READINESS FOR DIGITAL ANTENATAL NUTRITION EDUCATION: PERSPECTIVES OF PREGNANT WOMEN, FAMILIES AND HEALTHCARE PROFESSIONALS

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Abstract. Proper nutrition education is essential for improving pregnant women's knowledge, awareness, and dietary practices. Digital platforms offer a promising alternative for antenatal nutrition education, particularly when traditional methods are insufficient. This study explored the readiness of pregnant women, their families, and healthcare professionals in Malang City, Indonesia, to utilize digital media for delivering and accessing antenatal nutrition education. A qualitative study using in-depth interviews was conducted with eleven pregnant women, six family members, and five healthcare professionals in October 2023 and September 2024. The qualitative data were analyzed using thematic analysis. The findings revealed that inadequate nutrition education was a significant concern, with many women reporting a lack of direct guidance from healthcare professionals and limited use of existing educational platforms. Pregnant women often turned to digital media for nutrition information, but their concerns about the accuracy and reliability of online content remained. While digital platforms offer valuable opportunities to increase accessibility to nutrition education, challenges such as low interactivity and delayed response times limit their effectiveness. The study suggests enhancing digital education platforms by improving accessibility, providing personalized and scientifically accurate content, and integrating interactive features such as real-time consultations and peer support networks. These improvements could significantly enhance the impact of digital nutrition education, ultimately improving maternal health outcomes. In conclusion, addressing the gaps in digital nutrition education could lead to more effective support for pregnant women, improving their health and well-being during pregnancy.

Keywords: antenatal nutritional education, digital readiness, pregnant women

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INTRODUCTION

Pregnant women's nutrition is crucial for supporting the growth and development of the fetus, as well as optimizing the immune system, intelligence, and overall health of the fetus both in the short and long term (Bhutta *et al*, 2013; Koletzko *et al*, 2012). Nutritional problems during pregnancy, including malnutrition, micronutrient deficiencies, or excessive weight gain, can have adverse effects on both the mother's and the fetus's health (Bhutta *et al*, 2013; Dietz *et al*, 2006).

Inadequate weight gain due to insufficient nutritional intake can elevate the risk of low birth weight (LBW) and contribute to stunted growth in children (Aryastami *et al*, 2017). Additionally, poor eating patterns such as limited food variety or unbalanced portions can lead to micronutrient deficiencies in pregnant women, negatively impacting their health and the cognitive development of their child (Koletzko *et al*, 2012). Conversely, consuming foods high in carbohydrates and fat during pregnancy can increase the risk of overweight, obesity, and excessive weight gain, consequently raising the likelihood of complications such as premature birth, high birth weight (>4 kg), surgical delivery, and postpartum weight retention (Dietz *et al*, 2006; Heslehurst *et al*, 2008).

To enhance knowledge, awareness, and healthy eating behaviors during pregnancy, comprehensive nutritional education and counselling are essential. Studies have shown that providing such education improves the nutritional status of pregnant women and optimizes fetal health

(Girard and Olude, 2012; Ota *et al*, 2015). Formative assessment, regarding existing nutrition education and its perceived importance by pregnant women, is crucial for developing an effective nutrition education model (Bookari *et al*, 2017).

Our research conducted in Malang City revealed that a significant number of pregnant women reported they do not receive adequate nutritional information from healthcare professionals (Rahmawati *et al*, 2021b; Rahmawati *et al*, 2021c). On the other side, qualitative research with healthcare professionals in Malang City identified obstacles such as limited time and opportunities for providing nutrition education to pregnant women (Rahmawati *et al*, 2021a). In addition, pregnant women from middle to upper socioeconomic backgrounds may access nutritional information through digital media, this information often lacks credibility as it is not delivered by healthcare professionals (Rahmawati *et al*, 2021b).

This research aimed to explore the readiness of pregnant women, their families, and healthcare professionals for using digital educational media to obtain and deliver antenatal nutrition education in Malang City, Indonesia. It examined this potential from the perspectives of both pregnant women and healthcare professionals.

MATERIALS AND METHODS

Study design, setting and participant recruitment

This study utilized a qualitative, descriptive research approach involving face-to-face semi-structured interviews (Sandelowski, 2010). The study design adhered to the Consolidated Criteria for Reporting Qualitative Studies (COREQ) guidelines (Tong *et al*, 2007).

This research was conducted in the urban area of Malang, Indonesia, characterized by high accessibility to antenatal care facilities and the internet. Participants included pregnant women and health professionals.

The inclusion criteria for pregnant women were as follows: gestational age of ≥12 weeks, age ≥18 years, singleton pregnancy, residency in Malang City for at least two years, good health, and proficiency in Indonesian. Inclusion criteria for health professionals comprised nutritionists, midwives, or health promoters who had been working in two public health centers in the middle of Malang City for at least the past two years. Purposive sampling was employed to recruit participants (Harris *et al*, 2009).

Participation selection

The healthcare professionals recruited for this research included nutritionists, midwives, and a health promoter who play an important role in providing nutritional education to pregnant women at two community health centers in the middle of Malang City, East Java, Indonesia. Pregnant women were recruited with the support of community health volunteers and midwives in the selected areas. Invitations were extended to pregnant women who attended the antenatal care services at POSYANDU (community-based health services) and the community health center.

Data collection

Pregnant women and healthcare professionals were invited to participate, along with information about the research. Upon agreement and signing of informed consent, researchers arranged in-depth interviews were conducted at the most convenient place and time for the participants.

The interview questions included in this study were adapted from those used in previous studies in France and Australia (Bianchi *et al*, 2016; Bookari *et al*, 2017), as well as in Indonesia (Rahmawati *et al*, 2021a; Rahmawati *et al*, 2021c), which examined pregnant women's behavior regarding accessing nutrition information. Questions asked to

participants in this study included:

1. Can you share your views and experiences regarding the nutrition education and information you received (question for pregnant women), or that pregnant women in your family received (question for families of pregnant women), or that was provided to pregnant women in your work area (question for healthcare professionals) through digital platforms during pregnancy?

2. Can you explain your views on the potential and barriers of nutrition education through digital platforms?

3. Can you share your expectations for nutrition education for pregnant women through digital platforms in the future?

The interviews were conducted and transcribed verbatim. To identify recurring patterns in the data, the authors employed a six-step thematic analysis approach: 1) becoming acquainted with the data, 2) creating initial codes, 3) identifying potential themes, 4) reviewing and refining themes, 5) defining and labelling the themes, and 6) compiling the report (Braun *et al*, 2019).

Ethical consideration

Ethics approval was granted from Health Research Ethics Committee Health, Faculty of Health Sciences Universitas Brawijaya, Indonesia (Reference 6602/UN.F17.10.4/TU/2023). Each participant was provided written consent before the interviews. All participation was voluntary.

RESULTS

Participants in this study consisted of 11 pregnant women aged 25-31 years old (five in their first pregnancy and six in their second

pregnancy), eight family members of pregnant women (six mothers or mothers-in-law and two husbands), and five healthcare professionals (two midwives, two nutritionists, and one health promoter).

The findings from this study highlight three main themes regarding nutrition education for pregnant women. First, inadequate nutrition education is a critical issue, with subthemes including the lack of direct guidance from healthcare professionals, reliance on alternative sources like digital media, and barriers in accessing traditional mode of nutrition education. Second, the potential of digital media for nutrition education is recognized, with subthemes focusing on its frequent use by pregnant women, its role as a preferred information source, and the challenges surrounding the accuracy of online content. Third, suggestions for improving digital education platforms emphasize the need for better accessibility, more personalized content, and the integration of interactive features such as real-time consultations.

Theme 1: Inadequate nutrition education

Lack of direct nutrition education from healthcare professionals

A significant number of pregnant women reported that they had never received direct nutrition education during their pregnancies. This gap in education was often attributed to the absence of nutrition-related discussions during routine check-ups at healthcare facilities. For example,

> *"I have never received any nutritional education at all. The one who told me about food recommendations was my husband, who was told by the doctor when he took me for a check-up."* ... (Woman #2)

This observation suggests that nutrition education is rarely incorporated into the standard care routine, leaving expectant mothers without essential dietary guidance.

Additionally, many women who did receive some form of nutrition education found it to be too generalized.

> *"In my opinion, [nutrition education] needs to be improved because I rarely receive it."* ... (Woman #3)

For those who did, the information was often limited to food restrictions rather than providing comprehensive, evidence-based recommendations that are personalized to each woman's unique needs during pregnancy.

Reliance on alternative sources of nutrition education

Given the limited nutrition education from healthcare professionals, many pregnant women turned to alternative sources of information, particularly digital media.

> *"Nutrition education is rare, so I just search for it myself, like searching on Google, TikTok, or Instagram."* ... (Woman #10)

These platforms became crucial tools for pregnant women, as they could access information conveniently and independently.

However, there was an expressed need for verification of the information found online. Many women acknowledged the necessity of cross-checking information obtained from social media or other online sources with healthcare professionals.

> *"There is a lot of information on Google, but do not just accept it straight away. Later, when I checked with the midwife, I would ask whether it was true or not."* ... (Woman #2)

This sentiment underscores the cautious approach many women adopt when relying on digital sources, recognizing the potential for misinformation.

Inaccessibility of nutrition education platforms provided by healthcare facilities

While healthcare facilities have made digital platforms available for nutrition education, these platforms remain underutilized.

> *"We have a website and use social media, including Instagram, a website, Facebook, Twitter, and an application to share educational materials."* ... (Health Professional #5, a Health Promoter)

Despite these resources being available, one healthcare professional pointed out that *"pregnant women rarely use this facility"* (Healthcare Professional #2, a Nutritionist).

The low usage can be attributed to a lack of awareness, insufficient engagement, or limitations in the platforms' design.

Moreover, even when platforms are utilized, the interaction between healthcare professionals and pregnant women remains limited. Nutrition education via digital platforms is often a one-way communication, without interactive feedback mechanisms or real-time consultations.

> *"If we want to ask in person, that means we have to wait for the pregnancy check-up. But if we use WhatsApp, we can do it at any time."* ... (Woman #9)

This illustrates the demand for more interactive, real-time communication channels for pregnant women to clarify their doubts and receive personalized advice.

Barriers in traditional nutrition education delivery

Logistical and structural barriers also play a significant role in limiting access to traditional in-person nutrition education. Many pregnant

women face challenges such as long distances to healthcare facilities and time constraints during visits.

> *"I felt that the nutrition education at the clinic was limited."* ... (Woman #6)

This finding indicated that time allocation for nutrition education in healthcare settings is insufficient.

Additionally, the approach to nutrition education is often not personalized to the needs of individual women.

> *"The doctor only gives general advice, but I need something more specific to my condition."* ... (Women #10)

This suggests that pregnant women prefer more tailored and specific advice, as general information may not address their particular health concerns.

Theme 2: The potential of digital media for nutrition education

Frequent use of digital media by pregnant women

Pregnant women reported frequent use of digital media, particularly platforms like TikTok and Instagram, as part of their daily routines.

> *"Every day, I often use my cell phone to access the internet via my home Wi-Fi and phone credit when I'm outside the house."* ... (Woman #10)

This highlights the ubiquity of digital media and its role in shaping the information-seeking behavior of pregnant women.

Preference for digital media as an information source

Due to the inadequacy of traditional nutrition education, many pregnant women rely heavily on digital media to acquire knowledge.

> *"I access the internet in my free time to scroll and search for information. Since this is my first pregnancy, I find it helpful to look up any concerns or questions on Google."*... (Woman #2)

Social media platforms, in particular, serve as primary sources of nutrition information, reflecting a shift toward self-directed learning.

Recognition of digital media as a suitable channel for education

Both healthcare professionals and pregnant women recognize the potential of digital platforms in delivering nutrition education.

> *"Now pregnant women here are ready [for education via digital platforms], no one does not carry a cell phone. Apart from using WhatsApp, they definitely access Instagram."* ... (Healthcare Professional #4, a midwife)

This reflects the widespread acceptance and familiarity with digital media among pregnant women, which presents an opportunity for expanding nutrition education delivery.

Challenges and accuracy concerns of information on social media

Despite the advantages of using social media for nutrition education, pregnant women expressed concerns about the reliability and accuracy of the information available.

"Sometimes the information was not the same, which makes things confusing. But I usually confirm it with an obstetrician, for example, getting information from TikTok 'Is it okay or not?'" ... (Woman #7)

This concern underscores the need for more rigorous quality control and expert involvement in digital content.

The role of social media in making education accessible

Social media was recognized as an effective tool for reaching a broad audience, particularly for those unable to attend in-person educational sessions.

"From my point of view, [education via social media] makes it easier to access because I am used to using social media. It can be accessed by many people. For those who cannot attend the event, they can learn it via social media." ... (Woman #8)

This highlights the role of social media in making nutrition education more flexible and accessible, especially for those with logistical challenges.

The use of WhatsApp for information sharing and consultation

WhatsApp emerged as a particularly useful tool for facilitating consultations and sharing educational materials.

"We created a WhatsApp Group with midwives, community health volunteers, and pregnant women. We can share educational materials there so that those who cannot attend the educational sessions can still receive education." ... (Healthcare Professional #1, a nutritionist)

This feature enables real-time communication, making it easier for pregnant women to receive timely advice and clarification.

Theme 3: Suggestions for improving digital education platforms

Platform accessibility and usability

Pregnant women emphasized the importance of using widely accessible platforms such as Instagram and WhatsApp.

> *"Instagram is the most suitable for information sharing because of its easy-to-navigate layout and large user base."* … (Woman #10)

The ease of use of these platforms plays a critical role in ensuring that nutrition education reaches a broad audience.

Content quality and relevance

A key finding was the desire for more detailed and accurate nutrition content. Pregnant women expressed the need for science-backed, specific information that addresses their individual concerns.

> *"I hope the information could be more specific, like explaining the benefits of eating certain foods."* … (Woman #10)

Moreover, the importance of interactive and engaging learning materials, such as videos, was highlighted. One healthcare professional suggests that nutrition education should be delivered in a manner preferred by pregnant women.

> *"If educational videos are made like Korean dramas … the public will definitely pay more attention!"* … (Healthcare professional #2)

Technological support and response time

Pregnant women also stressed the importance of timely responses from healthcare professionals on digital platforms.

> *"I wish there were faster responses from professionals regarding my questions, sometimes when I ask through social media, I don't get answers."* … (Woman #9)

This highlights the need for more efficient communication channels that ensure quick and reliable responses to inquiries.

Community engagement and support

Peer support networks were also seen as a valuable addition to digital education platforms.

> *"It would be great to have a community where we can share our experiences and learn from each other."* … (Woman #10)

This sentiment reflects the importance of fostering a sense of community and shared learning among pregnant women.

The findings of this study suggested that while there is a significant reliance on digital media for nutrition education, there are substantial gaps in both the content quality and the interactivity of existing platforms. Healthcare professionals and pregnant women alike recognize the potential of digital media, but there is a clear need for improvements in platform accessibility, content specificity, and response time. Addressing these challenges could significantly enhance the effectiveness of nutrition education for pregnant women, ensuring that they receive timely, reliable, and personalized advice to support their health during pregnancy.

DISCUSSION

The current study investigates the readiness for digital antenatal nutrition education in Malang, Indonesia, focusing on the perspectives of pregnant women, their families, and healthcare professionals. The findings highlight both the considerable potential of digital platforms to enhance nutrition education for pregnant women and the substantial challenges that must be addressed to improve accessibility, quality, and engagement with these platforms.

Inadequate nutrition education

This study reveals a significant gap in the delivery of direct nutrition education during pregnancy, primarily due to its exclusion from routine healthcare visits. Many pregnant women reported not receiving nutrition-related guidance during check-ups, leaving them without essential dietary advice. This gap in structured nutrition education is particularly concerning, given that nutrition plays a critical role in maternal and fetal health (Teweldemedhin *et al*, 2021). This underscores the urgent need for healthcare systems to integrate nutrition education into routine care to better arm expectant mothers with the knowledge necessary for healthy pregnancies. Furthermore, for those who do receive some level of nutrition education, the content is often overly generalized and insufficiently tailored to individual needs. Many women reported dissatisfaction due to the lack of personalized, evidence-based recommendations that consider specific health conditions or pregnancy stages, corroborating the findings of McCarthy *et al* (2024) that emphasize the importance of individualized nutrition advice to prevent complications and promote optimal fetal development.

Reliance on alternative sources of nutrition education

In the absence of adequate nutrition education from healthcare providers, pregnant women are increasingly turning to alternative sources, particularly digital platforms, such as social media, search engines, and health blogs. The notable use of platforms like Instagram, TikTok, and Google reflects a shift towards self-directed learning, whereby pregnant women actively seek information to bridge the educational gaps left by healthcare facilities (Mahmudiono *et al*, 2019). This shift aligns with previous research that highlights the growing reliance on social media and online resources for health-related guidance (Lucas *et al*, 2018). However, concerns arise regarding the accuracy and reliability of the information found online. Many pregnant women reported seeking confirmation from healthcare professionals regarding information obtained from these sources, as echoed by Rizk *et al* (2023), who identified misinformation on digital platforms as a significant barrier to effective online health education.

Inaccessibility and underutilization of healthcare facility platforms

Despite efforts by healthcare facilities to provide digital nutrition education platforms, the current study found that these resources are underutilized by pregnant women. Several factors contribute to this underutilization, including lack of awareness, inadequate promotion, and poorly designed user interfaces (Rahmawati *et al*, 2021a; Rahmawati *et al*, 2021c). These findings resonate with the studies of Rahmawati *et al* (2021b) and Rahmawati *et al* (2020) which pointed out that digital tools often fail to engage their target audience effectively due to accessibility issues. Furthermore, the interaction between healthcare professionals and pregnant women on these digital platforms remains limited, often designed as one-way communication tools that lack the opportunity for real-time feedback or personalized consultations. This is a critical

limitation, as it hinders pregnant women's ability to clarify doubts or discuss specific health concerns. In contrast, platforms that encourage two-way communication, such as WhatsApp groups or video consultations, are more likely to provide engaging and interactive learning experiences (Lucas *et al*, 2018).

Barriers in traditional nutrition education delivery

In addition to the gaps in digital education, significant barriers exist in traditional in-person nutrition education. Logistical challenges, such as distances to healthcare facilities and time constraints during check-ups, often hinder pregnant women's access to in-person educational sessions. The limited time allocated for nutrition education during healthcare visits further exacerbates this issue (Ibikunle *et al*, 2021; Rahmawati *et al*, 2021a; Rahmawati *et al*, 2021c). Existing literature supports these claims, identifying logistical challenges and time limitations as key obstacles to effective maternal nutrition education (Olloqui-Mundet *et al*, 2024). The study also finds that many women prefer personalized nutrition advice over general guidance, underscoring the need for healthcare providers to offer individualized consultations that account for each pregnant woman's unique circumstances (Versele *et al*, 2021).

The potential of digital media for nutrition education

Despite these challenges, the study demonstrates significant potential for digital media as a tool for delivering nutrition education to pregnant women. High usage rates of platforms such as Instagram, TikTok, and WhatsApp indicate widespread acceptance of these digital tools for health education. These platforms provide a convenient means for pregnant women to engage with nutritional information, especially for those facing logistical barriers to attending in-person sessions

(Olloqui-Mundet *et al*, 2023). Previous research has similarly highlighted the advantages of digital platforms in reaching broad audiences and offering flexible learning opportunities (Waring *et al*, 2023). However, while digital media offers accessibility, the findings indicate that pregnant women often express concerns about the accuracy of information encountered on these platforms, particularly in light of rising misinformation (Voorheis *et al*, 2023). Therefore, it is essential to ensure that digital nutrition education content is scientifically sound and evidence-based. Collaboration among healthcare professionals, digital content creators, and government agencies is vital in developing reliable educational materials adhering to medical guidelines.

Suggestions for improving digital education platforms

To improve digital nutrition education platforms, the study proposes several recommendations. Firstly, there is a need for platforms that are user-friendly and widely accessible. By leveraging familiar platforms like Instagram and WhatsApp, nutrition education can be delivered in a more engaging manner (Konduri *et al*, 2017). Secondly, the study highlights the importance of providing detailed, accurate nutrition content. Pregnant women desire science-based, personalized information that addresses their specific concerns. Digital platforms should move beyond general dietary advice to offer more comprehensive educational materials explaining the benefits of specific foods and dietary practices. Including interactive learning tools such as videos, quizzes, and real-time Q&A sessions can enhance engagement and promote active learning (Waring *et al*, 2023). Finally, the study underscores the necessity for timely responses and real-time consultations. Pregnant women expressed frustration with slow response times on digital platforms, emphasizing the need for services offering prompt communication with healthcare professionals. Integrating live chat or video consultation features could

significantly enhance user satisfaction and provide the personalized support necessary for informed decision-making regarding nutrition (Ługowska and Kolanowski, 2020; Soliman *et al*, 2019).

Limitations and implications

While this study provides valuable insights, it is essential to consider several limitations. The reliance on self-reported data may introduce bias, and the geographic focus on Malang, Indonesia, may limit the generalizability of findings to other contexts. Further research is required to explore the broader applicability of these findings in different cultural and healthcare settings.

The current study highlights the urgent need for improvements in both traditional and digital nutrition education for pregnant women. While digital media has considerable potential to enhance the accessibility and delivery of nutrition education, ensuring that content is scientifically accurate, engaging, and personalized remains critical. Collaboration among healthcare professionals, digital content creators, and governmental agencies is vital in ensuring that digital platforms provide reliable nutrition education, ultimately aiming to improve maternal and fetal health outcomes.

In conclusion, this study highlights critical gaps in the provision of nutrition education for pregnant women, emphasizing the significant role digital media can play in filling these gaps. The key findings demonstrate that traditional nutrition education is often insufficient, with many pregnant women reporting a lack of direct guidance from healthcare professionals and limited personalization of the information provided. Additionally, logistical barriers such as time constraints and long distances to healthcare facilities further impede access to in-person education, highlighting the need for more effective delivery methods.

The research also reveals a growing reliance on digital media, particularly social media platforms like Instagram, TikTok, and WhatsApp, as primary sources of nutrition information. While these platforms provide a convenient and accessible alternative, concerns about the accuracy and reliability of the content persist, underscoring the need for professional involvement in the creation and validation of digital content. Pregnant women expressed a strong desire for more personalized, evidence-based nutrition education that caters to their unique health needs.

This study contributes to the existing body of knowledge by demonstrating the potential of digital media in improving the accessibility and delivery of nutrition education for pregnant women. It emphasizes the importance of creating user-friendly platforms with interactive features, accurate content, and real-time communication to better meet the needs of expectant mothers. Further research is needed to evaluate the effectiveness of different digital platforms and to explore strategies for enhancing engagement and trust among users. By addressing the challenges identified in this study, digital nutrition education can become a vital tool for improving maternal and fetal health outcomes.

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CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

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