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Barriers and enablers toward healthy eating and weight gain among pregnant women in Vietnam: A qualitative study with analysis informed by the theoretical domains framework and COM-B model

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Abstract

Undernutrition and insufficient gestational weight gain can negatively affect maternal and infant health short- and long-term. In Vietnam, 50% of pregnant women lack essential nutrients, and 75% do not gain enough weight. Current interventions have limited success due to a gap in understanding their determinants. This study aimed to identify barriers and facilitators to healthy eating and weight gain among pregnant Vietnamese women. This qualitative study collected data from 20 pregnant Vietnamese women via virtual focus groups. Discussions were audio-recorded and translated into English for thematic analysis. The study utilized the Capability, Opportunity, Motivation to Behaviour (COM-B) model and Theoretical Domains Framework (TDF) to map the identified themes. Fifteen themes mapped onto nine of the 14 theoretical TDF domains, providing a comprehensive understanding of barriers and enablers to healthy eating and gestational weight gain within the COM-B model. **Capability:** Women had limited knowledge about food sources and the implications of insufficient weight gain and micronutrient deficiencies, though they exhibited high self-care and digital literacy. **Opportunity:** They lacked reliable online sources, had limited healthcare provider communication, spousal support, and faced cultural food beliefs and taboos. **Motivation:** The women understood the need for healthier lifestyles during pregnancy, but often lacked confidence in managing gestational weight and misunderstood the role of prenatal supplements. Our research identified key factors to inform future interventions to promote healthy eating and recommended weight gain during pregnancy among Vietnamese women. To be effective, interventions should focus on increasing nutritional knowledge, enhancing

communication with healthcare professionals, and improving husband supports. Addressing food taboos with culturally sensitive approaches is crucial. The potential of digital health interventions is enhanced by factors such as self-care and digital literacy among pregnant Vietnamese women.

Key words: Vietnamese Women, Pregnancy, Nutrition, COM-B Model, Gestational Weight Gain, Barriers, Digital Health Intervention, Theoretical Domains Framework

Highlights

- This study is the first to identify factors influencing eating behaviours and gestational weight gain among pregnant women in Vietnam, informed by theoretical behaviour frameworks.
- It highlights the cultural food beliefs and taboos among Vietnamese pregnant women, emphasising the need for culturally sensitive future interventions.
- The potential of digital health interventions is highlighted by the high levels of self-care and digital literacy observed among pregnant women in Vietnam.

Introduction

During pregnancy, it is important to follow a diet providing all essential nutrients in adequate amounts in order to support optimal fetal growth and development. Malnutrition and inadequate gestational weight gain (GWG) during pregnancy are strongly associated with poorer health outcomes for both mothers and their babies, both in the short and long term. This includes gestational diabetes, pre-eclampsia, and preterm birth (Kheirouri and Alizadeh, 2021).

The prevalence of malnutrition among the general population in lower-middle income countries is known to be high, and so it is unsurprising that pregnant women in lower-middle income countries face challenges in relation to nutrition and gestational weight gain. In northeastern Vietnam, approximately 75% of pregnant women fail to achieve recommended weight gain, raising the risk of having small-for-gestational-age (SGA) babies (Young et al., 2017). In major cities like Ha Noi, Hai Phong, and Ho Chi Minh City, about 50% of pregnant women do not meet the Recommended Nutrient Intake (Ha et al., 2019). Micronutrient deficiencies, including folic acid, iron, vitamin A, and calcium, are also prevalent among pregnant women in these areas (Tu et al., 2014; Nguyen et al., 2018; Tran et al., 2019). These deficiencies pose significant risks, leading to adverse birth outcomes such as low birth weight and long-term developmental challenges (Gernand, 2016). For instance, iron deficiency not

only results in anaemia in mothers but is also associated with impaired cognitive development in children (Geng et al., 2015). Additionally, insufficient folate levels increase the likelihood of neural tube defects (De-Regil, 2010). Therefore, addressing these nutritional gaps is crucial for improving maternal and child health outcomes in Vietnam.

Evidence suggests that interventions targeting psychological and behavioural factors that influence dietary behaviours during pregnancy can significantly improve maternal nutritional status, reducing the risks of low birth weight (LBW), SGA, and premature birth (Gresham et al., 2016; von Salmuth et al. 2021). However, interventions targeting maternal nutrition and GWG in Vietnamese pregnant women have shown limited effectiveness, focusing solely on prenatal multivitamin supplementation or dietary adjustments without addressing these psychological and behavioural factors. Research in other lower-middle income countries has identified various factors that play an important role in pregnant women's dietary behaviours such as family, health conditions, food taboos, and beliefs about dietary supplements (Kavle & Landry, 2018; Martin et al., 2020; Mohamed et al., 2022). However, there has been no research on healthy eating and weight gain among pregnant women in Vietnam. This study fills this crucial gap by examining how cultural and psychological factors shape maternal nutrition and weight gain among pregnant women in Vietnam.

Interventions rooted in theoretical frameworks are more likely to promote healthier eating habits and appropriate GWG throughout pregnancy (Hill et al., 2013; Beulen et al., 2020; Watson et al., 2023). The Capability, Opportunity, Motivation to Behaviour (COM-B) model developed by Michie et al. (2011) identifies six key components influencing behaviour such as psychological capability, physical capability, social opportunity, physical opportunity, social motivation, and reflective motivation. The Theoretical Domains Framework (TDF), which aligns with the COM-B model, provides a detailed structure by categorizing 14 groups of theoretical domains that influence behaviour (Cane, O'Connor & Michie, 2012) (see Figure 1). The TDF was applied to gain a deeper exploration and understanding of the barriers and facilitators affecting target behaviours. These models have been widely used in the area of maternal health (Flannery et al., 2018; Jhaveri et al., 2023) and were therefore deemed an appropriate theoretical basis for the present study. This study aimed to identify barriers and facilitators affecting eating behaviour and GWG in Vietnamese pregnant women, using the TDF to pinpoint these influences and the COM-B model to categorize them.

Methods

Design and Participants

A qualitative study was conducted, gathering data from Vietnamese pregnant women through semi-structured online focus group discussions. Recruitment advertisements were displayed at no cost on the Facebook page of a Vietnamese parent community, with permission from its administrator, in April 2021. Interested women viewed study information and completed a short questionnaire covering demographics, pregnancy details, perceived health status, and provided consent to be contacted along with their contact information. Eligible participants

were pregnant women aged 18 or older, residing in Vietnam, and without any diagnosed medical condition requiring dietary or medication recommendations.

Ethics Statement

Participants who submitted signed informed consent to contact were invited to join focus group discussions. The study protocol received approval from the clinical research Ethics Committee of the University of Stirling (Reference No. 0656) adhering to the Declaration of Helsinki and Good Clinical Practice principles.

Procedure

The focus group sessions were led by the first author (ANH), a Vietnamese male native and experienced nutritional practitioner with six years of experience working in a maternity hospital. He received qualitative research training during his clinical doctoral studies. Focus groups took place between May and November 2021. The focus groups, conducted in Vietnamese, were held online in a private Facebook group using Messenger Rooms, Facebook's video feature, and recordings were made for analysis. Each participant received one electronic gift voucher, equal in value to a typical lunch meal, as tokens of gratitude. Analyses were performed shortly after each discussion to assess recurring themes and patterns, and an extra focus group session was convened to confirm true saturation once it was reached.

Focus Group Guide

A semi-structured focus group guide was used to prompt participants' discussions, with follow-up questions, prompts, and probes used to encourage in-depth explanations (see Table 1).

Table 1: Semi-structured question guide for online focus group discussions

Topic 1: Concerns, beliefs and attitudes towards diet, nutrition, weight gain during pregnancy • Have your eating habits changed since you became pregnant? • What do you think a healthy diet in pregnancy is like? • What do you think about the well-known saying "eating for two when you are pregnant"? • I am interested in our traditional food beliefs and food restrictions during pregnancy. Do you know anything about these? Do you follow them? • Do you take folic acid? Do you think this is important during pregnancy? Do you take any other supplements? • Do you think your diet is healthy now? • What might get in the way of eating healthier? • Do you feel like you have control over what you eat and the amount you eat? • Have you noticed any changes in your weight since becoming pregnant? • How do you feel about the changes in your weight during pregnancy
Topic 2: Nutrition-related information seeking behaviour. • Where did you obtain all your nutrition-related information?

- Among the information sources you have quoted, are there some sources that you trust more than others? (Why do you trust them?)
- What type of nutrition information are you looking for?
- What makes one website more attractive to you than another?

Data Analysis

The demographic details of our study participants were analysed using descriptive statistics. The focus group discussions were transcribed and translated by the first author (ANH). An inductive thematic analysis (Braun and Clarke 2006) was employed for the initial open coding of the data. NVivo software (Ver.12) was used to facilitate the organisation and analysis of data. After open-coding, broader categories were linked to the domains of the TDF, then directly associated with the components of the COM-B model. This process identified themes pertaining to both enablers and barriers to healthy eating and gestational weight gain (GWG). Regular meetings among the first author (ANH) and authors FMH and HC were held to discuss codes and themes. The first author (ANH) employed the COM-B model and TDF to analyse determinants of eating and weight gain during pregnancy, refining the categorizations through collaborative discussions with all authors (CE, FMH, HC, and ANH).

Results

Study sample

Five focus groups were conducted with twenty pregnant women in total. Each group had four to six participants, primarily from Hanoi (45%) and Ho Chi Minh City (35%). Most were in the third trimester (65%) and lived with their husband's family (60%). Participants' demographic information is summarised in Table 2.

Table 2: Participants' demographic information

N =20	
Age in years, mean (SD)	28 (3.6) Age range: 21-34
First pregnancy (%)	50% (10)
Residents ▪ Hanoi ▪ Ho Chi Minh ▪ Danang ▪ Others	45% (9) 35% (7) 10% (2) 10% (2)
Trimester of pregnancy (%) ▪ First trimester ▪ Second trimester	5% (1) 30% (6) 65% (13)

▪ Third trimester	
Unplanned pregnancy (%)	10% (2)
Whom pregnant women live with (%) ▪ Husband only ▪ Husband and the parent of husband ▪ Husband and their own parent	30% (6) 60% (12) 10% (2)
Occupation (%) ▪ Housewife/ unemployed ▪ Self-employed ▪ Employed	25% (5) 20% (4) 55% (11)

Influences on Healthy Eating and Weight Gain Behaviours Among Vietnamese Pregnant Women

The behaviours of Vietnamese pregnant women concerning healthy eating and weight gain were analysed using the COM-B model and TDF, which encompassed capabilities, opportunities, and motivations. Our initial coding uncovered 15 themes aligning with the capability, opportunity, and motivation components of the COM-B model. These themes were further contextualised by mapping them onto nine domains of the TDF, including knowledge, skills, environmental context and resources, social identity, emotions, intentions, beliefs about capabilities, and beliefs about consequences, to better understand their potential role in intervention development (see Fig.1). The themes were discussed below in relation to healthy eating and weight gain during pregnancy.

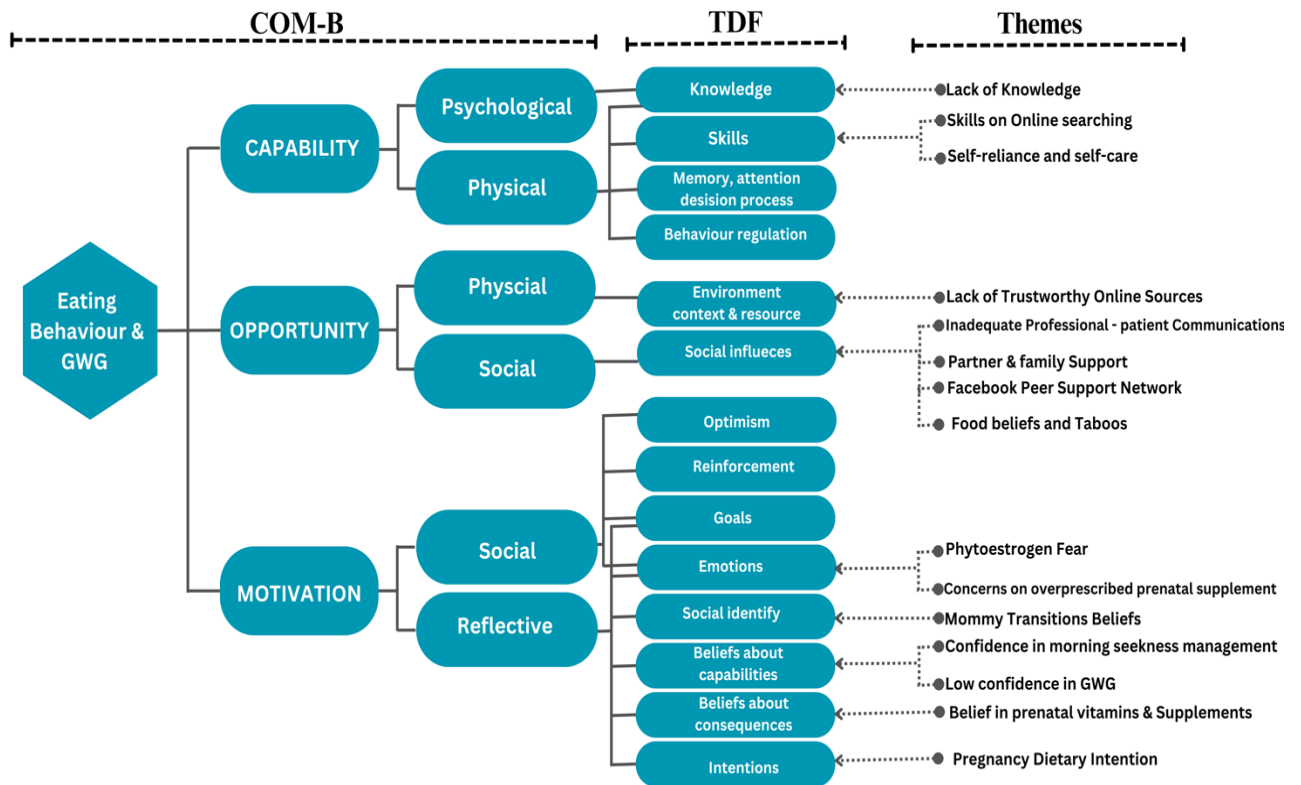


Figure 1: Themes linked to the Theoretical Domains Framework (TDF) and Capability Opportunity Motivation - Behaviour model (COM-B), as influences on eating and weight gain behaviours among pregnant women.

Capability

Capabilities encompassed both the psychological and physical abilities required to execute a behaviour, encompassing knowledge and skills. In this study, women exhibited a varied range of capabilities concerning healthy eating and managing weight gain during pregnancy. Despite lacking comprehensive knowledge in these areas, they displayed a strong inclination towards self-reliance and self-care throughout pregnancy. This inclination was reinforced by information obtained from online sources.

Theme 1: Lack of Knowledge

Through focus group discussions, it was evident that the women had incomplete and varied understandings of the role of nutrition during pregnancy. While they recognized the importance of micronutrients, their knowledge of specific food sources was limited. Misconceptions regarding sugar and carbohydrate intake and their relationship to gestational diabetes mellitus (GDM) led to dietary restrictions. Many relied heavily on supplements rather than incorporating nutrient-rich foods into their diets.

“I could not eat anything in my first trimester, but I didn’t try to eat. I thought my baby only needed iron and calcium enough in this period, so I only took these supplements instead” (Group 4).

Participants demonstrated uncertainty regarding appropriate weight gain during pregnancy, often relying on previous experiences rather than evidence-based recommendations.

“[...] I just want to gain the same weight as my previous pregnancy, about 12 kilos, to get my baby to have a healthy weight at birth like my first son.” (Group 5).

Theme 2: Self-Reliance and Self-Care

The women exhibited a strong sense of self-reliance and independence in managing their health, actively seeking out reliable information to make informed decisions. They conducted their own research and invested time and effort in acquiring accurate health-related information. As shared by participants,

"I prefer to research things on my own before making a decision. I think it's important to have accurate information, especially during pregnancy." (Group 1)

Theme 3: Skills on Online Searching

Participants demonstrated proficiency in online search capabilities, utilising platforms like Google and health-related websites to access information. However, they faced challenges in understanding and discerning reliable sources, often navigating through an "information maze" online. As one woman stated:

“I'm more likely to go to Google and type my question. If I didn't find my answer, I used “Hello Doctor” which is a doctor hub. I can request a question on this page and get an answer from a doctor afterwards” (Group 3).

Opportunity

Opportunities encompassed external factors that shaped individuals' involvement in activities, ranging from physical surroundings to social and cultural contexts, influencing perceptions and behaviours. Themes identified in this study highlight various opportunities for improvement in supporting pregnant women's nutritional needs. These included enhancing the reliability and accessibility of online information through verified sources, fostering more detailed and personalised communication between healthcare professionals and patients, encouraging supportive roles among partners and family members, and leveraging online peer support networks like Facebook groups to provide reassurance and tailored advice. Furthermore, there was an opportunity to address and educate about traditional beliefs surrounding pregnancy nutrition, promoting evidence-based practices for better maternal and foetal health outcomes.

Theme 4: Lack of Trustworthy Online Sources

While the internet and social media provided immediate access to nutrition-related information, pregnant women expressed concerns about the reliability and trustworthiness of online sources. Official websites often provided generic information, leading women to rely on alternative sources for personalised advice. As one woman noted:

"Information about pregnancy nutrition on these [government/hospital] websites often provides generic knowledge” (Group 5).

Theme 5: Inadequate Professional-Patient Communications

Participants desired more detailed guidance on nutrition from healthcare professionals but often found consultations lacking in specificity or depth.

"I asked my doctor about my symptoms, but she promptly replied to me that 'it's okay'. She seemed to be so busy that she could not wait for me to describe all the symptoms I suffered. I also wanted to ask her whether the food I was eating was related to my symptoms because my husband thought that I ate spoiled food. However, I didn't have any chance to ask her any further questions" (Group 5).

Simply distributing leaflets and brochures containing dietary information proved to be a limited approach in influencing decision-making for pregnant women. As highlighted by one woman,

"She [her doctor] showed me a booklet with a food pyramid and said I should consume like this. I knew I should eat, but I just couldn't. You know! the doctor has just been bombarded with a must-eat list, that's all" (Group 3).

These suggested a potential disconnect between the information provided and the woman's specific needs. While time constraints during consultations were a common challenge, they could limit opportunities for a more in-depth discussion about individual dietary challenges, such as nausea or food aversions, that might make following general recommendations difficult. Tailoring advice to address these specific challenges could improve the effectiveness of dietary guidance for pregnant women.

Theme 6: Partner and Family Support

While recommendations regarding nutrition often came from female family members, particularly older relatives, the women expressed concerns about the accuracy of this information.

"My mother-in-law gave me a lot of advice about pregnancy, but I often doubted it. She means well, but I think times have changed, and some of the things she suggested seemed outdated. I often read up on it online." (Group 1)

This hesitancy might stem from doubts about the up-to-date nature of the advice or a preference for evidence-based sources to guide their dietary choices during pregnancy. Male partners' dismissive attitudes towards nutritional concerns left women feeling unsupported during pregnancy as shared by one woman:

"I experienced belly bloat after I ate certain foods [...] my husband completely dismissed my concerns and he often brushed off my worries, thinking I was exaggerating I tried explaining how it was affecting my comfort and well-being, but he didn't take it seriously. It made me feel unheard and unsupported during this important time of my pregnancy." (Group 2)

Theme 7: Facebook Peer Support Network

Pregnant women sought comfort and information from online communities, particularly Facebook groups, where they shared experiences and sought reassurance from other women facing similar challenges.

“I sometimes experience belly bloat after I eat certain foods [...] I thought that there was something wrong. I went online to find an answer for myself. In Facebook groups, some women’s symptoms were similar to what I had. They said that the body during pregnancy may be sensitive to some foods such as tomatoes, oranges and bread that cause bloating. I found that I also had these foods in my meals, so I stopped eating them and the symptoms got better.” (Group 5)

Theme 8: Food beliefs and taboos

Many Vietnamese pregnant women adhered to traditional beliefs regarding the effects of "hot" and "cold" foods on pregnancy. Despite lacking scientific evidence, these beliefs influenced dietary choices and restrictions. For instance, certain foods were avoided during different trimesters based on concerns about miscarriage and blood circulation. The influence of family members and anecdotal experiences perpetuated these beliefs, often leading women to avoid specific foods without full confidence in their effectiveness.

“Cool foods” such as katuk, mung bean, and mostly green vegetables are not good for our pregnancy because these foods can induce ‘poor’ blood circulation in the uterus [...]” (Group 5).

These beliefs extended to attributing specific foods to the baby's appearance, with Coca-cola deemed to cause skin issues and coconut water believed to enhance skin condition. As noted by one participant,

“Drinking coke too much during pregnancy, baby’s skin will be rough” (Group 2).

In contrast, one participant stated,

“I drank a glass of coconut water a day [...] then the baby's going to be fair looking.” (Group 1)

Drinking coconut water is a widespread practice among pregnant women, who commonly assert that it purifies amniotic fluid and improves the baby’s skin condition at birth, despite the lack of scientific evidence supporting these claims.

Motivations

Motivation encompassed the mental processes that energize and guide behaviour. This included both automatic processes, such as emotions and impulses, and reflective processes, which involved evaluations and planning. Motivation involved conscious assessments rooted in beliefs and purposeful strategizing, as well as spontaneous reactions fuelled by cravings and instincts. The desire to prioritise fetal health from the onset of motherhood influenced choices regarding diet and lifestyle, impacting levels of stress and anxiety. Previous encounters with weight management among women also contributed to their drive to maintain wellness during pregnancy. It was evident to observe that many women were driven to take prenatal supplements primarily to alleviate pregnancy-related symptoms rather than solely as a preventive measure against nutrient deficiencies.

Theme 9: Phytoestrogen Fear

Participants worried that soy consumption during pregnancy, due to the presence of phytoestrogens, might make their sons more feminine. However, there was no evidence to

suggest this. Despite conflicting information online, cultural beliefs and a preference for bearing sons drove many women to avoid soy-based foods altogether. This avoidance stemmed from a fear of negative impacts on their baby's masculinity, rather than a concern about the baby's biological sex being altered. This fear underscored broader cultural pressures and highlights the interplay between traditional beliefs and scientific knowledge during pregnancy.

"I've heard mixed opinions about soy, but I didn't want to take chances with my baby's health. So, I decided to avoid soy products like tofu and soy milk while I'm pregnant with a boy." (Group 3)

Theme 10: Concerns on Over-Prescribed Prenatal Supplements

Participants expressed concerns about potentially over-prescribed prenatal supplements, particularly in public healthcare settings. They worried about unnecessary medication and potential side effects. In public healthcare, rushed consultations might limit the opportunity to discuss individual needs and address questions thoroughly. This could lead to a sense of being prescribed a generic regimen without consideration of their specific situation. The public nature of these interactions might also create pressure to accept the prescribed supplements despite any doubts. In contrast, private settings might offer a more personalized approach, allowing for open discussions and potentially alleviating some of these concerns. Doubts about the necessity and quality of supplements led some women to prefer private healthcare facilities. They expressed concerns about potential side effects and lack of trust in doctors, highlighting the importance of transparency and informed decision-making regarding prenatal supplementation.

"A 'bad' doctor might push unnecessary supplements just for profit. But a 'good' doctor knows what's truly essential, like iron and calcium." (Group 5)

Theme 11: 'Mommy Transitions' Belief

Pregnancy served as a pivotal moment for many Vietnamese women to adopt healthier lifestyle changes, driven by concerns for fetal development and personal well-being. Women often modified their diets, prioritising nutrient-rich foods and avoiding processed or low-nutrient options. This shift reflected a broader awareness of the impact of diet on pregnancy outcomes and future health. As highlighted by a woman,

"Since getting pregnant, I think I did not eat instant noodles anymore. I know that instant noodles do not have many nutrients" (Group 5).

Theme 12: Confidence in Morning Sickness Management

Morning sickness was a common experience for the women in this study, impacting their daily routines and dietary choices. While many perceived it as a normal part of pregnancy, prolonged symptoms can cause confusion and frustration. Participants navigated dietary modifications to alleviate symptoms, underscoring the need for effective management strategies and support during this challenging period.

"From the beginning to four months of pregnancy, I consumed very little because of the morning sickness, so I tried to eat anything that does not make me feel sick." (Group 5)

Theme 13: Low Confidence in Gestational Weight Management

Confidence in managing gestational weight varied among participants was, influenced by past experiences and perceptions of weight gain. Successful postpartum weight management boosted confidence, while previous struggles or excessive weight gain led to apprehension.

"I gained 16 kilos. I don't want to gain so much weight. I used to gain 25 kilos in my previous pregnancy, then it's difficult to lose weight afterwards." (Group 3).

This highlighted the importance of tailored support and education to empower women in managing their weight during pregnancy.

Theme 14: Belief in Prenatal Vitamins and Dietary Supplements

The participants relied on prenatal vitamins and supplements to address nutritional gaps and alleviate pregnancy-related symptoms. However, concerns about side effects and the quality of supplements contributed to hesitancy and selective adherence. Personal experiences and perceived benefits influenced supplement usage, emphasising the need for comprehensive guidance and informed decision-making.

"Notably, I often had cramps in my legs during pregnancy start. In addition, I felt dizzy when I changed my head or body position or moved from a seated position to a standing position, which usually lasts a few seconds or minutes. When I took this multivitamin, these symptoms seemed to be most relieved." (Group 5)

Theme 15: Pregnancy Dietary Intention

The dietary intentions of pregnant women in this study were multifaceted, driven by concerns for personal health, foetal well-being, and weight management. Participants viewed their dietary choices as integral to foetal development, reflecting a proactive approach to nutrition during pregnancy. Despite challenges and cultural influences, women strived to make informed decisions and prioritise their health and that of their unborn child.

"I routinely drink milk formula before bedtime; I feel like my baby loves drinking it too. You know, my baby moves a lot once I drink a glass of hot milk formula. It seems that he [her unborn baby] gets more energetic." (Group 1)

Barriers and Facilitators to healthy eating and weight gain during pregnancy

Our analysis revealed a wide range of barriers and facilitators influencing women's capability, motivation, and opportunity to maintain appropriate dietary and weight management practices during pregnancy (see Table 3).

Table 3: Barriers and facilitators to healthy eating & weight gain behaviours among pregnant women in Vietnam, mapped on the COM-B and TDF model.

COM-B components	Target behaviours (healthy eating or appropriate GWG)	What needs to happen for target behaviours to occur	Is there a need for change (Barrier or Enabler)	TDF domains

Psychological capability	Healthy eating	Knowledge about healthy diet during pregnancy	Barrier: Change needed as women have low awareness of the role of eating a variety of foods during pregnancy, as well as, incomplete knowledge of healthy diet during pregnancy, particularly micronutrient-rich food sources and carbohydrate sources	Knowledge
	Healthy eating	Awareness about the risks associated with micronutrient deficiencies.	Barrier: Change needed as women have limited knowledge about the risks associated with micronutrient deficiencies.	knowledge
	Appropriate GWG	Knowledge about the guidance on GWG.	Barrier: Change needed as women have low awareness of monitoring gestational weight gain based on prenatal BMI	Knowledge
	Appropriate GWG	Awareness about the risks associated with inadequate or excessive gestational weight gain.	Barrier: Change needed as women have limited knowledge about the consequences of inappropriate GWG	knowledge
Physical capability	Healthy eating & Appropriate GWG	Self-care	Enabler: No change needed as women display a strong inclination towards self-reliance and self-care throughout pregnancy	Skills
	Healthy eating & Appropriate GWG	Skills to seek information online.	Enabler: No change needed as women shows skills in using online search functions	Skills
Physical Opportunity	Healthy eating & Appropriate GWG	Unbiased or trusted online information sources	Barrier: Change needed because of lacking unbiased or trusted online sources of information or guidance about healthy eating and GWG.	Environmental context
Social Opportunity	Healthy eating & Appropriate GWG	Communication with healthcare providers	Barrier: change needed because of limited conversations with healthcare providers to explain advice to healthy eating and GWG and answers related questions	Social influences
	Healthy eating	Communication	Barrier: change needed	Social

	& Appropriate GWG	and support from the male partner of women	due to inadequate support and comprehension from the male partners of women	influences
		Social community support	Enabler: no change needed as women actively sought social community support, particularly social media network, during their pregnancies.	Social influences
	Healthy eating	Food beliefs and food taboos	Barrier: change needed as women strongly follow food beliefs and taboos that affect their dietary decisions and limitations.	Social influences
Reflective motivation	Healthy eating	Belief about the role of prenatal vitamins and dietary supplements while being pregnant.	Barrier: Change needed because women are prompted to take prenatal supplements, focusing on their positive consequences for sleep quality and pregnancy pains, rather than realising their main role in preventing nutrient deficiencies during pregnancy.	Beliefs about consequences
	Appropriate GWG	Confidence in Gestational Weight Management	Barrier: Change needed as women's confidence is influenced by experiences of excessive weight gain in current pregnancy or unsuccessful attempts at weight loss in previous pregnancies.	Beliefs about capabilities
	Healthy eating	Intention for Pregnancy Diet	Enabler: no change needed because women already prioritise their dietary intentions, driven by concerns for personal and foetal health	Intentions
Social motivation	Healthy eating & Appropriate GWG	Embracing motherhood	Enabler: No change needed as women already recognize pregnancy as a time to embrace healthier lifestyle modifications.	Social identify

Discussion

This study is the first to examine the integration of the COM-B model and the TDF in analysing qualitative responses from pregnant women to identify the determinants affecting their eating behaviours and gestational weight gain behaviours. To the best of our knowledge, it is the first

study to systematically explore barriers and enablers to healthy eating and gestational weight gain among pregnant women in Vietnam. Barriers identified included inadequate knowledge about diverse food options and micronutrient-rich sources, lack of awareness of appropriate GWG guidelines and monitoring methods, limited reliable online sources for information, insufficient discussions with healthcare providers, lack of support from male partners, conflicting advice from older female relatives, misconceptions about prenatal supplement intake, prevalent cultural food beliefs and taboos, and low confidence in gestational weight management due to previous unsuccessful efforts. However, the women exhibited high self-care behaviours and adept online search skills for information, often seeking support from social communities, which can facilitate healthy eating and GWG.

Prospects for Interventions

This study identified key factors that facilitate healthy eating and appropriate weight gain during pregnancy, setting the stage for future interventions targeting pregnant women in Vietnam. High self-care behaviours and digital literacy among Vietnamese women suggest a potentially receptive environment for evidence-based digital interventions. This aligned with the World Health Organization's (2022) emphasis on digital tools to encourage self-care among pregnant women. Vietnam's high internet penetration (74%) and smartphone ownership (90%) (AlphaBeta, 2021) further supported this potential.

The widespread use of digital platforms for accessing health-related information during pregnancy is well-documented in both developed and developing countries (Lagan et al., 2010; Gao et al., 2013). Digital technology can empower pregnant women with essential knowledge and resources to navigate their pregnancy journey effectively (Sayakhot & Carolan-Olah, 2016). Our study also highlighted that social networks like Facebook serve as vital platforms for knowledge exchange and peer support among pregnant Vietnamese women, emphasizing the importance of integrating digital interventions with social media to promote informed decision-making and healthy eating habits. Future research could explore the development and implementation of culturally appropriate digital tools that leverage these existing skills, empowering pregnant women with the knowledge and resources they need to navigate their pregnancy journey effectively.

Leveraging local organizations such as the Vietnam Women's Union (VWU) and the Youth Union can enhance the effectiveness of these digital interventions. The VWU's extensive network of 19 million members offers a robust platform for disseminating digital health tools and self-care messages, while the Youth Union, targeting the 16-35 age group, can engage young pregnant women through its digital outreach. By collaborating with these organizations, digital health interventions can tap into established social networks to amplify their reach and impact. Integrating local organizations into the digital health strategy ensures that interventions are culturally relevant and effectively supported by trusted community resources, creating a cohesive system for improving maternal health outcomes.

Addressing Barriers in Future Digital Health Interventions

This study illuminated critical barriers that future digital health interventions targeting Vietnamese women must address to promote healthy eating habits and achieve appropriate gestational weight gain during pregnancy. Pregnant Vietnamese women faced challenges in determining optimal weight gain and lacked guidance on monitoring weight gain based on

prenatal BMI, coupled with limited awareness of risks related to inadequate or excessive weight gain and micronutrient deficiencies. This stresses the necessity for educational programs tailored to the Vietnamese context within future digital health interventions, focusing on gestational weight management, nutritional needs, and specific health risks. Providing women with comprehensive knowledge can empower them to make informed decisions, potentially enhancing adherence to dietary recommendations (Spronk et al., 2014; Wardle et al., 2016). Similar to Nechitilo et al. (2016), who found that misconceptions about prenatal supplements influenced adherence among trial participants, our study also identified a reliance on these supplements driven by inaccurate beliefs about their benefits. However, there is a key difference between the studies. Nechitilo et al., (2016) interviewed a mixed group of Vietnamese pregnant and postpartum women who were recruited from a clinical trial on dietary supplementation, which might have resulted in higher adherence rates than expected in the general population. In contrast, our study focused on pregnant women from the general population, providing a broader perspective on supplement use. Both studies emphasize the importance of clear education on the true role of prenatal supplements in preventing nutrient deficiencies throughout pregnancy. Our findings suggested that supporting women with previous experiences of excessive weight gain or unsuccessful weight loss attempts in prior pregnancies is crucial for boosting confidence in managing weight effectively. Incorporating success stories could serve as motivational tools to inspire pregnant women on their journey towards better health outcomes (McCarthy et al. 2018).

Limited communication with male partners and the inadequacy of guidance from healthcare professionals regarding diet and weight management during pregnancy contributed to increased anxiety and distrust among pregnant women. Prevalent cultural food beliefs and taboos posed significant challenges to maintaining a healthy diet, with notions like the 'Am and Duong' harmony influencing food choices based on perceived temperature effects. Many Vietnamese pregnant women adhered to traditional food taboos, such as avoiding leafy green vegetables like spinach, lettuce, and katuk. These beliefs often stemmed from concerns that specific foods can negatively impact the baby's health, despite a lack of scientific evidence to support these claims. For example, some women believe that consuming these green vegetables can disrupt the body's balance of heat, potentially leading to miscarriage. As a result, this avoidance significantly limits the variety of vegetables consumed during pregnancy, depriving both mothers and their fetuses of essential nutrients like folate and iron. This phenomenon aligns with existing literature that underscores how cultural beliefs influence dietary choices, leading to reduced nutritional diversity and insufficient intake of key nutrients (Siega-Riz et al., 2009; Vasilevski & Carolan-Olah, 2016). These findings highlighted the importance of future interventions that respect cultural beliefs and taboos. By integrating these beliefs into a non-judgmental approach, healthcare professionals can develop more effective strategies to support pregnant women in adopting healthy and balanced eating practices during pregnancy (de Sa et al., 2013; Triratnawati et al., 2016). Improving communication between healthcare providers and pregnant women is crucial for addressing cultural beliefs and enhancing adherence to dietary recommendations (Kavle & Landry, 2018; Caut, 2020). Finally, the research emphasizes the importance of reliable online resources on nutrition and gestational weight gain to support pregnant women, highlighting the need for future digital health interventions to provide accessible and trustworthy resources for maintaining healthy eating habits and managing weight during pregnancy (Vogels-Broeke et al., 2022). Future digital health interventions should leverage and expand upon existing resources, aligning with

Vietnam's national nutrition strategy for 2021-2030 (Prime Minister 2022). By digitizing and personalizing educational materials, such as those already developed by the Vietnam Ministry of Health, these tools can offer accurate, culturally sensitive advice and address misconceptions effectively. To ensure broad reach, existing networks like the VWU and the Youth Union can be utilized for wide engagement and dissemination of digital health messaging. Collaborating with healthcare providers to validate and promote these platforms will further enhance their credibility, ensuring that pregnant women receive reliable information and support for making informed decisions about their nutrition and prenatal care.

To tackle barriers in promoting healthy eating and appropriate gestational weight gain (GWG) during pregnancy, a coordinated effort among government, community, and the private sector is essential. While the Vietnamese Government has established comprehensive policies and national guidelines for pregnant and breastfeeding women, focusing on healthy eating, key nutrients, supplements, and weight management (Vietnam's Ministry of Health, 2017), there remains a need for a concerted effort to disseminate and implement these guidelines effectively in practice. Digital health interventions offer a promising solution for bridging this gap. With nearly 90.7% of pregnant women attending at least three antenatal visits (Vietnam's Ministry of Health, 2018), there is a key opportunity to integrate personalized digital tools into existing maternity care services. High self-care behaviours and digital literacy identified among Vietnamese women indicate a strong potential for tailored digital interventions. Future interventions can leverage this by offering mobile apps or SMS-based reminders for tracking nutrition intake or gestational weight gain. Additionally, incorporating interactive educational content and real-time consultations could further engage participants, making health guidance more accessible. Local groups like the Vietnam Women's Union and Youth Union can enhance digital interventions by leveraging their trusted networks to promote health apps and online resources. They can organize community sessions that teach women how to effectively use these tools, ensuring that digital solutions align with local needs and cultural practices. They can also engage with local businesses, such as grocery stores or markets, to provide digital resources that educate pregnant women about healthy eating and shopping habits, offering practical guidance on selecting nutritious, affordable foods in their communities. The private sector can contribute by developing innovative technological solutions and collaborating with healthcare providers to ensure accuracy and cultural sensitivity. Integrating digital solutions into the national health system aligns with Vietnam's 2025 digital health strategy, providing a sustainable and cost-effective way to improve prenatal care. This approach enhances communication, promotes healthier dietary practices, and bridges knowledge gaps, while ensuring scalability and long-term impact on national nutrition strategies.

Strengths and Limitations

This study is the first in Vietnam and used a theoretical framework to systematically explore factors influencing healthy eating and gestational weight gain behaviours, facilitating a comprehensive understanding and targeted intervention development. The primary objective was to ensure theoretical grounding for our findings and to effectively identify determinants shaping these behaviours, thereby informing the development of interventions to support sustained behaviour change. Our study also sheds light on prevalent food beliefs and taboos in this population, emphasising the need for culturally sensitive interventions. However, reliance on online recruitment may have introduced sample bias as participants may have greater internet access and proficiency compared to the broader population. The small sample size

typical of qualitative research may not be generalizable to all pregnant women in Vietnam. Despite this, we achieved thematic saturation, the point where no new themes or significant insights emerge from additional discussions. This approach allowed us to deeply understand the determinants influencing healthy eating and gestational weight gain behaviours among this population.

Conclusion

Our research highlights essential factors for developing future interventions aimed at promoting healthy eating and appropriate weight gain during pregnancy among Vietnamese women. Effective interventions should prioritize enhancing nutrition knowledge, fostering effective communication with healthcare professionals, and strengthening male partner support. Additionally, it is vital to address food taboos through culturally sensitive approaches. By leveraging the high levels of self-care behaviours and digital literacy among women, we can implement impactful digital health interventions, such as mobile apps that provide personalized nutrition information and resources. We encourage policymakers to enhance nutrition guidelines through digital solutions and partner with local organizations to effectively share health information that aligns with the distinct needs of pregnant women. By integrating these strategies, we can create a supportive environment that enhances maternal health outcomes in Vietnam.

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