide to participate? Then have her sign the consent form and send it to the researchers. The woman will also receive a copy of this.
- Send the invitation to the woman to complete the questionnaires.

FOR YOUR INFORMATION:

- The questionnaire is sent from “de Eetscore”. The questionnaire is specifically developed for use during pregnancy. Professional guidelines, scientific articles and reports form the basis of the Eetscore questionnaire and advice. More information can be found here: <http://www.eetscore.nl/>
- De Eetscore is also the sender of the e-mail that the women receive. You can prepare the participating woman for this.
- The mail the participating women receive contains both an invitation to the first part of the questionnaire (de Eetscore), and the second (questionnaire on empowerment, health and personal data). A link to an online questionnaire will take the women to the second part. Please communicate to participating women that they should complete both questionnaires.

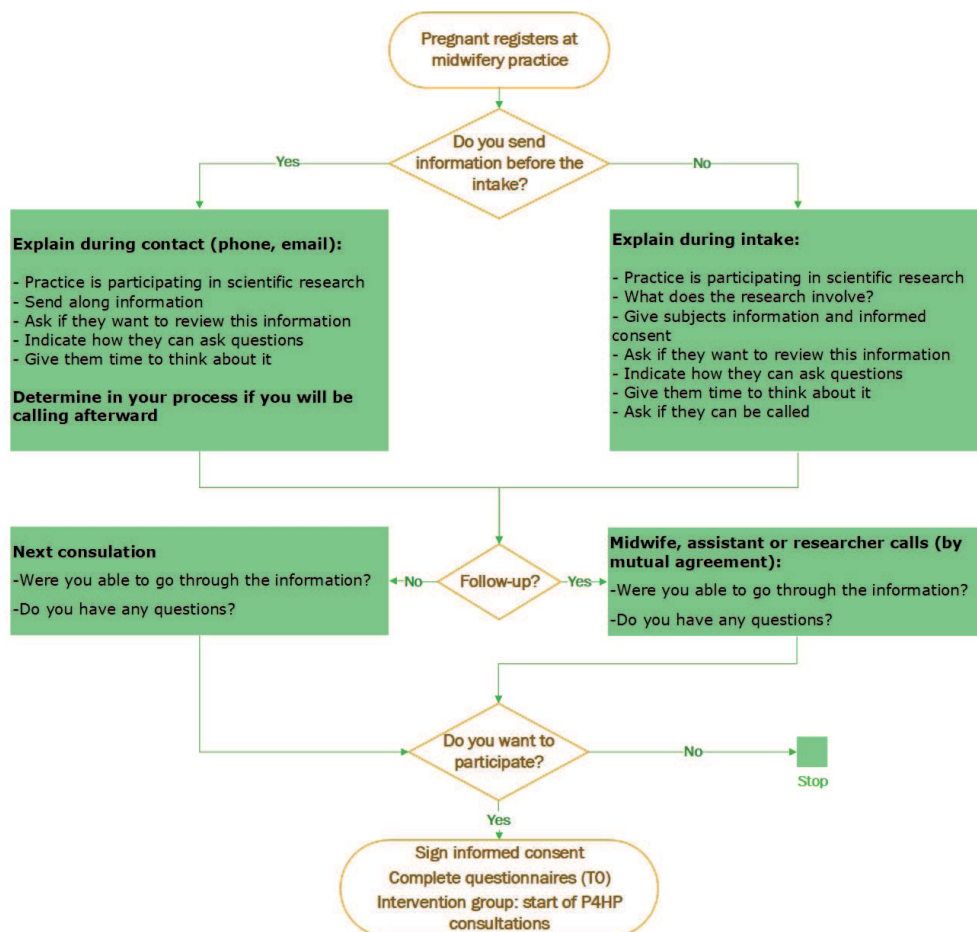


FIGURE 2: ROADMAP FOR RECRUITMENT OF PARTICIPANTS

ROADMAP OF THE POWER 4 A HEALTHY PREGNANCY CONSULTATIONS

Has the woman signed the informed consent form, has this form been uploaded into Teams and have the questionnaires been completed? Then you can start implementing Power 4 a Healthy Pregnancy. Below you will find the steps of the programme incorporated into a flowchart (**Figure 3**).

You can go through the first 5 stages in early education by the midwife (1st moment) and the consultation with the dietitian (2nd moment). The contact moments are detailed below.

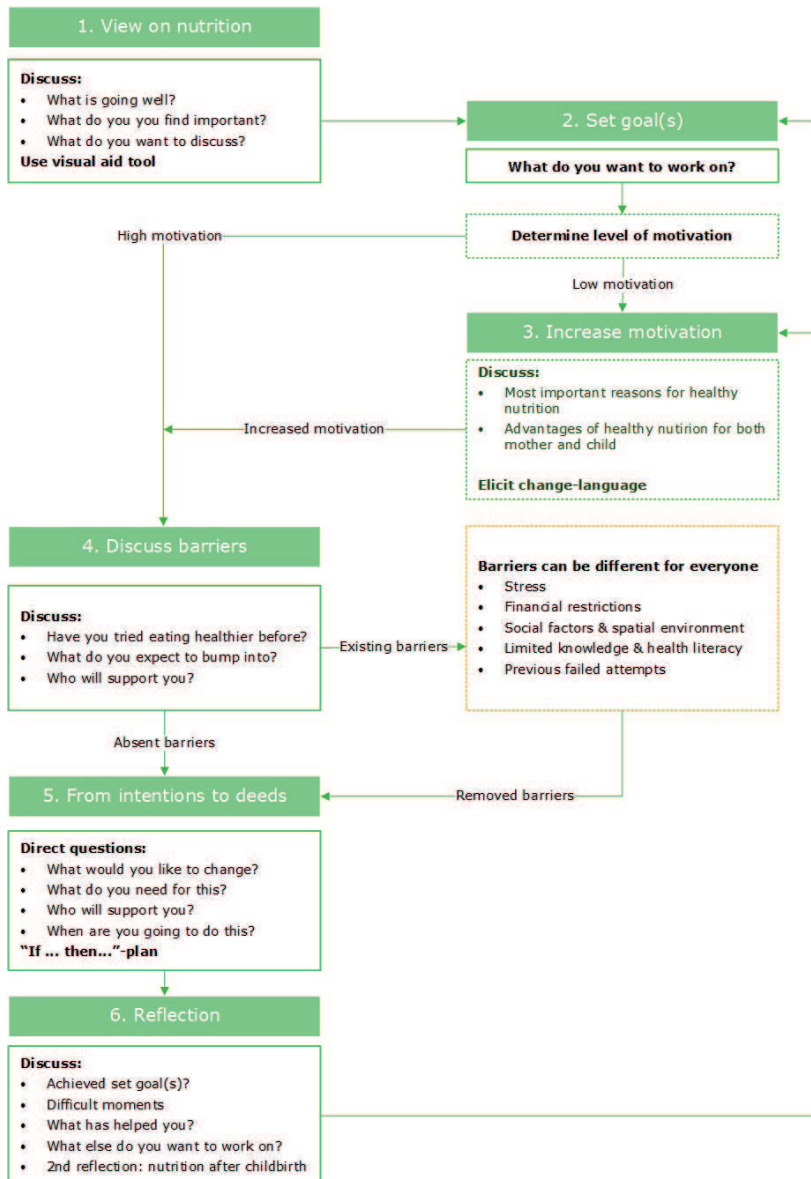


FIGURE 3: FLOWCHART POWER 4 A HEALTHY PREGNANCY CONSULTATIONS

1ST MOMENT: EARLY INFORMATION BY THE MIDWIFE VIEW ON NUTRITION

Summary

Content: Provides information about the woman's motivation

Purpose: To estimate the woman's motivation

When: Early information

Discuss what the pregnant person herself thinks is going well regarding nutrition, what is important to her and what she would like to discuss. In the research setting, you can ask the woman why she would like to participate in the study, or refer to the questionnaire about nutrition she filled out. Again, you can get information about her motivation from this. Sample questions are:

"Can you tell me why you would like to participate in the study?"

"You have already thought about your nutrition in the past when filling out the questionnaire. Would you tell me what you think is going well in your nutrition?"

"I am curious about what you think is important about eating during pregnancy. Could you tell me something about this?"

Important side note for the first consultation:

We understand that time for this first consultation is scarce. With some women, the steps are quicker to complete than others. We rely on your skills to sense what needs to be talked about and do what is possible within the time.

By doing this, you encourage the woman to look at her nutrition positively. Give compliments and affirm her in her abilities to provide a healthy diet. Then you can use the conversation card (**Appendix 1**) to let the woman decide what to continue the conversation about. You could use it in the following way:

"During pregnancy, a varied and healthy diet is important, and some topics require special attention. On this card, you will see different topics. Would you like to take a look at these and check off what you would like to talk about? You may check off multiple topics."

Checking topics works to increase commitment. Many pregnant women will check "What's better not to eat". It makes sense that there will be questions about this. Motivate them to check multiple topics. This helps you find out what the woman is interested in and allows you to gauge her motivation. Ask why she checked certain topics. By asking what she wants to talk about first, you leave control of the conversation with the woman:

"I see you checked 'vegetables,' 'snacks/ready-to-eat,' and 'what's better not to eat.' What makes you choose these topics?"

"What do you want to talk about first?"

From here, you can see where she is open to change.

SET GOAL(S)

Summary

Content: Discuss what the woman wants and can change

Purpose: Agree on a concrete and achievable goal

When: Early information and consultation with a dietitian

You can briefly summarise what the woman told you in step 1. Make the connection between what she thinks is important and what she wanted to talk about. You could do this in the following way:

"You indicate that healthy eating is important to you because you want to take good care of the baby. Good that you realise that healthy food is good for your child's development and also contributes to an enjoyable pregnancy. We have now talked about snacks and ready-to-eat, about vegetables and what you really should not eat during pregnancy. The latter goes very well with you. You say that you eat too few vegetables and too much ready-made food. What would you most like to change in the coming weeks?"

Let the woman herself write down on the conversation card what is going well and what she would like to change; this increases commitment. Do you feel that noting yourself is not successful? You can also ask if the woman wants to write it down herself or if she would rather you do it for her.

INCREASE MOTIVATION

Summary

What tools do you have for this conversation?

- Visual conversation card (**Appendix 1**)

- Flow chart (**Figure 3**)

- Registration and peer communication document

- Sample case study (Chapter 7)

Content: Increase motivation if needed

Purpose: To help the woman understand her reasons for eating healthier

When: Early information and consultation with a dietitian

Make an assessment based on the conversation so far of how motivated the woman is. If the woman is highly motivated, you can skip step 3 (increase motivation). Then confirm the woman in her motivation and proceed to step 4 (discuss barriers). If the motivation is low, try to increase it.

You can use the scale question about motivation:

"If I ask you how motivated you are to eat healthier, where do you rank on a scale of 0-10?"

Then you can ask the follow-up question:

"What makes it a 4 and not a 0?"

"What do you need to make a 4 a 6?"

Chances are slim that the women participating in the study are not at all motivated to eat healthier. Still, a woman may not yet be completely clear on why she should eat healthier. Discuss motivational information to stimulate the thought process. You can ask what the woman already knows about healthy eating during pregnancy and then ask for permission to provide additional information.

“May I explain a little more about this?”

“Do you mind if I tell you a little more about it?”

In education, connect to what the woman has previously indicated is important. You can emphasise the direct benefits of healthy eating for mother and child⁸:

- Beneficial to the baby’s physical and cognitive development
- Less chance of preterm birth
- Beneficial for preventing complications during pregnancy, such as gestational diabetes, pre-eclampsia or high blood pressure
- Healthy weight gain
- More energy, which is beneficial during childbirth

You might ask the following questions after this:

“Hearing this like this, what do you think?”

“What would be the most important reason for you to eat healthier?”

Next, pay attention to recognising change language. Did you succeed in increasing motivation? Then move on to step 4 (discuss barriers).

Change language

*To increase motivation, you can apply techniques from **Motivational Interviewing**. Provoking change language is one of these techniques. Change language indicates that someone is making a move toward change. If you know how to recognise change language, you can add a twist to the conversation. Examples of change language include:*

- Disadvantages of current situation:

“I’ve been craving chocolate so much lately, but I’ve already gained 5 pounds.”

- Benefits of change:

“I have heard once that healthy eating is important for the baby.”

- Intention to change:

“I should/would like to watch my diet more, but...”

- Ambivalence:

“On the one hand..., but on the other hand...”

- Optimism about change:

“Now that I am pregnant I do think I will manage to drink less energy drinks.”
The scale question of importance can help elicit change language: “Looking at eating

more vegetables, how important is that to you on a scale of 0-10?"
Then you can ask: "Why is it a 4 and not a 0?" or "What do you need to turn a 4 into a 6?"

If this step is the maximum feasible for this conversation, you can move to the next step of the programme, the consultation with the dietitian. Hand out the conversation card and point the woman to the tips for more information on the back.

In this manual in the example sentences "eat healthier" is used as the goal. In practice, you can use what the woman wants to change instead.

DISCUSS BARRIERS

Summary

Content: Discussing problems the woman anticipates if she wants to eat healthier and mobilising support from her immediate environment

Purpose: Increasing women's confidence that they can overcome these problems

When: Early information and consultation with a dietitian

All change is difficult. If the woman prepares herself for the challenges she will encounter, it will be easier to sustain the change. Therefore, pay attention to barriers, for example, with the following questions:

"Does it seem difficult to you to start eating healthier?"

"Have you ever tried to eat healthier before?"

"Suppose you decided to start eating healthier, what do you expect to encounter?"

You can use the scale question about confidence to increase self-efficacy:

"Suppose you decide to start eating healthier, how much confidence do you have on a scale of 0-10 that you will succeed?"

Then ask through to increase confidence and remove barriers:

"What makes it a 4 and not a 0?"

"What do you need to turn a 4 into a 6?"

Information obtained in the earlier course of the general intake interview may also be relevant in the context of nutrition. Possible barriers to healthy eating include:

- Physical and mental complaints
- A lot of stress
- Domestic violence
- Financial constraints
- Social and spatial environment
- Knowledge and health skills

Help the woman remove barriers and mobilise support from her immediate environment:

“How can you reward yourself?”

“What do you need to start eating healthier?”

“Who will support you to start eating healthier (and who won’t)?”

FROM INTENTIONS TO ACTIONS

Summary

Content: Formulate a concrete goal

Goal: Putting intentions into action

When: Early information and consultation with a dietitian

Tip:

*Midwives and dietitians can take the free e-learning **Goedkoop Gezonde Voeding** [Cheap healthy eating] (10 credits). This way you can guide women with limited financial options to eat healthy even better.*

Contact the researchers to make use of this possibility.

End boxOnce motivation and barriers are above water, it is important to translate good intentions to eat healthier into action. Support the woman to make an achievable goal as concrete as possible within her capabilities by asking pointedly:

“What exactly are you going to do?”

“How will you organise it to start eating healthier?”

“When are you going to do this?”

An “If ... then ...” plan can help a good intention succeed. For example:

“If I get hungry while watching TV, then I’ll have a piece of fruit.”

Have the woman write down the goal and the “If... then...” plan on the conversation card.

Sometimes the situation is so complex that it is difficult to work on healthy eating. In that case, leave it at that and make a note in the file. You can then return to it at a later time.

Based on this conversation, book a consultation with the dietitian. Make sure that the dietitian has the results of the questionnaire and a short report available to properly follow up. At least note in your record what was discussed:

- What is going well
- What does the woman want to change
- Possible barriers
- What goal/“if... then...” plan has the woman formulated
- Details of the conversation

2ND MOMENT: CONSULTATION WITH THE DIETITIAN (~12 WEEKS OF PREGNANCY)

In this conversation, you will have 30-45 minutes to go deeper into goals, motivation and barriers. You will have the midwife's report from the first meeting and the results available to you. This eliminates the need for you to do an extensive nutritional history. This conversation begins with step 6, a brief reflection.

What resources do you have for this conversation?

- *The record of the first conversation with the midwife*
- *Registration and peer communication document*
- *Visual conversation card (Appendix 1)*
- *Flow chart (Figure 3)*
- *Sample case study (Chapter 7)*

REFLECTION

Summary

Content: Guidance for women in reflection

Purpose: Increase own effectiveness. Women are more likely to achieve long-term goals if they realise the effects of their own actions on outcomes.

When: Consultation with dietitian, reflection moment 1 (22 weeks) and reflection moment 2 (32 weeks)

Come back to the goal from early information with the midwife and inquire about progress. The goal is for the woman to gain insight into supporting and impeding factors and to find ways to deal with difficult situations. This will increase her own effectiveness.

Changes may occur during the course of the pregnancy, for example, with regard to physical symptoms. Therefore, check to see if anything has changed since the last consultation that has created new challenges.

Were you successful in achieving this goal?

Give compliments for this success and use this to review with the woman where there are further opportunities for a healthier diet. For this, you can follow the structure with steps 2 through 5 (set goal, increase motivation, discuss barriers, move from intentions to actions).

Did it not work out?

Ask what the woman ran into (barriers). Find out if the woman is motivated to work on the chosen goal. Is motivation still high? Then, from step 4 (discuss barriers), you can see what is needed to still make the goal achievable. Is motivation low? See if you can increase motivation (step 3) or if you should start at step 2 (goal) to see what the woman wants to change. Go through the step-by-step plan to step 5, turning intentions into actions, and conclude with concrete agreements.

Link back to the midwife what was discussed. You can also use the intervention card for this. Note at least the following in your record what was discussed:

- Achieved/not achieved goals
- Challenges discussed
- New goals and agreements
- Possible barriers
- What goal/"if... Then..." plan did the woman formulate
- Details of the conversation

3RD MOMENT: REFLECTION WITH THE MIDWIFE (~22 WEEKS OF PREGNANCY)

Revisit the conversation with the dietitian. Assist the woman through targeted questions in her reflection (step 6). Were the goals met? If yes, what and who helped achieve them? What more can and would the woman like to accomplish (steps 2 through 5)?

What tools do you have for this conversation?

- *The records of the early education and consultation with the dietitian*
- *Registration and peer communication document*
- *Visual conversation card (Appendix 1)*
- *Flow chart (Figure 3)*
- *Sample case study (Chapter 7)*

If no, what made it difficult? How can the woman handle certain situations differently in the future to still achieve her goals? Who and what does she need to do so (steps 3 through 5)?

Note in your record what/or discussed:

- Achieved/not achieved goals
- Discussed challenges and barriers
- New goals and agreements
- Possible barriers
- What goal/"if... Then..." plan did the woman formulate
- Details of the conversation

4TH MOMENT: REFLECTION WITH THE MIDWIFE (~32 WEEKS OF PREGNANCY)

The 4th conversation has the same reflective nature as the 3rd conversation. Revisit the previous reflective conversation. The woman is now already in the third trimester of her pregnancy, so other situations may arise that interfere with healthy eating. Are there new things the woman is encountering? What options does the woman have in these situations?

In this conversation, you can address nutrition after childbirth.

After the 4th conversation, the woman will receive another invitation to complete the questionnaires

(T1). Remind her of this in the consultation.

Note in your record what/or discussed:

- Achieved/not achieved goals
- Discussed challenges and barriers
- New goals and agreements
- Possible barriers
- What goal/"if... Then..." plan did the woman formulate
- Details of the conversation

WHAT DOES PARTICIPATION IN POWER 4 A HEALTHY PREGNANCY MEAN FOR MIDWIVES AND DIETITIANS?

Participation in the study requires a time investment by the midwifery practice and the dietitian. In the intervention group, we assume about 1.5 hours per pregnant woman for the midwife and about 1 hour for the dietitian. This time is for the recruitment of participants, the interviews and administration (**Table 1**). What we expect from you each time is detailed below.

TABLE 1: EXPECTED TIME INVESTMENT OF THE POWER 4 A HEALTHY PREGNANCY PROGRAM

Action	Time
Recruitment of participants	15 min
1st moment: consultation with midwife (~8-10 weeks)	15 min
2nd moment: consultation with dietitian (~12 weeks)	30-45 min
3rd moment: consultation with midwife (~22 weeks)	10 min
4th moment: consultation with midwife (~32 weeks)	10 min
Administration	20 min

Collaboration

In the Power 4 a Healthy Pregnancy programme, the collaboration of the different midwives in a practice and the dietitian plays an important role. It is important to discuss the implementation of the programme and ensure proper registration and transfer. The intervention chart can serve as a communication tool between the different healthcare providers. You can find it digitally in your practice's Teams environment. Discuss what would be the best means of communication between the different midwives in your practice. Also discuss this with the dietitian you work with.

Administration

We are working with Microsoft Teams in this study to exchange information and communicate with each other. This is secure and low-threshold. Your practice has a private channel in the Power 4 a Healthy Pregnancy team, to which only the researchers and your own practice have access. In this environment, each participant has her own folder for her documents.

If a woman decides to participate in the study, have her sign the consent form:

- Scan the signed consent form and save it in the participant folder in the Teams environment.
- Once the consent form is uploaded, the researchers can send the questionnaires to the participants.

Inform us by a short post on the private channel that you have included a new participant. For example, "Participant 1401 included on 2-12-2021, first interview scheduled on 15-12-2021."

Important: Participants must complete the questionnaires before the first interview. Therefore, it is important that the researchers know when the interview is scheduled. This way, we can remind the participant to fill it out, should the need arise. After each conversation, complete the intervention card in the Teams environment. You will find this in each participant's folder. We may ask you to do a final interview with us to evaluate the Power 4 a Healthy Pregnancy programme. This is completely voluntary.

DESCRIPTION OF CONVERSATION CARD

In chapter 7, you will find an example case in which you can see how you can provide early information (1st moment) about nutrition and how you can use the conversation card (**Appendix 1**). On the conversation card, you will find images of different food groups that are important during pregnancy. The choice of these food groups is based on the advice of the Health Council for nutrition during pregnancy². Show the conversation card to the woman during the first conversation and have her tick several topics she would like to talk about. During the conversation, you find out what the woman thinks is going well about her diet, what she would like to change and what goal she wants to set for herself for the coming weeks. Checking topics by the woman and writing down goals increases the woman's commitment.

Motivational interviewing

You can use the techniques of motivational interviewing in your conversation. Motivational interviewing is generally well developed among midwives and dietitians. As a reminder, below you will find some general tips and sample questions for all conversations in this intervention.

Tips

- Ask permission to talk about nutrition
- Question thoughts and ambivalence carefully
- Let your conversation partner do a lot of talking, especially at the beginning of the process
- Do not contradict your conversation partner, and avoid discussions
- Ask why someone wants to change their behaviour
- Ask what motivates someone to change their behaviour
- Pay close attention to change language
- Only provide information that your conversation partner is ready for and that is relevant at the moment

Sample questions for increasing motivation

- What would you like to see differently about your food?
- How important is that change to you?
- What makes you think this is important?
- And what else?
- If you were to eat more/less..., what would it benefit you? What solutions have you already come up with for this? What else could you think of?
- Who benefits if you eat ...? (Win-win situation, not only the woman herself but also someone else benefits from it, in this case, the baby)

If the woman herself cannot think of anything:

I do have some suggestions. Do you want to hear it?/Can I share it with you?

EXAMPLE CASE STUDY

Martine, 32 years old, married to Bart, and 7 weeks pregnant with her first child. Martine works full-time as a hairdresser in her own salon. Bart is a truck driver, which means he is often away from home for several days at a time. Martine has been overweight for years (BMI 27), and she has been unable to lose weight. **How can you start the conversation with Martine about healthy eating during pregnancy?** Martine has indicated she would like to participate in the study. In that sense, you already have permission to talk to her about nutrition. However, things may have changed in the meantime, and it is a good idea to ask for permission.

Midwife: Martine, how nice that you completed the questionnaires for the survey on empowerment and nutrition. Do you have any questions about that?

Martine: No, I think it all worked out.

Midwife: Good to hear, and nice that you are participating in the study. As you already know, we are going to talk about nutrition several times. In the first conversation, I would like to look with you at what you think is important, what you think is going well and what you would like to change. Do you mind if we do that now?

Martine: Yes, that's fine, that's what I signed up for anyway.

Now you have outlined the framework for this conversation and have Martine's permission, which makes her open to talking about nutrition. Next, you start with **step 1** of the step-by-step plan, asking how Martine views nutrition during pregnancy.

Midwife: First of all, I am curious as to why you would like to participate in this study. Can you tell me a little bit about that?

Martine: I've been trying to lose weight for a while anyway, and I'm not doing very well. I think it's also important for the baby that I eat healthy, and I hope I'll do better if we talk about that more often.

Midwife: You are right, it is indeed very important for you and your baby to eat healthy during pregnancy. Healthy eating can contribute to a happier pregnancy and delivery for yourself, and also to a healthy start for

your baby. You are laying the foundation for your baby's health with this, which starts in the womb. What are some other things you consider important about food?

With this, you already have some information about Martine's motivation to eat healthier; she wants to eat healthier for the baby. Reinforce her in this motivation and then ask further what else she considers important about eating.

Martine: It should be tasty, and it shouldn't take too much time. I am often busy with my work, and then it should not take me too much time.

Midwife: All very understandable. So very briefly, you are concerned about the health of your baby; it should be tasty and fast. Is this everything you want to discuss, or are there other things you find very important?

Martine: This is true, this is the most important thing, though.

You have let Martine tell you what she feels is important and summarised it. By asking if she wants to discuss anything else, you allow her to add to it, and she feels heard and understood. It is good to have Martine now mention what she is happy with.

Midwife: You have already thought about your nutrition in the past by filling out the questionnaire. Can you tell me what you yourself think is going well in your nutrition?

Martine: Well, I read once that breakfast is very important, and I do that every day. A bowl of cruesli with yoghurt and fresh fruit. I feel comfortable with that, because I have to walk around the salon all morning and I stand a lot. I used to often skip breakfast, but then I got hungry much faster in the morning and started snacking a lot. I don't do that anymore.

You may feel the reflex here to point out that cruesli is not that healthy. Resist that tendency. Martine has improved her previous eating habits and is happy about it. Compliment her on this and let her tell you more.

Midwife: Very good to hear, Great that you picked up this much. What else is going well?

Martine: My lunch usually goes well, too. I always eat brown bread. Sometimes I skip lunch when the salon is very busy, but then I eat quickly in between. I also eat a lot of fruit. I like that. And I don't drink alcohol, of course, I shouldn't during pregnancy, but normally I don't drink that much.

Midwife: So breakfast, lunch, fruit, no alcohol, those are quite a few things that are going well! Good to hear, you can be proud of that. When you're pregnant for the first time, new questions about food often come up. You mentioned that you think it's important to eat healthy for your baby, and I can imagine that it's not always clear what that means during pregnancy. I have a chart here with pictures of food groups. I would like to ask you to look at these and check off what you would like to talk about. You can tick more than one.

Martine ticks "Vegetables," "Snacks/ready-to-eat," and "What's better not to eat." By letting her choose topics herself and actively tick them, you increase her **commitment** to these topics.

Midwife: Ok, you want to talk about “Vegetables”, “Snacks ready-to-eat” and “What’s better not to eat”. Can you tell me a little more about these? What made you choose these groups?

Martine: Well, “vegetables” because I do know that you should eat a lot of those, but I find that difficult. “Snacks, ready-made” because I do find that tasty and easy, but I know it’s not so healthy. And “what better not to eat” because I don’t know that very well, but that is important for the baby.

Martine here names **motives** to talk about this, and she also names a **barrier**. Ask what she wants to talk about first and come back to the barrier later (in this case, she finds eating vegetables difficult).

Midwife: Do you have a preference as to which one you want to talk about first?

Martine: What I better not eat I think is most important. I have heard something about that from my girlfriends, but everyone says something different, too.

Now you can give **targeted information** about what she had better not eat during pregnancy. Martine also points out that everyone says something different. Recently, the dietary recommendations for pregnant women were published by the Health Council² which has created clarity in this area. The nutrition centre has translated these recommendations into practice. In that area, refer to the website of the **Nutrition Centre**. Good to also **refer to ZwangerHap**, the Nutrition Centre’s app on safe eating time pregnancy. Here, reliable information about food safety during pregnancy is presented very clearly and conveniently.

Once you have talked about this and checked that it is clear, you can move on to the other topics. You can make the transition by telling them that it is important for the baby’s development not only to avoid the products you cannot eat, but also to eat healthy.

Midwife: You still wanted to talk about vegetables. You mentioned that you find it difficult to eat vegetables. What makes you find that difficult?

Martine: I just don’t like vegetables very much, and it’s such a hassle to cut and prepare them. I usually eat alone in the evening because my husband is often away, and I find that too much work. Before my pregnancy, I used to eat those snack tomatoes sometimes, but since I am pregnant, I find them so disgusting, I don’t want to think about eating a tomato.

Midwife: That’s understandable, your tastes can change during pregnancy. Most of the time, fortunately, this is temporary. Eating enough vegetables is important for the baby’s development, though. So, can you tell me what vegetables you eat in a day now?

Martine: Well, not so much so. Yesterday evening I ate a pizza with vegetables, and it had bell pepper on it. The day before, I had gotten a sandwich in town for lunch, which also had vegetables on it, but I took out the tomato, and later I had some mini spring rolls, I think there were vegetables in those. But really, it’s not much, I know. I just don’t like to cook that much.

Midwife: Is that why you checked “snacks and ready-to-eat”?

Martine: Yes. When I come home in the evening after work, I’m just tired. I have been standing the whole time,

and I prefer to sit on the couch and not be in the kitchen. I'm also often the last one to close the salon, then I'm home quite late. When my husband is home, it's easier; he cooks. Wonderful if the food is ready when I come home.

Here you can magnify **ambivalence** by summarising for yourself what Martine says with "On one side..., on the other side...". There are already motivation-enhancing aspects in this.

Midwife: Yes, I can imagine. So, on the one hand, you do like having something easy to eat quickly; on the other hand, you indicated at the very beginning that you do know that ready-made things and snacks are not so healthy.

Martine: Yes, that's right. I don't feel good about that either, and I'm already pretty heavy, but at that point, I just don't know how else to do it. But I am quite afraid that I am going to gain a lot of weight because of pregnancy.

Midwife: Why are you afraid of that?

Martine: Well, it has to come off eventually, and with my mother, it never did. I just don't want to get any fatter.

At this stage of the conversation, a lot of information and some barriers come up. Briefly summarise and ask her what she would most like to change (**step 2**).

Midwife: On the one hand, you would like to avoid gaining a lot of weight and want to eat healthy food for the baby. It is good that you are aware that you can influence this yourself. Eating less ready-to-eat food can help limit weight gain. On the other hand, I understand that you find it difficult if your tastes have changed and that you find it a lot of work to cook if you eat alone. We have now talked about ready-to-eat, vegetables and what you really should not eat during pregnancy. The latter goes very well, which is nice. You say you eat too few vegetables and too much ready-to-eat food. What would you most like to change in the coming weeks?

Martine: I don't like eating so few vegetables. I would like to change that.

So Martine wants to eat more vegetables, but has previously indicated that she finds this difficult and also does not like it very much. On top of that, due to pregnancy, she no longer likes the cherry tomatoes she used to eat. Time to increase her motivation in **step 3**!

Midwife: If I ask you how motivated you are to eat more vegetables, where do you rank on a scale of 0-10?

Martine: I think a 5.

Midwife: What makes it a 5 and not a 2?

Martine: I think eating vegetables is always good, but for the baby, I'm sure it's even more important. And it also doesn't make you fat. I think that has only advantages.

You can now affirm Martine in her motivation to eat more vegetables and provide more targeted information about them. Vegetables contribute to feeling full without containing many calories. It

contains many nutrients, such as vitamin C, vitamin A, folic acid, potassium, iron and calcium. Thus, eating vegetables helps reduce the risk of preterm birth, gestational hypertension and pre-eclampsia⁸.

Midwife: Hearing this like this, what do you think?

Martine: I really should eat more vegetables, I didn't know at all that it's so important. I want it too, but I find it hard right now.

Martine speaks in change language while erecting a barrier. This is a great time to move on to **step 4**.

Midwife: Now, suppose you decide to eat more vegetables. What do you expect to run into then?

Martine: I think it's a combination of the fact that I don't like to cook and that I don't like a lot of vegetables. I used to eat those cherry tomatoes, but I don't have to think about that now. That makes it difficult for me.

Midwife: The cherry tomatoes you came up with are a smart solution for when you don't like to cook, though, you thought of that well. Can you think of another vegetable that you do like and is easy to eat?

Martine: I did see candy cucumbers and candy peppers the other day. I don't like those, but I don't hate them either. I could eat those sometime. That would be convenient, and I could also take those to work.

Midwife: Good idea! If you envision this, how confident are you that it will work out on a scale of 0-10?

Martine: Well, a 6. I think this should do.

Midwife: Good to hear. And what do you need to turn a 6 into an 8?

Martine: If I don't have it in the house, it can be tricky, then of course I can't eat it. I just have to make sure I always have snack vegetables in the house.

Once you've discussed what might be preventing Martine from eating more snack vegetables, in **step 5**, you make a concrete plan to take action.

Midwife: Good point. How are you going to make sure you have it in the house?

Martine: I just have to put that on my grocery list by default and then take it to work.

Midwife: Sounds harsh! Do you always do the shopping yourself?

Martine: Often I do, but when my husband is home, he does. Then I also have to tell him to buy me other candy vegetables.

Midwife: Yes, exactly, it is very good to think about who can help you. You may write this down on this card, which you may also take home as a reminder of your goal.

Have Martine write down what is going well, what she wants to work on, and what her concrete goal is for the time ahead.

Midwife: Great that you want to eat more vegetables, you have written down how you are going to approach this. You'll have your next conversation about nutrition with our dietitian, then you can review together how it went.



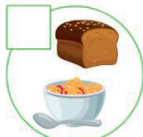









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APPENDIX 1: CONVERSATION CARD

What would you like to discuss? Please indicate

You may check off more than one!

					
vegetables	Fruit	Bread and cereals	Pasta, rice, couscous, and potatoes	Meat, fish, legumes, egg, and nuts	Fats and oils
					
Dairy	Snacks ready-made	Drinks	Supplements	Alcohol	What should I not eat?

This is going well: _____


I want to change: _____

Goal for the next few weeks: _____



Do you want to know more?

The Nutrition Center provides information on nutrition during pregnancy on their **website**.

 www.voedingscentrum.nl/zwanger



On the Nutrition Center's **YouTube** channel, you can find videos on such topics as: Nutrition during pregnancy and breastfeeding | Safe eating | The Wheel of Five | Recipes



Do you ever doubt what you **can** and **cannot safely** eat when you are pregnant?

Download the app ZwangerHap.

You will find clear and reliable information.



Notes





SUMMARY

This dissertation describes an interdisciplinary research project that integrates nutritional and social sciences to improve the diet quality of pregnant women. The central aim is to contribute to improved maternity care in the Netherlands by developing, implementing, and evaluating the ‘Power 4 a Healthy Pregnancy’ (P4HP) programme. Adequate prenatal nutrition is crucial for maternal health and optimal child development. While many pregnant women are motivated to improve their dietary patterns, they often encounter challenges such as nausea, food cravings, and a lack of tailored nutritional support.

This research is grounded in an empowerment approach that places women centrally in their care process. Unlike traditional educational methods, this approach recognises women as active participants rather than passive recipients of information. The project comprises three main components: the development of the P4HP programme, an evaluation of its implementation, and an exploration of additional factors influencing dietary behaviour during pregnancy and postpartum. Each phase employed a mixed-methods design, combining quantitative and qualitative research methods.

THE STUDY PROTOCOL OF THE P4HP PROGRAMME

Chapter 2 describes the study protocol for evaluating the P4HP programme. The programme distinguishes itself through four core principles: early intervention during pregnancy, repeated nutrition communication, a positive empowerment approach, and the collaborative involvement of midwives and dietitians. The programme consists of four additional consultations during pregnancy to discuss nutrition: three with a midwife and one with a dietitian. To support meaningful dialogue, a visual conversation tool was developed to enable women to steer discussions toward nutrition topics most relevant to their needs. The evaluation employed a mixed-methods approach, combining a cluster randomised controlled trial to assess effectiveness with comprehensive process evaluations. The process evaluation included surveys and in-depth interviews with pregnant women and healthcare professionals (HCPs) to examine implementation experiences, facilitators, and barriers.

EFFECTIVENESS OF THE P4HP PROGRAMME

Chapter 3 presents the results of the cluster-randomised controlled trial evaluating the P4HP programme. The study included 342 pregnant women from 16 midwifery practices in the Netherlands, with 186 women assigned to the intervention group and 156 to the control group. Both groups completed questionnaires at baseline (approximately week 11 of pregnancy) and post-intervention (approximately week 34). The results show that diet quality significantly improved in the P4HP group compared to the control group. Additionally, women in the P4HP group demonstrated increased knowledge about appropriate gestational weight gain, although no significant differences were found in

other empowerment measures and health outcomes.

Chapter 4 explores pregnant women's experiences with the P4HP programme through interviews with 22 women. Participants reported various dietary improvements, including increased consumption of dairy products, fish, fruits, vegetables, whole-grain bread, unsalted nuts, water, and supplements, and reduced intake of risky foods during pregnancy. Women particularly valued the personalised nutritional guidance from dietitians, which increased their awareness and boosted their confidence in making healthier dietary choices. Follow-up consultations with midwives helped women maintain these improvements by serving as ongoing motivational reminders throughout pregnancy. While most women saw their dietary choices as a personal responsibility, some acknowledged their partner's role in sharing this responsibility.

Chapter 5 describes how HCPs experienced implementing the P4HP programme. Surveys (n=29) and interviews (n=36) revealed that HCPs noted improved understanding of each other's roles in nutritional care and enhanced interprofessional collaboration. Midwives reported greater confidence in discussing nutrition and recognising cases where referring women to a dietitian would be beneficial. Similarly, dietitians gained a deeper understanding of the specific nutritional challenges women face at different stages of pregnancy. Key facilitators for successful implementation included clear procedures, flexibility in the programme's execution, and professionals' commitment to promoting healthy eating. However, several barriers were identified, including time constraints, limited staff availability among midwives, and the financial burden of dietitian consultations outside the research context. HCPs emphasised the importance of addressing the financial challenges related to out-of-pocket costs to ensure the successful integration of the P4HP programme into routine antenatal care.

In **Chapter 6**, the researchers reflected on the participatory development process of the P4HP programme. This process unfolded over four phases: exploratory research, iterative programme development, pilot implementation, and full-scale implementation and evaluation. The development process emphasised stakeholder engagement and sought to balance the standardisation of core elements with flexibility for local adaptation. The reflection was conducted through documentation on how the programme was developed and an examination of what worked well at each phase. This reflection revealed key lessons. First, it was crucial to involve all stakeholders from the beginning and keep them engaged throughout. Second, continuously and iteratively testing and refining the P4HP programme based on feedback improved its design. Third, the programme needed to be structured enough to maintain its core principles while being flexible enough to work in different practice settings.

ADDITIONAL FACTORS INFLUENCING MATERNAL NUTRITION

Chapter 7 investigates the role of partners in supporting pregnant women's healthy diets through 16 couple interviews. Partners primarily provided instrumental support (e.g. cooking, grocery shopping, avoiding unsafe foods) and informational support (mainly concerning food safety), while emotional support was less frequently reported. The acceptance of support was influenced by how it was delivered. Support was more readily accepted when it was perceived as helpful, involved the partner in the process, and was expressed positively and non-judgmentally.

Chapter 8 explores current nutritional counselling practices during the postpartum period through surveys (n=69) and interviews (n=16) with HCPs. While 77% of professionals provided some form of postpartum nutritional counselling, this support was often limited to basic advice and typically provided only when explicitly requested. Most HCPs (80%) supported the development of a mobile health application to assist in providing nutritional guidance to postpartum women.

Chapter 9 examines the preconditions necessary for an empowerment strategy to improve diet quality among parents in the first year postpartum. The study identified that current healthcare systems prioritise child health over parental nutrition, with support largely reactive rather than preventive. While parents demonstrated strong motivation to maintain healthy dietary habits postpartum, they faced several barriers, including time constraints, competing priorities, and limited access to professional support.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

Chapter 10 synthesises the findings from all preceding chapters. This analysis results in five critical insights:

1. The P4HP programme effectively improved the diet quality of pregnant women, with significant health benefits at both individual and population levels.
2. The empowerment approach went beyond simply transferring knowledge by supporting women in developing practical skills applicable to their daily lives. The programme was tailored to align with their circumstances, with consultations guided by women's motivations and needs rather than predetermined curricula.
3. The collaboration between midwives and dietitians emerged as a key strength of the P4HP programme. Together, they provided more comprehensive support than either could deliver independently.

4. The social environment, particularly the involvement of partners, plays a significant role in shaping dietary choices during pregnancy. This underscores the importance of involving social networks in nutritional guidance.
5. While digital tools can be valuable, personal connections with healthcare providers remain irreplaceable. Future innovations should aim to combine technology with human contact.

Based on these insights, practical recommendations are proposed for Dutch maternity care. First, integrating empowerment approaches into nutritional guidance for pregnant women is essential. This approach enables healthcare providers to support women in building their capacity to make informed dietary choices. Second, strengthening interprofessional collaboration between midwives and dietitians is crucial, as it allows optimal use of their complementary expertise in providing comprehensive nutritional support. Lastly, developing a continuous care pathway that extends nutritional support from pregnancy into the postpartum period is recommended, addressing the unique challenges of the postpartum period more effectively.

For health policy, key recommendations include revising the funding for preventive care, which is necessary to promote a shift from reactive to proactive approaches, recognising the long-term benefits of investing in maternal nutrition. Also, eliminating out-of-pocket costs for pregnancy and postpartum-related dietitian consultations by including them in basic health insurance coverage would be a tangible step toward improving access to specialised nutritional care.

This dissertation highlights the critical importance of the first 1,000 days in establishing the foundations for lifelong health, with pregnancy serving as a unique opportunity for nutritional intervention. The research shows that when pregnant women are empowered and supported in making informed dietary choices, this leads to healthier eating patterns. The strength of the P4HP programme lies in the collaboration between midwives and dietitians, whose combined expertise provides more effective support than either could offer individually. The findings underscore that quality nutritional care during and after pregnancy benefits both mother and child. Involving partners and other close relations in nutritional guidance ensures more substantial support in daily practice. Additionally, the research indicates that personal contact between healthcare providers and women remains valuable, even as digital tools become more prevalent. This research advocates for continuous care beyond delivery, providing ongoing support for women during the challenging postpartum period. Investing in preventive nutritional care during this critical life stage establishes a solid foundation for the health of both current and future generations.



SAMENVATTING

Dit proefschrift beschrijft een onderzoeksproject dat voedings- en sociale wetenschappen combineert met als doel de voedingskwaliteit van zwangere vrouwen te verbeteren. Het onderzoek richt zich op het verbeteren van de Nederlandse geboortezorg door de ontwikkeling, implementatie en evaluatie van het 'Power 4 Gezond Zwanger' (P4GZ) programma. Goede voeding tijdens de zwangerschap is essentieel voor de gezondheid van zowel moeder als het kind. Hoewel zwangere vrouwen vaak gemotiveerd zijn om gezonder te eten, ondervinden zij verschillende belemmeringen zoals misselijkheid, specifieke trek in bepaalde voedingsmiddelen, en beperkte toegang tot persoonlijk voedingsadvies.

Dit onderzoek is gebaseerd op een empowerment-benadering, waarbij vrouwen centraal staan in hun eigen zorgproces. Deze benadering beschouwt vrouwen als actieve deelnemers in hun zorg, in plaats van passieve ontvangers van informatie. Het onderzoeksproject omvat de ontwikkeling van het P4GZ programma, de evaluatie van de implementatie ervan, en het bestuderen van aanvullende factoren die het voedingsgedrag tijdens de zwangerschap en de periode na de geboorte beïnvloeden. Er is gebruik gemaakt van een combinatie van kwantitatieve en kwalitatieve onderzoeksmethoden.

HET STUDIEPROTOCOL VAN HET P4HP PROGRAMMA

Hoofdstuk 2 beschrijft het onderzoeksplan voor de evaluatie van het P4GZ programma. Het P4HP programma onderscheidt zich door vier kernprincipes: vroege interventie tijdens de zwangerschap, herhaalde gesprekken over voeding, een positieve empowerment-benadering, en de gecombineerde expertise van verloskundigen en diëtisten. Het programma bestaat uit vier extra consulten tijdens de zwangerschap waarin voeding centraal staat: drie met een verloskundige en één met een diëtist. Daarnaast werd een visueel hulpmiddel ontwikkeld om vrouwen te ondersteunen bij het sturen van de gesprekken naar de voedingsonderwerpen die voor hen persoonlijk het belangrijkste zijn. Voor de evaluatie werd een mixed-methods aanpak gehanteerd, waarbij een cluster gerandomiseerde gecontroleerde trial werd gecombineerd met uitgebreide procesevaluaties. De procesevaluatie omvatte vragenlijsten en diepte-interviews met zowel zwangere vrouwen als zorgverleners om implementatie-ervaringen, faciliterende factoren en barrières te onderzoeken.

EFFECTIVITEIT VAN HET P4HP PROGRAMMA

Hoofdstuk 3 presenteert de resultaten van de cluster gerandomiseerde gecontroleerde trial. De studie omvatte 342 zwangere vrouwen uit 16 verloskundigenpraktijken in Nederland, waarvan 186 vrouwen het P4GZ programma volgden in aanvulling op reguliere zorg, en 156 vrouwen reguliere zorg kregen. Beide groepen vulden vragenlijsten in aan het begin van de studie (gemiddeld in week 11 van de zwangerschap) en na afloop van het programma (gemiddeld in week 34). De resultaten laten zien dat de voedingskwaliteit

significant verbeterde in de P4GZ groep vergeleken met de controlegroep. Vrouwen in de P4GZ groep hadden ook meer kennis over gezonde gewichtstoename tijdens de zwangerschap. Er zijn geen significante verschillen gevonden in andere empowerment-maten en gezondheidsuitkomsten.

Hoofdstuk 4 onderzoekt de ervaringen van zwangere vrouwen met het P4GZ programma door middel van interviews met 22 vrouwen. De deelnemers rapporteerden verschillende verbeteringen in hun voeding, waaronder een hogere consumptie van zuivelproducten, vis, fruit, groenten, volkoren brood, ongezoeten noten, water en supplementen, en een lagere inname van risicovolle voedingsmiddelen. Vrouwen waardeerden vooral het persoonlijke voedingsadvies van de diëtisten, dat hun bewustzijn vergrootte en hun vertrouwen in het maken van gezonde voedingskeuzes versterkte. De vervolgsconsulten met de verloskundigen droegen bij aan het behouden van deze verbeteringen door als herinnering te dienen. Hoewel vrouwen hun voeding vooral als hun eigen verantwoordelijkheid zagen, erkenden sommigen dat ze deze verantwoordelijkheid deelden met hun partners.

Hoofdstuk 5 beschrijft de ervaringen van zorgverleners met het P4HP programma. Uit vragenlijsten (n=29) en interviews (n=36) bleek dat zorgverleners een beter begrip kregen van elkaars rol en effectiever samenwerkten. Verloskundigen kregen meer vertrouwen in het bespreken van voeding en het herkennen van situaties waarin doorverwijzing naar een diëtist nuttig zou zijn, terwijl diëtisten meer inzicht kregen in de specifieke voedingsuitdagingen tijdens de zwangerschap. Belangrijke succesfactoren voor de uitvoering waren duidelijke procedures, flexibiliteit en de toewijding van de zorgverleners. De belangrijkste belemmeringen waren tijdgebrek bij verloskundigen en de kosten van diëtistconsulten buiten het onderzoek om. Zorgverleners benadrukten dat het essentieel is om de financiële drempel voor diëtistconsulten weg te nemen, zodat het P4HP programma in de reguliere zorg kan worden geïntegreerd.

Hoofdstuk 6 reflecteert op de ontwikkeling van het P4GZ programma. De ontwikkeling verliep in vier fases: verkennend onderzoek, iteratieve programmaontwikkeling, pilot-implementatie, en volledige uitvoering en evaluatie. Tijdens dit proces waren zwangeren, verloskundigen en diëtisten actief betrokken en werd gestreefd naar een balans tussen vaste elementen en ruimte voor aanpassing aan de lokale praktijk. De reflectie werd uitgevoerd op basis van documentatie van hoe het programma werd ontwikkeld en onderzoek naar wat goed werkte in elke fase. Deze reflectie leverde belangrijke lessen op. Ten eerste was het cruciaal om alle betrokkenen vanaf het begin erbij te betrekken en betrokken te houden. Ten tweede verbeterde het P4GZ programma door het voortdurend en iteratief testen en verfijnen van het programma op basis van feedback. Ten derde moest het programma gestructureerd genoeg zijn om de kernprincipes te

behouden, maar flexibel genoeg om in verschillende praktijksettings te kunnen werken.

AANVULLENDE FACTOREN DIE DE VOEDING VAN DE MOEDER BEÏNVLOEDEN

Hoofdstuk 7 onderzoekt de rol van partners bij het ondersteunen van de gezonde voeding van zwangere vrouwen, aan de hand van interviews met 16 koppels. Partners boden vooral praktische hulp (zoals koken, boodschappen doen, en het gezamenlijk vermijden van onveilige voeding) en informatie (met name over voedselveiligheid). Emotionele steun kwam minder vaak voor. Of de zwangere vrouw de steun accepteerde bleek sterk afhankelijk van de manier waarop deze werd aangeboden. Steun werd beter ontvangen wanneer deze als behulpzaam werd ervaren, betrokkenheid toonde en op een positieve, niet-veroordelende manier werd gegeven.

Hoofdstuk 8 onderzoekt de huidige praktijken rondom voedingsadvies na de bevalling op basis van vragenlijsten (n=69) en interviews (n=16) met zorgverleners. Hoewel 77% van de zorgverleners enige vorm van voedingsadvies gaf aan vrouwen na de bevalling, was dit vaak beperkt tot basisadvies en werd het meestal alleen gegeven wanneer vrouwen er zelf om vroegen. De meeste zorgverleners (80%) waren voorstander van het gebruik van een app om voedingsadvies te geven aan vrouwen na de bevalling.

Hoofdstuk 9 onderzoekt wat er nodig is voor een empowerment-strategie om de voedingskwaliteit van ouders in het eerste jaar na de bevalling te verbeteren. Het onderzoek laat zien dat de huidige zorg vooral gericht is op de gezondheid van het kind, terwijl de voeding van de ouders minder aandacht krijgt. Hoewel ouders gemotiveerd zijn om gezond te blijven eten na de bevalling, ervaren ze belemmeringen zoals tijdgebrek, andere prioriteiten en beperkte professionele ondersteuning.

ALGEMENE CONCLUSIES EN AANBEVELINGEN

Hoofdstuk 10 combineert en reflecteert op de bevindingen uit de voorgaande hoofdstukken, wat leidt tot vijf belangrijke inzichten:

1. Het P4HP programma verbeterde de voedingskwaliteit van zwangere vrouwen, wat zowel op persoonlijk als bevolkingsniveau kan bijdragen aan aanzienlijke gezondheidsvoordelen.
2. De empowerment-benadering ging verder dan alleen kennisoverdracht door vrouwen te ondersteunen in het ontwikkelen van praktische vaardigheden die bruikbaar zijn in hun dagelijks leven. Het programma werd afgestemd op hun persoonlijke omstandigheden, waarbij consulten werden geleid door de motivaties en behoeften van vrouwen zelf in plaats van vooraf bepaalde leerdoelen.

3. De samenwerking tussen verloskundigen en diëtisten was een sterk punt van het P4HP programma. Gezamenlijk boden zij betere ondersteuning dan wanneer zij afzonderlijk werkten.
4. De sociale omgeving, in het bijzonder partners, speelt een cruciale rol bij het maken van gezonde voedingskeuzes tijdens de zwangerschap. Dit benadrukt het belang van het betrekken van het sociale netwerk bij voedingsadviezen.
5. Hoewel digitale hulpmiddelen waardevol kunnen zijn, blijft het persoonlijke contact met zorgverleners onvervangbaar. Toekomstige innovaties moeten zowel technologie als menselijk contact combineren.

Op basis van deze inzichten zijn diverse praktische aanbevelingen geformuleerd voor de Nederlandse verloskundigenzorg. De integratie van empowerment-benaderingen in het voedingsadvies voor zwangere vrouwen is een eerste essentiële stap. Zorgverleners kunnen vrouwen hierbij ondersteunen in het ontwikkelen van hun vermogen om geïnformeerde voedingskeuzes te maken. Daarnaast is het essentieel om de samenwerking tussen verloskundigen en diëtisten te versterken, zodat hun complementaire kennis optimaal wordt benut voor voedingsondersteuning. Het ontwikkelen van een doorlopend zorgpad waarin voedingsondersteuning zich uitstrekt van de zwangerschap tot na de bevalling maakt deze aanbevelingen compleet. Dit zou helpen om de unieke uitdagingen van de postpartumperiode effectiever aan te pakken.

Er zijn ook aanbevelingen ontwikkeld voor het gezondheidsbeleid. Allereerst is een herziening van de financiering van preventieve zorg noodzakelijk om een verschuiving van reactief naar proactief beleid te stimuleren en de langetermijnvoordelen van investeren in maternale voeding te onderkennen. Daarnaast zou het wegnemen van financiële drempels voor diëtistconsulten tijdens de zwangerschap en in de postpartumperiode, door deze op te nemen in de basisziektekostenverzekering, een concrete maatregel zijn om de toegang tot voedingszorg te verbeteren.

Dit proefschrift laat zien dat de eerste 1.000 dagen cruciaal zijn voor een gezonde start in het leven, waarbij de zwangerschap een bijzondere kans biedt om de voeding te verbeteren. Het onderzoek toont aan dat wanneer zwangere vrouwen worden aangemoedigd en ondersteund om zelf keuzes te maken over hun voeding, dit leidt tot gezondere eetpatronen. De kracht van het P4GZ programma ligt in de samenwerking tussen verloskundigen en diëtisten, die samen effectievere ondersteuning kunnen bieden dan wanneer zij afzonderlijk werken. De bevindingen onderstrepen dat goede voedingszorg zowel tijdens als na de zwangerschap voordelen oplevert voor moeder en kind. Het betrekken van partners en andere naasten bij voedingsadviezen versterkt

de ondersteuning in de dagelijkse praktijk. Ook blijkt dat persoonlijk contact tussen zorgverleners en vrouwen waardevol blijft, zelfs nu digitale hulpmiddelen steeds meer beschikbaar zijn. Dit onderzoek pleit voor doorlopende zorg die niet stopt bij de bevalling, maar vrouwen blijft ondersteunen in de uitdagende postpartum periode daarna. Door te investeren in preventieve voedingszorg tijdens deze belangrijke levensfase, leggen we een stevige basis voor de gezondheid van zowel de huidige als toekomstige generaties.



Appendices

DANKWOORD

ABOUT THE AUTHOR

LIST OF PUBLICATIONS

OVERVIEW OF COMPLETED TRAINING ACTIVITIES

DANKWOORD

*“Nobody trips over mountains. It is the small pebble that causes you to stumble.
Pass all the pebbles in your path and you will find you have crossed the mountain.”*

Na vijf jaar heb ik de berg beklommen! Ik ben zeker wat ‘pebbles’ tegengekomen, maar bovenal heb ik genoten van deze leerzame en gezellige jaren. Ik ben gezegend met een warme en liefdevolle cirkel aan familie, vrienden en collega’s om me heen. Ieders constante support en interesse in dit onderzoek heeft geholpen in de uitvoer van begin tot eind. Uiteraard heb ik die uitvoer niet alleen gedaan. Ik wil daarom een aantal mensen in het bijzonder bedanken voor hun aandeel.

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Ik heb de eer gehad om me als wetenschapper te ontwikkelen bij de Health & Society groep. Hiervoor wil ik Carlijn Wentink bedanken, die me in mijn tweede BSc-jaar vroeg om student-assistent te worden bij de leerstoelgroep. Het bracht me veel meer dan een leuke bijbaan naast de studie – het gaf me inzicht in de wereld ‘achter de schermen’ van de universiteit, ik leerde wat een PhD was, en ik maakte persoonlijk kennis met een geweldig gepassioneerde, vriendelijke, behulpzame groep. Ik ben heel dankbaar dat dit bijbaantje uiteindelijk heeft geleid tot dit proefschrift. Ik wil iedereen die bij HSO (heeft ge)werkt hartelijk bedanken voor alle hulp, inspiratie, motivatie, gezelligheid en lunchwandelingen – ik heb jarenlang mogen profiteren van een warme, vertrouwde en motiverende plek om te werken. In het bijzonder wil ik Susanne Cremers heel hartelijk danken: het succes van dit onderzoek is voor een groot deel aan jou te danken. Dankjewel voor de ontzettend leuke samenwerking tijdens de implementatie en evaluatie van Power 4 Gezond Zwanger. En ook heel hartelijk dank aan Sabina Super en Yvette Beulen; ik ben erg dankbaar dat ik voort mocht bouwen op jullie eerdere

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ABOUT THE AUTHOR

Renske Mirjam van Lonkhuijzen-Martinovic is married to Martin Martinovic-van Lonkhuijzen. Renske and Martin live in Wageningen with their son, Mateo Eise Martinovic van Lonkhuijzen (2023). Born on 9 May 1996, she was raised in Heerenveen by her parents, Geert and Wilma van Lonkhuyzen. As the youngest of three children, she has two older sisters: Sanneke Ruth (1992) and Nynke Marije (1994). In 2014, she graduated from her pre-university education at the high school Bornego College Heerenveen.



EDUCATION

She moved to Wageningen to pursue a BSc in Health and Society (*Gezondheid en Maatschappij*) at Wageningen University & Research (WUR). Drawing from her broad academic interests, she composed a personalised minor at Radboud UMC in Nijmegen, incorporating courses from Psychology, Gender Studies and Arts faculties. She completed her BSc thesis under the supervision of Annemarie Wagemakers, where she examined the behaviour and perception of menstruating women. She graduated her BSc in 2017.

She continued her academic journey with a MSc in Communication, Health and Life Sciences at WUR, specialising in Health and Society. Her MSc thesis, again supervised by Annemarie Wagemakers, further explored menstruation stigma. At her request, the thesis was structured as two academic articles, comprising both a systematic literature review and a mixed-method study examining attitudes and practices regarding menstruation and sexual activity during menstruation in the Western world. During her internship, she conducted a process evaluation of the Long Live Love (*Lang Leve de Liefde*) educational programme on relationships and sexuality, specifically created for secondary special education students. This evaluation employed five distinct qualitative and quantitative research methods. After graduating with her MSc in 2019, she successfully published her thesis research.

PROFESSIONAL EXPERIENCE

Throughout her studies, Renske held various positions at WUR. She initially served as a one-on-one student supervisor, introducing new students to Wageningen and the BSc Health and Society programme. Subsequently, she supported the Health and Society

chair group as a student assistant for over two and a half years and assisted with the Scientific Writing Skills course.

Following her MSc graduation, she participated in SPRINT – an initiative of The Dutch National Youth Council, which included training, visits to social organizations, personal development, and network building. As part of this programme, she volunteered with health and sexuality-focused organisations IFMSA-NL and CHOICE.

This experience led to a junior researcher position with the Health and Society chair group, where she conducted a Qualitative Comparative Analysis (QCA) using data from the ‘Healthy Futures Nearby’ programme evaluation. QCA is a method that uses Boolean algebra to bridge qualitative and quantitative data analysis. Her combined experiences in research, employment, and volunteer work solidified her passion for research and motivated her PhD application.

DOCTORAL STUDIES

Renske commenced her PhD with the Social Sciences Group (Health and Society chair group) and the department of Nutrition and Health in summer 2020. The COVID-19 pandemic delayed in-person meetings with supervisors for over a year and necessitated modifications to her research plan. Throughout her doctoral program, she has published multiple articles, presented at national and international conferences, supervised numerous BSc and MSc students, assisted with MSc coursework, and delivered lectures and tutorials for BSc- and MSc-level courses. Additionally, she served as a directly elected PhD representative on the WUR Council (2022-2023), participating in Education & Research and Communication committees, as well as the Working Group for the 2023 Elections.

Following the completion of her PhD, Renske started a position as researcher at Rutgers – center of expertise on sexuality, where she conducts research in the field of sexuality and health.

PERSONAL INTERESTS

Outside of her professional work, Renske enjoys doing quizzes or watching quiz shows, lifting weights, skiing, and attending theatre performances. Finally, she draws inspiration from Beyoncé’s music and artistry.

For further contact, she can be reached via email: renskevanlonkhuijzen@gmail.com.

LIST OF PUBLICATIONS

Van Lonkhuijzen, R. M., Cremers, S., de Vries, J. H. M., Feskens, E. J. M., & Wagemakers, M. A. E. (2022). Evaluating ‘Power 4 a Healthy Pregnancy’ (P4HP) – protocol for a cluster randomized controlled trial and process evaluation to empower pregnant women towards improved diet quality. *BMC Public Health*, 22(1), 148. <https://doi.org/10.1186/s12889-022-12543-z>

Van Lonkhuijzen, R. M., Garcia, F. K., & Wagemakers, A. (2022). The Stigma Surrounding Menstruation: Attitudes and Practices Regarding Menstruation and Sexual Activity During Menstruation. *Women’s Reproductive Health*, 0(0), 1–21. <https://doi.org/10.1080/23293691.2022.2124041>

Van Lonkhuijzen, R. M., Rustenhoven, H., de Vries, J. H. M., & Wagemakers, A. (2023). The role of the partner in the support of a pregnant woman’s healthy diet: An explorative qualitative study. *BMC Pregnancy and Childbirth*, 23(1), 760. <https://doi.org/10.1186/s12884-023-06072-9>

Cregan, K., Boonekamp, G. M. M., Buy, M., Matusiak-Wieczorek, E., **van Lonkhuijzen, R.,** Braga, M., Berisha, M., & Ortiz Barreda, G. (2023). Community coherence during COVID-19 – a pilot study. *Journal of Interdisciplinary Sciences*, 7(1), 67–80.

Van Lonkhuijzen, R. M., de Vries, J. H. M., Brouwer-Brolsma, E., Cremers, S., Faessen, J. P. M., Feskens, E. J. M., & Wagemakers, A. (2025). An empowerment programme to improve diet quality during pregnancy – the Power 4 a Healthy Pregnancy cluster randomised controlled trial. *BMC Public Health*, 25(1), Article 1. <https://doi.org/10.1186/s12889-025-21344-z>

Van Lonkhuijzen, R. M., Prins, S., Van Loghem, F., De Vries, J. H. M., & Wagemakers, A. (2025). Pregnant Women’s Experiences With a Collaborative Midwife-Dietitian Empowerment Programme to Improve Diet Quality. *Journal of Human Nutrition and Dietetics*, 38(1), e70027. <https://doi.org/10.1111/jhn.70027>

Van Lonkhuijzen, R. M., Vries, J. H. M. de, Feskens, E. J. M., & Wagemakers, A. (2025). Developing Power 4 a Healthy Pregnancy: Reflective insights on co-creating an effective dietary programme for pregnant women. *Accepted for publication in TSG – Tijdschrift voor gezondheidswetenschappen*.

SUBMITTED MANUSCRIPTS FOR PUBLICATION

Faessen, J. P. M., Mattijssen, S., **Van Lonkhuijzen, R. M.**, Feskens, E. J. M., Wagemakers, A., & Brouwer-Brolsma, E. M. (n.d.). Health care professionals' postpartum nutritional counselling to women; a mixed-methods approach. *Submitted*.

Van Lonkhuijzen, R. M., Baggen, O. A., van der Heijde, C., van Eck, C., Akkersdijk, I., Nijsen, M., Berghuis, B., De Vries, J. H. M., & Wagemakers, A. (n.d.). Empowering Postpartum Parents to Improve Diet Quality. *Submitted*.

Van Lonkhuijzen, R. M., Cremers, S., De Vries, J. H. M., & Wagemakers, A. (n.d.). Midwives and dietitians' perspectives on an empowerment programme to enhance diet quality in pregnant women: A mixed-method study. *Submitted*.

OVERVIEW OF COMPLETED TRAINING ACTIVITIES

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1. Managing a research project			
WASS Introduction course	WASS, WUR, Wageningen, The Netherlands	2020	1.0
Writing research Proposal	Health & Society (HSO), WUR, Wageningen, The Netherlands	2020	6.0
Project and Time Management	WASS, WUR, Wageningen, The Netherlands	2021	1.5
Reviewing a scientific paper	Journal: BMC Pregnancy and Childbirth	2024	1.0
Reviewing a scientific paper	Journal: Archives of Public Health	2024	1.0
Reviewing a scientific paper	Journal: Journal of Human Nutrition and Dietetics	2025	1.0
(Inter)national presentations		2021-2024	4.0
<i>'Implementing and evaluating 'Power 4 a Healthy Pregnancy' - an intervention that empowers pregnant women to improve their diet quality'</i>	De Nederlandse Academie van Voedingwetenschappen, Dutch Nutritional Science Days, The Netherlands	2021	
<i>'Developing, implementing, and evaluating an integral strategy that empowers low SES pregnant women to have a healthier dietary intake'</i>	Aletta Talent Network (ATN) Junior Research Meet-up, Groningen, The Netherlands	2021	
<i>'Power 4 a Healthy Pregnancy: Improving diet quality among pregnant women using empowerment'</i>	HSO Seminar: <i>From Ottawa to Wageningen: Building healthy societies in a planetary context</i> , Wageningen, The Netherlands	2023	
<i>'A collaborative midwife-dietician empowerment programme to improve diet quality of pregnant women - what are the effects and experiences?'</i>	De Nederlandse Academie van Voedingwetenschappen, Dutch Nutritional Science Days, Heeze, The Netherlands	2024	

<i>'Developing 'Power 4 a Healthy Pregnancy' - an intervention to empower pregnant women towards improved diet quality'</i>	Health in Preconception, Pregnancy, and Postpartum Early- and Mid-career Researcher Collective (HiPPP EMR-C) Conference <i>"Healthy Lifestyle Interventions in the reproductive years"</i> , Australia	2021	
<i>'Opportunities for empowerment for a healthy dietary intake during pregnancy'</i>	24th World Conference on Health Promotion of the International Union for Health Promotion and Education (IUHPE): <i>Promoting policies for health, well-being and equity</i> , Canada	2022	
<i>'Empowering pregnant women to improve diet quality: an RCT among pregnant women in the Netherlands'</i>	15th European Public Health Conference (EPH): <i>Strengthening health systems: improving population health and being prepared for the unexpected</i> , Berlin, Germany	2022	
<i>'Empowering pregnant women to improve diet quality: Results from a randomized controlled trial among pregnant women in the Netherlands'</i>	22nd International Congress of Nutrition (ICN) – <i>The power of nutrition: for the smiles of 10 billion people</i> , Tokyo, Japan	2022	
<i>'The participatory development of Power 4 a Healthy Pregnancy: An intervention to empower pregnant women to have a healthier diet quality'</i>	WASS PhD Day, Wageningen, The Netherlands	2022	1.0
Scientific Writing	Wageningen in'to Languages, WUR, Wageningen, The Netherlands	2021	1.8
Scientific Publishing	Wageningen Graduate Schools (WGS), WUR, Wageningen, The Netherlands	2024	0.3
A2. Integrating research in the corresponding discipline			
Salutogenesis for community health and wellbeing	The European Training Consortium in Public Health and Health Promotion (ETC-PHHP) 29 th Summer Course, Lodz, Poland	2021	5.0

Nutrition and Lifestyle in Pregnancy	Maximilians-Universität München (LMU), offered through Coursera	2020	1.0
Motivational Interviewing voor de Zorg	Online Academy	2021	0.1
B) General research related competences			
B1. Placing research in a broader scientific			
Scientific Integrity	WGS, WUR, Wageningen, The Netherlands	2020	0.6
PhD Workshop Carousel	WGS, WUR, Wageningen, The Netherlands	2021	0.3
PhD Workshop Carousel	WGS, WUR, Wageningen, The Netherlands	2024	0.3
Concha Colomer Symposium: <i>Covid 19 and Health Promotion – Time for change in Europe</i>	The European Consortium in Public Health and Health Promotion (ETC-PHHP) in collaboration with Medical University of Lodz, Lodz, Poland (online)	2020	0.1
Art meets Science programme	Artist platform Wageningen (BKW) and Science Shop, WUR, Wageningen, The Netherlands: Art meet Science connects artists and researchers in a process of exploration and co-creation	2024-2025	2.0
B2. Placing research in a societal context			
Organising and participating in Writing Retreat	Sponsored by The Centre for Space, Place and Society (CSPS) and Wageningen Centre of Sustainability Governance (WCSG), and research schools WASS and The Wageningen Institute for Environment and Climate Research (WIMEK), Bakkeveen, The Netherlands	2022	2.0
Writing blogs	Online	2020-2023	0.5
Creating and publishing videos	Online	2022-2025	0.5
Radio recording on Power 4 a Healthy Pregnancy	RTV Rijnstreek with Yvonne Bik, Wageningen, The Netherlands	2023	0.1

C) Career related competences**C1. Employing transferable skills in different domains/careers**

Teaching activities	HSO, WUR, Wageningen, The Netherlands	2020-2025	4.0
- Thesis (co)supervision (14 BSc/ MSc students)			
- Lecture and tutorial in course <i>Health Policy and Action (HSO-30306)</i> (2021 to 2025)			
- Teacher and tutor in course <i>Social Inequalities in Health (HSO-31806)</i> (2020 to 2024)			
- Lecture in course <i>Introduction to Health & Society</i> (2021 and 2023)			
Active bystander training	WIMEK, WUR, Wageningen, The Netherlands	2020	0.1
Competence assessment	WGS, WUR, Wageningen, The Netherlands	2020	0.3
Supervising BSc and MSc thesis students	Teaching and Learning Centre, WUR, Wageningen, The Netherlands	2021	0.64
Popular Science Writing	WASS, WUR, Wageningen, The Netherlands	2021	1.5
PhD Representative	WUR Council, WUR, Wageningen, The Netherlands	2022-2023	4.0
Career Perspectives	WGS, WUR, Wageningen, The Netherlands	2024	1.7
Total			43.34

*One credit according to ECTS is on average equivalent to 28 hours of study load



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