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Scoping Review: WhatsApp-based Education to Increase Iron Intake to Prevent Pregnancy Anemia

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ABSTRACT

Background: Pregnancy anemia is a global health problem that affects both mother and fetus. One solution to address pregnancy anemia is to increase iron intake, which can be done through various educational methods, including the use of technology platforms such as WhatsApp. This scoping review explores the academic literature on WhatsApp-based education to increase iron intake to prevent pregnancy anemia. **Methods**: This review used a scoping review method based on the Arksey and O'Malley framework. The literature search was conducted through several electronic databases, namely Google Scholar and PubMed by determining keywords using the PICO format, namely P (pregnancy anemia), I (WhatsApp), C (nil), O (iron supplementation) which captured articles from national and international journals, in English and Indonesian, using the PRISMA Method. Studies were selected from 2014-2024. Found in the initial search as many as 2,780 articles and filtered to get 9 articles to synthesize. **Results**: The results of the article review obtained seven articles. The results showed that technology-based interventions, especially mobile applications and WhatsApp, were effective in improving the health of pregnant women through increased knowledge, anemia prevention practices, hemoglobin levels, and compliance with iron and folic acid consumption. **Conclusion**: WhatsApp-based education is effective in improving knowledge and anemia prevention practices among pregnant women.

INTRODUCTION

Anemia in pregnancy is a significant global health problem, especially in developing countries, with prevalence reaching 40% among pregnant women. This condition often occurs due to iron deficiency, low nutritional status, and limited access to health services. The impact not only jeopardizes the health of the mother, but also increases the risk of serious complications for the fetus, such as low birth weight, premature birth, and perinatal death (WHO, 2023). The prevalence of anemia among pregnant women in Indonesia in 2023 reached 27.7%, indicating that almost a third of pregnant women experience this condition. Although there was a decrease compared to the previous year, this figure is still relatively high and exceeds the WHO standard that recommends the prevalence of anemia in pregnant women

below 20%. This condition is of serious concern due to its far-reaching impact on maternal and fetal health (Kemenkes RI, 2024).

The high prevalence of anemia among pregnant women suggests that more attention needs to be paid to the factors that contribute to this condition. One of the main influencing factors is the level of knowledge of pregnant women regarding anemia and the importance of iron consumption during pregnancy. The high prevalence rate indicates the need for more attention to factors that contribute to anemia in pregnancy, one of which is the level of knowledge of pregnant women about this condition and the importance of iron consumption (Kemenkes RI, 2019). Previous studies have shown that low knowledge of pregnant women has a negative impact on adherence to taking blood supplement tablets (TTD), which is a key intervention in anemia prevention (Souganidis et al., 2014; Yunika, 2021). Pregnant women who do not understand the impact of anemia on their personal and fetal health tend to ignore the recommendation to take blood supplement tablets regularly, even though the supplements are available for free at health facilities. Therefore, improving the knowledge of pregnant women through proper education is one of the important strategies in reducing the prevalence of anemia and preventing pregnancy complications (Liu et al., 2024; Zhao et al., 2015).

One effective educational approach to improve knowledge and prevention of anemia in pregnant women is through the use of social media. Social media allows the dissemination of information widely, quickly, and flexibly, so it is very potential to be used as a means of health education. One platform that can be utilized is WhatsApp, as this application has a very high usage rate in Indonesia, including among pregnant women. WhatsApp allows real-time two-way communication, delivery of educational materials in various formats (text, images, audio and video), and is more personalized and accessible. The ease of use and wide reach make WhatsApp an effective medium to support education-based interventions, especially in increasing pregnant women's awareness of the importance of iron intake in preventing anemia (Aliva et al., 2021; Azizah & Sulastri, 2023; Sang et al., 2022).

Several previous studies have shown that WhatsApp-based educational interventions have the potential to improve pregnant women's knowledge and compliance regarding anemia prevention. For example, a study in Jordan found that delivering educational materials via videos sent via WhatsApp increased knowledge, compliance, ability to choose food, and hemoglobin levels in pregnant women compared to the control group (Abujilban et al., 2018). In Indonesia, similar studies have also shown positive results. A study at the Kartasura Health Center reported an increase in pregnant women's knowledge after receiving education about anemia via WhatsApp (Azizah & Sulastri, 2023). Another study in Yogyakarta noted an increase in compliance with consuming Fe tablets and an increase in pregnant women's self-efficacy after receiving WhatsApp-based reminders. In addition, a study in Surakarta also showed that sending daily educational messages via WhatsApp regarding diet and anemia prevention contributed to an increase in pregnant women's knowledge and compliance in consuming iron tablets (Arifah et al., 2023). Although these studies have shown positive effects of using WhatsApp in health education during pregnancy, there is still limited evidence that systematically reviews its effectiveness specifically in increasing iron intake during pregnancy. Therefore, further research is needed that specifically evaluates the impact of WhatsApp-based interventions on increasing iron consumption as a preventive measure for anemia in pregnant women.

Lack of knowledge among pregnant women about anemia and iron consumption is a major factor in the high prevalence of anemia in pregnancy. Various educational

methods, including direct counseling and social media, have been proven effective in raising awareness among pregnant women. However, the main challenge remains in areas with limited access to information. The use of WhatsApp as a health education platform is a potential solution due to its ease of access and wide reach. This scoping review aims to analyze the literature related to the effect of WhatsApp-based education in increasing iron intake and preventing pregnancy anemia.

METHODS

The method used in this review is a scoping review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR). The scoping review was conducted using an online electronic search engine from two databases, namely PubMed and Google Scholar. The selection of PubMed and Google Scholar in this scoping review was based on practical and methodological considerations. PubMed was chosen because it is a leading database in the field of health with rigorous peer-reviewed articles and high relevance for the topic of maternal health. Google Scholar was chosen because of its broader scope, including articles not indexed in PubMed, such as dissertations and research reports. While Scopus and ScienceDirect are also valuable, both databases focus more on technical literature and are sometimes limited to full access, so the combination of PubMed and Google Scholar is expected to provide a good balance in covering a wide range of relevant literature.

The PICO format was used, with P (pregnancy anemia), I (WhatsApp), C (nil), O (iron supplementation). Keywords used were (“WhatsApp” OR “WhatsApp-based education”) AND (“iron intake” OR “iron supplementation”) AND (“pregnancy” OR “pregnant women”) AND (“anemia”). Data were screened using the inclusion criteria of: 1) studies that addressed WhatsApp-based health education; 2) Studies that examined the effect on increasing knowledge and iron intake; 3) Population: Pregnant women; 4) Primary (quantitative) studies; 5) Articles in English and Indonesian; 5) Full articles can be accessed freely (free full text); 6) There are no duplicates; 7) Publication year 2014-2024. The exclusion criteria were any studies that did not match the inclusion criteria.

The screening process began with a search in each database using predetermined keywords, followed by the removal of duplicate articles using Mendeley bibliographic software. Next, the researcher assessed the titles and read the abstracts of the articles found through the keyword search, filtering them based on the predetermined criteria. Articles with titles and abstracts that met the inclusion criteria then proceeded to the content identification stage, namely by reading the article in full. In addition, researchers also conducted additional screening in a snowballing manner by checking references from articles that had met the inclusion criteria, starting with reading the title, abstract, and content of the article as a whole. After the screening process was complete, the researcher rechecked the results obtained. This process was conducted by two independent reviewers, with one mediator to resolve any discrepancies that may have occurred. Study selection was documented using the PRISMA flowchart found in Section 1.

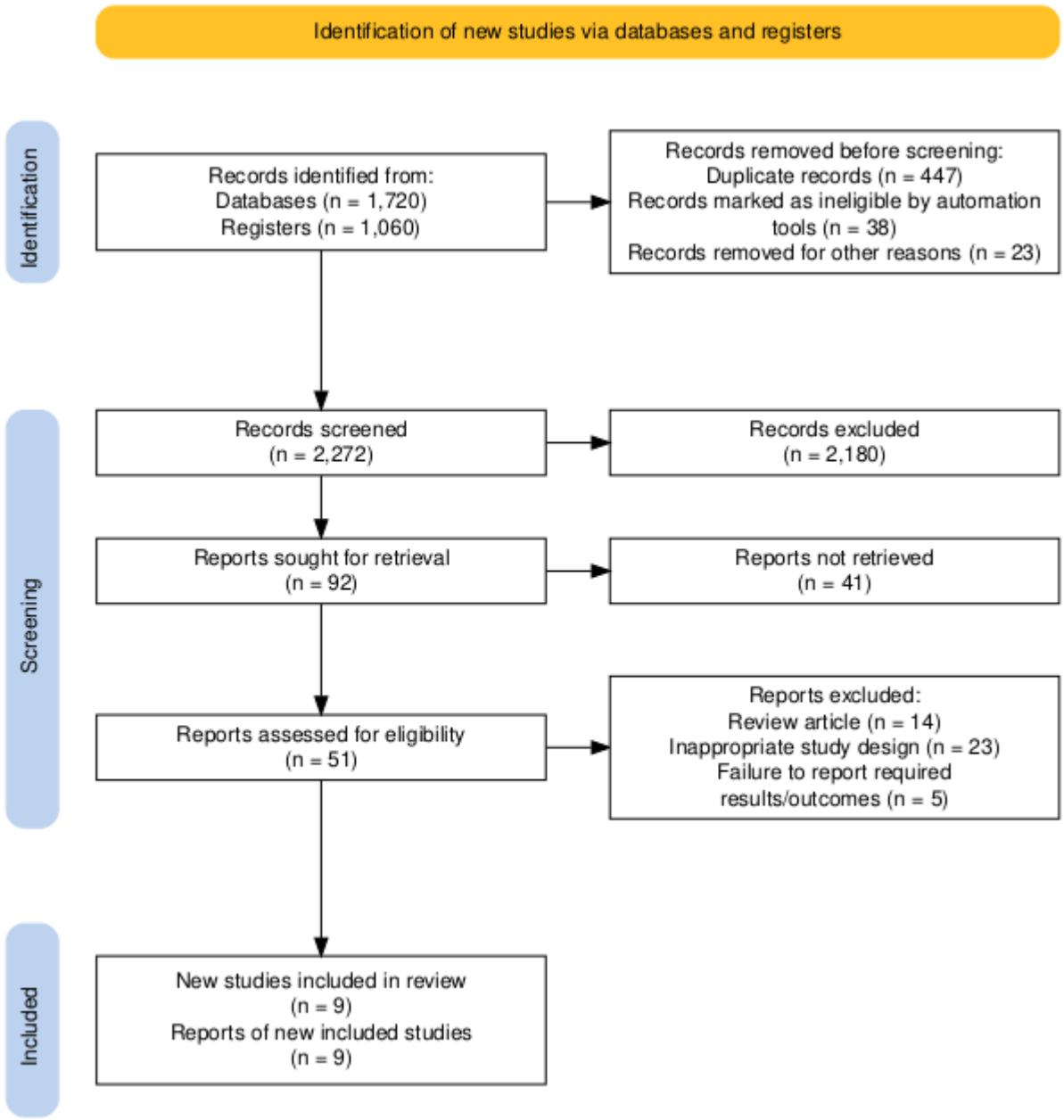

Figure 1. PRISMA Flowchart: Study Selection Stages

Figure 1 shows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart, which illustrates the systematic stages in the process of identification, screening, eligibility assessment, and inclusion of studies in a systematic literature review (SLR). During the identification stage, a total of 2,780 records were collected from two primary sources: the PubMed scientific database (n = 1,720) and Google Scholar as a registry (n = 1,060). After undergoing deduplication and initial cleaning, 508 records were removed because they were identified as duplicates (n = 447), marked as ineligible by the automation tool due to irrelevant document types (n = 38), and were not fully accessible (n = 23). Next, 2,272 records were screened based on title and abstract, and 2,180 records were deemed ineligible and excluded from the selection process. From the screening results, 92 reports were further reviewed in full text, but 41 reports could not be obtained. A total of 51 reports were then comprehensively evaluated for eligibility (full-text assessed for eligibility), and 42 reports were excluded for the following

reasons: review articles (n = 14), inappropriate study design (n = 23), or failure to report the required results (n = 5). Nine studies that met all inclusion criteria were included in the final systematic review analysis. This diagram demonstrates that the literature selection process was conducted rigorously, objectively, and transparently in accordance with PRISMA guidelines to ensure that only relevant and high-quality studies were analyzed in this review.

RESULT

The results of the article search are illustrated in the following table:

Table 1. Description of the Characteristics of the Analyzed Articles

No	Reference And Origin Journal	Design Study	Objective Study	Sample	Variable Study	Results
1	Elagamy, et al (2019) Egyptian Journal of Health Care	Quasi-experimental	Menganalisis efek intervensi keperawatan berbantuan aplikasi mobile pada anemia defisiensi besi pada ibu hamil	210 pregnant women	Knowledge, anemia practice, Hemoglobin level	Intervention significantly improved knowledge, practices, and Hb levels of pregnant women
2	Arifah, et al (2023) Journal of Education and Health Promotion	Randomized Controlled Trial	Analyzing the effectiveness of daily educational messages on anemia prevention behavior and IFA tablet consumption	44 pregnant women	Knowledge, anemia prevention behavior, iron and folic acid consumption	Daily educational messages increase iron and folic acid consumption and knowledge of pregnant women.
3	Anggi Dwi Yanti, et al (2022) MPPKI Journal	Pre-Experimental	Analyzing the difference in the level of nutritional knowledge of pregnant women through e-booklets and e-leaflets based on WhatsApp	40 pregnant women (20 e-booklets, 20 e-leaflets)	Nutrition knowledge, energy consumption, protein consumption	E-booklets are more effective in improving knowledge, energy and protein consumption than e-leaflets.
4	Sang, et al (2022) Bima Nursing	Quasi-experimental	Analyzing the effect of WhatsApp Group	30 pregnant women	Hemoglobin levels	Education significantly increases pregnant

No	Reference And Origin Journal	Design Study	Objective Study	Sample	Variable Study	Results
	Journal		education on increasing Hb levels of anemic pregnant women			women's Hb levels.
5	Aliva, et al (2021) Indonesia Jurnal Kebidanan	Quasi-experimental	Analyzing the effect of health promotion through leaflets and WhatsApp on adherence to taking Fe tablets	46 pregnant women (23 intervention, 23 control)	Fe adherence	Health promotion through WhatsApp and leaflets improves Fe tablet consumption compliance.
6	Rahayu, et al (2023) Journal of Health Research Science	Quasi-experimental	Analyzing the effectiveness of health promotion with WhatsApp mentoring on knowledge and attitudes about anemia	50 pregnant women (25 intervention, 25 control)	Knowledge, attitude	WhatsApp mentoring effectively improves knowledge and attitudes compared to Educational Information Communication.
7	Azizah & Sulastri (2023) Health Information Jurnal Penelitian	Pre-Experimental	Analyzing the effect of health education about anemia and Fe tablets through WhatsApp on the knowledge of pregnant women	50 pregnant women	Knowledge	There was a significant increase in the knowledge of pregnant women after the intervention (pre-test average 12.16 and post-test average 20.48)
8	Irawan, Alfiah, et al. (2023) Media Karya Kesehatan	Quasi-eksperimen pre-posttest one group	Improving pregnant women's knowledge about anemia using WhatsApp Auto Responding	18 pregnant women and preconception women in Parung Panjang Village18 pregnant women and preconception	Knowledge about anemia in pregnant women before and after WAR intervention	Mean knowledge increased from 62.3 to 91.9 ($p<0.05$). WAR was effective in increasing participants' knowledge and enthusiasm

No	Reference And Origin Journal	Design Study	Objective Study	Sample	Variable Study	Results
			(WAR)	women in Parung Panjang Village		towards anemia
9	Irawan, Cholidhazia, et al. (2023) Ghidza : Jurnal Gizi Dan Kesehatan	Eksperimental pre-posttest	Testing the effectiveness of chatbots in improving knowledge and attitudes about nutrition and anemia in pregnant women	30 pregnant women in the working area of Parung Panjang Community Health Center	Knowledge about nutrition and anemia before and after chatbot intervention, Attitude related to nutrition and anemia before and after chatbot intervention	Mean knowledge increased from 9.6 to 10.9 (p=0.019). Attitude increased from 35.6 to 37.2 (not statistically significant, p=0.32)

The analysis of various studies shows that mobile app-based interventions, especially through WhatsApp, contribute significantly to improving various aspects of knowledge and health behaviors related to anemia in pregnant women. The main findings of this scoping review can be divided into three major themes, namely increased knowledge, behavior change and adherence, and increased hemoglobin levels.

1. Knowledge Improvement
   Most studies showed that digital interventions, whether in the form of educational messages, e-booklets, WhatsApp mentoring, to the use of chatbots and auto-responding systems, consistently improved pregnant women's knowledge about anemia. Studies by Elagamy et al. (2019), Arifah et al. (2023), Azizah & Sulastri (2023), and Irawan et al. (2023) reported a significant increase in knowledge after the intervention. For example, in the study by Azizah & Sulastri, the average knowledge score increased from 12.16 to 20.48, while Irawan et al. noted an increase in scores from 62.3 to 91.9 after the use of WhatsApp Auto Responding (WAR). Something similar was also found in another chatbot study by Irawan et al., with a significant increase in knowledge despite attitudes showing no statistically significant difference.
2. Behavior Change and Compliance
   Several studies focused on the impact of digital interventions on anemia prevention behavior and iron (Fe) tablet consumption adherence. Arifah et al. (2023) showed that daily educational messages increased Fe tablet consumption and anemia prevention behavior. Aliva et al. (2021) also found that health promotion through WhatsApp and leaflets improved adherence in consuming Fe tablets. In addition, the study by Rahayu et al. (2023) noted an increase in knowledge and better attitudes towards anemia in the group that received assistance through WhatsApp compared to the conventional educational communication approach.
3. Improved Hemoglobin Levels

Three studies directly assessed the impact of the intervention on hemoglobin levels. Elagamy et al. (2019) and Sang et al. (2022) reported a significant increase in Hb levels after the WhatsApp education and app-based intervention. In addition, Anggi Dwi Yanti et al. (2022) showed that the use of WhatsApp-based e-booklets is more effective in increasing energy and protein intake, which is closely related to increasing Hb levels.

DISCUSSION

Health education plays a very important role in disseminating health information, especially in the prevention of anemia in pregnant women. By providing proper knowledge about nutritional needs and ways to prevent anemia, pregnant women can better understand the importance of iron and folate intake during pregnancy. Effective education programs, both through face-to-face and digital media, can increase pregnant women's awareness and understanding of the risks of anemia and the preventive measures to be taken. In addition, health education can encourage positive behavioral changes, such as increased consumption of nutritious foods and adherence to iron supplements (Kemenkes RI, 2019).

The use of WhatsApp has proven to be effective as a health education medium in efforts to prevent anemia in pregnant women (Aliva et al., 2021; Anggi Dwi Yanti et al., 2022; Azizah & Sulastri, 2023; Melati & Afifah, 2021; Rahayu et al., 2023; Sang et al., 2022). Through the delivery of educational materials online, WhatsApp succeeded in significantly increasing the knowledge of pregnant women regarding the importance of early detection of pregnancy anemia. This was shown by an increase in the pre-test mean score from 64.4 to 78.2 in the post-test, where all participants experienced an increase in score. This education introduces the importance of checking hemoglobin levels as the first step in preventing anemia, which is also a risk factor for stunting in children under five. WhatsApp was chosen for its ease of access, especially in areas with limited network such as Cikunir Village, making it a cheap, fast, and practical alternative educational media. This increased knowledge is expected to encourage pregnant women to be more active in conducting antenatal care (ANC) and prevent serious complications due to anemia such as miscarriage, preterm labor, bleeding, and maternal death (Hidayani et al., 2022).

WhatsApp has various advantages that make it an effective educational medium, especially for pregnant women. Its wide access and familiarity among the community allows WhatsApp to be used by various age groups and educational backgrounds. The real-time communication feature allows two-way interaction between health workers and pregnant women, either through text messages, voice, images, or videos, so that health information can be conveyed quickly and easily understood. Compared to conventional education methods such as face-to-face counseling or the use of leaflets, WhatsApp has advantages in terms of time flexibility, continuity of information, and wider reach, especially in times when access to health facilities is limited or pregnant women experience mobility limitations (Sulastri et al., 2021). WhatsApp can improve pregnant women's knowledge of anemia and iron requirements due to its ability to provide interactive, flexible and technology-based education. Education through WhatsApp allows for the delivery of repetitive and accessible information, such as the use of text, videos, and images, which support pregnant women's understanding of the importance of early detection of anemia and management of iron requirements during pregnancy (Elagamy et al., 2019).

The use of WhatsApp allows for quick and interactive delivery of information, so pregnant women can easily access educational materials and discuss their health (Irawan, Alfiah, et al., 2023). WhatsApp outperforms other social media in improving pregnant women's knowledge about anemia due to its ability to provide immediate and interactive information. WhatsApp Auto Responding leverages the power of technology to deliver relevant information in a personalized and flexible way, making it a practical alternative to support health education for pregnant women, especially for groups with limited access to conventional health services (Irawan, Cholidhazia, et al., 2023).

The use of WhatsApp as a health promotion medium to increase compliance of pregnant women in taking iron tablets faces several potential barriers. One of them is the varying digital literacy among pregnant women. Mothers with low technological skills may have difficulty using the application, thus hindering their access to the information provided. In addition, access to adequate smartphones is also a challenge, especially for pregnant women from lower-middle economic classes who may not have the necessary devices (Elagamy et al., 2019; Hidayani et al., 2022). Internet connectivity issues also play a significant role, as areas with unstable or limited signals may prevent pregnant women from accessing educational content provided through WhatsApp. These barriers need to be addressed to ensure the effectiveness of health promotion through digital media (Aliva et al., 2021; Hidayani et al., 2022; Sang et al., 2022). The use of WhatsApp as a health promotion medium faces several potential barriers that need to be addressed. One is digital literacy, where not all pregnant women have adequate skills to use the application effectively. In addition, access to smartphones is a challenge, especially for pregnant women from low-income families who may not have the necessary devices. Internet connectivity issues also play a role, as in areas with weak signal, pregnant women may have difficulty accessing important information and attending educational sessions. These barriers can reduce the effectiveness of health promotion programs and need to be addressed so that all pregnant women can use this medium to increase their knowledge of health during pregnancy (Hidayani et al., 2022).

The implications of these findings suggest that the use of digital media such as WhatsApp can be a very effective strategy in maternal health education and practice, especially in increasing knowledge about anemia during pregnancy. Digital platforms allow for flexible, continuous counseling and reach pregnant women who may have difficulty accessing health services directly, especially during the pandemic or in remote areas. This provides a great opportunity for health workers to integrate digital education into maternal and child service programs. However, to strengthen the evidence of the effectiveness of this method, further research is needed in the future. Recommendations for further research include the need for more randomized controlled trials (RCTs) to measure the long-term impact of digital education on changes in maternal behavior and health status. In addition, further exploration is also needed regarding the implementation of this program in rural areas that still have limited digital infrastructure, so that strategies can be adjusted to local conditions. Closing this gap is important so that the digital transformation in maternal health education can be equitable and inclusive across regions.

CONCLUSION

This study shows that health education through WhatsApp media has proven effective in increasing pregnant women's knowledge about anemia. The use of WhatsApp as an educational platform provides easy access, allows for interactive

group discussions, and supports the delivery of information in real time. The results of the pre-test and post-test showed a significant increase in pregnant women's understanding of early detection of anemia and the importance of pregnancy checks. The advantages of WhatsApp as a flexible, cost-effective, and easy-to-use media make it a superior alternative to conventional education methods.

It is hoped that health workers can utilize digital media such as WhatsApp more optimally in maternal health education programs, especially in areas with limited access to health services. In addition, further research is needed with a randomized experimental design (RCT) to examine the long-term effectiveness and impact on changes in maternal behavior and health status. Research is also recommended to reach rural areas and populations with limited technology to develop an inclusive and sustainable digital education model.

Author Contribution Statement: **Herinawati:** conceptualization, study design, methodology, formal analysis, and writing of the original draft, particularly the introduction, methodology, and results sections. **Ani Margawati** was responsible for the literature search, screening and defining inclusion and exclusion criteria, participated in data analysis, and contributed to drafting the results and discussion. **Sri Achadi Nugraheni** developed the theoretical framework, contributed to methodological analysis, and wrote the conclusion and policy recommendations. **Dwi Pudjonarko** conducted quality assessment of included studies, refined the methodology especially in applying the PRISMA framework, and edited the manuscript for clarity, coherence, and journal compliance.

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