



Effectiveness of the Ayocenting website on maternal knowledge, attitude, and motivation to prevent stunting

Efectividad del sitio web Ayocenting en el conocimiento, actitud y motivación materna para prevenir el stunting

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Abstract

Introduction: Stunting remains a critical global health challenge requiring innovative educational strategies to improve maternal awareness. Digital platforms offer a potential alternative to traditional media for delivering nutritional health information to caregivers.

Objective: The study aimed to evaluate the effectiveness of the ayocenting website compared to conventional physical infographics in enhancing maternal knowledge, attitudes, and motivation toward stunting prevention.

Methodology: A quasi-experimental study with a non-equivalent control group design was conducted involving 252 mothers of toddlers. Participants were divided into an intervention group (n=126) using the website and a control group (n=126) receiving physical infographics. Data were analyzed using Wilcoxon signed-rank and Mann-Whitney U tests.

Results: The intervention group achieved a significantly higher proportion of good knowledge (61.2%) compared to the control group (29.4%). Post-test scores showed significant improvements in supportive attitudes (p=0.003) and strong motivation (p=0.001) only in the intervention group. The Mann-Whitney U test confirmed that the ayocenting website was significantly more effective than physical infographics in increasing knowledge (p=0.001), attitudes (p=0.002), and motivation (p=0.018).

Discussion: The findings indicated that interactive digital features provided a more engaging learning experience than static infographics. The results contrasted with previous studies by highlighting that web-based accessibility facilitated better information retention and psychological readiness than traditional printed materials.

Conclusions: The ayocenting website is a significantly more powerful educational tool than traditional physical media for stunting prevention.

Keywords

Growth disorders; health education; health knowledge, attitudes, practice; internet-based intervention.

Resumen

Introducción: El retraso del crecimiento sigue siendo un desafío crítico para la salud global que requiere estrategias educativas innovadoras para mejorar la concienciación materna. Las plataformas digitales ofrecen una alternativa potencial a los medios tradicionales para entregar información de salud nutricional a los cuidadores.

Objetivo: El estudio tuvo como objetivo evaluar la efectividad del sitio web ayocenting en comparación con las infografías físicas convencionales para mejorar el conocimiento, las actitudes y la motivación materna hacia la prevención del retraso del crecimiento.

Metodología: Se realizó un estudio cuasiexperimental con un diseño de grupo de control no equivalente en el que participaron 252 madres de niños pequeños. Los participantes se dividieron en un grupo de intervención (n=126) que utilizó el sitio web y un grupo de control (n=126) que recibió infografías físicas. Los datos se analizaron mediante las pruebas de rangos con signo de Wilcoxon y U de Mann-Whitney.

Resultados: El grupo de intervención logró una proporción significativamente mayor de conocimiento bueno (61.2%) en comparación con el grupo de control (29.4%). Las puntuaciones posteriores a la prueba mostraron mejoras significativas en las actitudes de apoyo (p=0.003) y una fuerte motivación (p=0.001) solo en el grupo de intervención. La prueba U de Mann-Whitney confirmó que el sitio web ayocenting fue significativamente más efectivo que las infografías físicas para aumentar el conocimiento (p=0.001), las actitudes (p=0.002) y la motivación (p=0.018).

Discusión: Los hallazgos indicaron que las funciones digitales interactivas proporcionaron una experiencia de aprendizaje más atractiva que las infografías estáticas. Los resultados contrastaron con estudios previos al resaltar que la accesibilidad basada en la web facilitó una mejor retención de información y preparación psicológica que los materiales impresos tradicionales.

Conclusiones: El sitio web ayocenting es una herramienta educativa significativamente más poderosa que los medios físicos tradicionales para la prevención del retraso del crecimiento.

Palabras clave

Actitudes y práctica en salud; conocimientos; educación en salud; intervención basada en internet; trastornos del crecimiento.

Introduction

Malnutrition is a multifaceted condition that includes undernutrition manifesting as stunting, wasting, and underweight, as well as essential vitamin and mineral deficiencies. In 2022, an estimated 149 million children under the age of five were affected by stunting (being too short for their age), highlighting the profound global impact on the youngest population (WHO, 2024). The greatest burden of stunting prevalence is largely concentrated in countries across South and Southeast Asia and sub-Saharan Africa (Vaivada et al., 2020).

The Southeast Asian sub-region has a stunting prevalence of around 27% (Azriani et al., 2024). The highest prevalence is observed in Timor-Leste (approximately 48–49%), followed by Indonesia (around 32%), Laos and Cambodia (each about 30%), the Philippines (approximately 29%), Myanmar (around 25%), and Vietnam (about 22%). This regional average remains above the global prevalence, which is estimated at 20–23%, underscoring that stunting continues to be a major priority for child nutrition and growth and development interventions in ASEAN countries (Global Nutrition Report, 2025).

Based on the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI), the prevalence of stunting among children under five years of age in Indonesia was approximately 21.5%, indicating that about one in five children under five was affected by stunting. In Lampung Province, the prevalence of stunting among children under five was recorded at 14.9% (SKI, 2023). Data from the Kota Gajah Community Health Center indicate that the incidence of stunting in its service area has fluctuated over time. In 2019, 221 children (19%) were affected by stunting; in 2020, this decreased to 72 children (18%); and in 2023, the number further declined to 57 children (Puskesmas Kota Gajah, 2023).

Stunting is a serious threat to children's future and the quality of human resources. Children affected by stunting not only experience impaired physical growth but also suffer from delayed brain development, reduced cognitive ability, increased susceptibility to illness, and a higher risk of low productivity in adulthood (Desweni, 2025). In the long term, stunting contributes to increased health burdens and significant economic losses for the country (Khotimah, 2022). Chronic malnutrition, recurrent infections during the critical first 1,000 days of life, low birth weight, inadequate maternal nutrition, education, lack of information, and socioeconomic factors (Beal et al., 2018; Laksono et al., 2022; Miranda et al., 2023). According to the United Nations Children's Fund (UNICEF) conceptual framework, stunting is influenced by immediate factors (inadequate dietary intake and disease), underlying factors (household food security, caregiving practices, and health services), and basic factors such as socioeconomic conditions, education, and inequality, highlighting its multifactorial nature (UNICEF, 2020).

Educational and informational interventions play a key role in stunting prevention by addressing multiple underlying causes, including inadequate nutrition, poor caregiving practices, and low sanitation awareness. Evidence from studies in Indonesia shows that improving maternal knowledge through community-based health education can significantly reduce stunting risk by promoting appropriate feeding, hygiene, and infection prevention behaviors (Arqam et al., 2026; Handayani et al., 2025). The Health Belief Model (HBM) framework also includes cues to action and self-efficacy, which together explain how external triggers and individual confidence facilitate behavior change. Empirical studies have shown that maternal perceptions based on HBM components are significantly associated with adherence to stunting prevention practices, including appropriate feeding and health service utilization (El-satria et al., 2025). Health education plays a crucial role in improving the quality of growth and development in toddlers, particularly in cases of stunting. Through structured and continuous health education, mothers as primary caregivers gain a better understanding of balanced nutrition principles, appropriate feeding practices, as well as the importance of hygiene and child care. This increase in knowledge directly contributes to improvements in toddlers' dietary intake, both in terms of quality and diversity of the foods consumed (Salma et al., 2026).

Delivering educational information through websites is an effective and efficient approach due to the widespread ownership of smartphones, which enables unlimited access to information regardless of time and location. Web-based education facilitates self-directed learning through videos, text, interactive content, quizzes and discussions, making it flexible and accessible for diverse populations (Faridah et al., 2024). Website based education and counseling demonstrate clear advantages in supporting early stunting prevention by improving knowledge, shaping positive attitudes, and encouraging healthy caregiving practices among mothers and community health volunteers. Web platforms allow information to



be delivered in a comprehensive, engaging, and easily accessible manner, enabling users to learn anytime and at their own pace. Educational content presented through text, infographics, videos, and interactive features helps mothers better understand nutrition, child growth and development, and early detection of stunting compared to conventional printed media. This accessible and flexible learning approach contributes to significant improvements in knowledge, which form a strong foundation for behavior change (Masmuri & Hidayah, 2025).

In addition, increased knowledge gained through website-based education positively influences attitudes and practical behaviors related to stunting prevention. Mothers become more aware, motivated, and committed to adopting healthy practices, such as providing nutritious complementary feeding and routinely monitoring their children's growth. Digital interventions also support the consistent application of appropriate caregiving practices, as information can be revisited and applied according to individual needs. Overall, website-based education is an effective and sustainable strategy for promoting positive behavioral change and strengthening early stunting prevention efforts, particularly in the digital era (Ambarika & Indasah, 2025). This approach is also supported by learning theories such as Edgar Dale's Cone of Experience, which suggests that interactive and visual learning media improve information retention compared to passive printed materials (Dale, 1969).

Several studies in Indonesia have demonstrated that web-based educational interventions significantly improve maternal knowledge, attitudes, and preventive practices related to stunting (Andayani et al. 2024; Senanda et al. 2025). The study Senanda et al., (2025) in the Kebonarum Health Center, Klaten, showed that the Stunting Early Detection (Stulytion) website significantly increased the nutritional knowledge of mothers with toddlers aged 12–59 months, confirming the effectiveness of digital platforms in strengthening maternal understanding of balanced nutrition and early stunting detection. These findings are convincingly reinforced by the study of Andayani et al., (2024) which revealed that web-based educational interventions not only improved maternal knowledge but also positively transformed mothers' attitudes toward stunting prevention, with highly significant results in the intervention group.

Stunting prevention education websites are effective because they provide interactive, evidence-based information that gradually influences mothers' behaviors through repeated exposure to credible health messages. This mechanism can be explained by the Health Belief Model (HBM), a behavioral theory which states that individuals are more likely to adopt healthy behaviors when they perceive a health problem as serious (perceived severity), feel personally at risk (perceived susceptibility), believe that preventive actions will be beneficial (perceived benefits), and recognize that the barriers to action are manageable (perceived barriers). Research in Indonesia has shown that maternal beliefs regarding stunting risk and perceived benefits of preventive action are strongly associated with adoption of healthy caregiving practices (Hendrawati et al., 2023; Masmuri, Nurul Hidayah, 2025).

Website-based stunting education is effective because it is interactive, user-friendly, and scalable, allowing wide reach at low cost through features such as quizzes, gamification, and expert consultation, while progress-tracking tools can strengthen mothers' motivation. However, previous platforms still have limitations, including digital access gaps in rural areas, passive one-way content that reduces retention, and weak follow-up systems due to the lack of personalized reminders, which can slow sustained behavior change (I Made Sudarma Adiputra et al., 2018; Putri et al., 2025).

Based on strong evidence supporting the effectiveness of website-based education, this study developed a stunting education website called "AyoCenting", which was specifically designed to address limitations of previous platforms by integrating interactive infographics, educational videos, consultation services, and monitoring features. The inclusion of counseling and follow-up elements allows mothers not only to receive information but also to discuss concerns, obtain personalized guidance, and monitor progress related to stunting prevention. The purpose of this study was to examine the effect of the AyoCenting website on mothers' knowledge, attitudes, and motivation in stunting prevention.

Method

Study Design and Setting

This study employed a quasi-experimental design with a non-equivalent control group pre-test–post-test approach. The research was conducted between September and October 2024 within the working area of the Kotagajah Public Health Center, Central Lampung District, Indonesia. This design was selected to evaluate the effectiveness of a website-based stunting prevention education platform (AyoCenting) in improving maternal knowledge, attitudes, and motivation, while maintaining the natural flow of community health services.

Population and Sample

The study population consisted of 782 mothers with toddlers residing in the Kotagajah Public Health Center area. Respondents were selected based on the following inclusion criteria: (1) mothers aged 20–45 years, (2) a minimum education level of junior high school, and (3) willingness to provide written informed consent. Exclusion criteria included: (1) not owning an Android-based smartphone and (2) having a chronic or severe illness that hindered participation. The determination of the sample size in this study is based on the formula “Sample size calculation for comparing two proportions” for testing hypotheses of two independent group proportions, as proposed by Sastroasmoro, (2014), requiring a minimum of 126 respondents per group (total N = 252). Proportional random sampling based on village strata was utilized to ensure representative distribution. The sample was distributed across four villages: Kotagajah (50), Kotagajah Timur (36), Purworejo (17), and Sumberrejo (23) for each group.

This formula is considered methodologically robust and representative, as the research design aims to compare the effectiveness of an intervention between an experimental group (the AyoCenting website) and a control group. This formula offers superior accuracy in results by not only considering the confidence level (α) but also incorporating a Power of Test ($Z\beta$) of 90% (Sastroasmoro, 2014). The establishment of this high power refers to the principles of Lemeshow et al., (1990), which state that sound health research must possess sufficient sensitivity to detect real intervention effects in the field, thereby minimizing the risk of Type II errors (failing to detect a difference that actually exists), by incorporating the initial proportion (P1) and the estimated increase in proportion (P2) based on literature reviews, this calculation ensures that the minimum requirement of 126 respondents per group meets the statistical criteria for generalizing the research findings to the population of mothers with toddlers in the Kotagajah Public Health Center service area (Lemeshow et al., 1990).

Intervention Procedures

The intervention group received education through the AyoCenting website. This platform provides structured content, including infographics, educational videos, and articles covering balanced nutrition, complementary feeding (MP-ASI), growth monitoring, and early stunting detection. A key feature of the website is an interactive consultation module, enabling daily monitoring and professional counseling at least once per day. This allowed mothers to discuss real-world challenges and reinforce their understanding throughout the intervention period. The control group received conventional health education through face-to-face lectures and Q&A sessions delivered by health workers at the public health center, following the standard government protocol. Educational activities were conducted gradually in each village to prevent information contamination. Pre-test assessments and initial intervention sessions took place from 12 to 19 September 2024. The post-test assessments were conducted 15 days later, between 26 September and 3 October 2024, following the respective village schedules. This study received ethical exemption approval from the Health Research Ethics Committee of Health Polytechnic Tanjungkarang (No. 270/KEPK-TJK/IV/2023).

All procedures were conducted in accordance with the ethical principles WHO (2011) and the Council for International Organizations of Medical Sciences (CIOMS), (2016) standards. Ethical principles WHO (2011) refer to the WHO Guidance for ethics review of health-related research with human participants, which emphasizes principles such as respect for persons, informed consent, privacy and confidentiality, fair participant selection, and the minimization of risks relative to benefits. In this study, compliance with these standards means that mothers were fully informed about the research, voluntarily agreed to

participate, and their personal data were kept confidential and used only for research purposes (WHO, 2011).

The CIOMS (2016) international ethical guidelines provide a comprehensive framework for health-related research involving humans, including requirements for scientific validity, independent ethical review, informed consent, and protection of vulnerable groups. In this study, adherence to CIOMS (2016) is reflected in clear inclusion and exclusion criteria, respect for mothers' autonomy, protection of children's best interests, and the assurance that the AyoCenting website intervention did not pose unnecessary risks while potentially improving knowledge and motivation for stunting prevention (CIOMS, 2016).

Measurement and Instruments

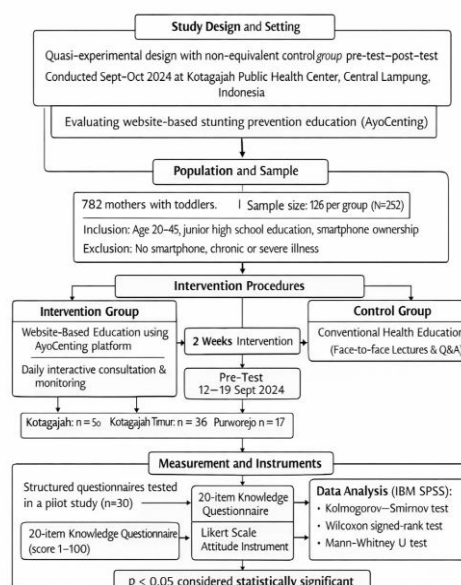
Data were collected using structured questionnaires that underwent prior validity and reliability testing on a similar population ($n=30$). The validity test results confirmed that all items were valid with $r(\text{count}) > 0.361$. Reliability testing yielded a Cronbach's alpha of 0.874 for knowledge, 0.812 for attitudes, and 0.795 for motivation, indicating high internal consistency as all values exceeded 0.60. Maternal knowledge was assessed via a 20-item questionnaire scored from 1 to 100 and categorized (Notoatmodjo, 2014). Attitudes were measured using a Likert-scale instrument and categorized (Azwar, 2022), while motivation was evaluated through a Likert-scale questionnaire to determine low, moderate, or strong motivation levels (Hamzah, 2019).

Data Collection and Analysis

Data collection was performed by trained researchers and assistants. Respondents completed questionnaires under direct supervision to ensure response clarity and completeness. Data were analyzed using IBM SPSS. The normality of the data was initially assessed using the Kolmogorov–Smirnov test, which is suitable for moderate to large sample sizes ($n \geq 50$) to determine whether the data distribution meets the assumptions for parametric testing. If the data had been normally distributed ($p > 0.05$), parametric tests such as the Paired T-test and Independent T-test would have been utilized; the Paired T-test is appropriate for comparing means within the same group before and after an intervention, while the Independent T-test is suitable for comparing means between two independent groups.

However, since the normality testing indicated a non-normal distribution ($p < 0.05$), non-parametric alternatives were employed, as these tests do not assume normal distribution. The Wilcoxon signed-rank test was used for within-group comparisons (pre-test and post-test) because it is the non-parametric equivalent of the Paired T-test, and the Mann–Whitney U test was used for between-group comparisons as the non-parametric equivalent of the Independent T-test. A $p\text{-value} < 0.05$ was established as the threshold for statistical significance.

Figure 1. Flowchart Study Design and Data Analysis



Results

The baseline characteristics of the study participants and their toddlers were summarized in Table 1. A total of 252 respondents participated, with an equal distribution between the intervention and control groups. Mothers were predominantly in the early-to-mid adulthood stage and the majority had completed high school education. Most respondents were housewives with two or fewer children. Regarding toddler characteristics, a significant portion were in the critical age range for stunting intervention. While birth weight was mostly normal, a notable proportion of mothers reported non-exclusive breastfeeding and incomplete immunization.

Table 1. Demographic and Clinical Characteristics of Respondents (N=252)

Characteristics	Intervention (n=126)	Control (n=126)	Total (N=252)	Percentage (%)
Maternal Age (Years)				
20 - 25	22	25	47	18.6
26 - 35	75	73	148	58.7
36 - 45	29	28	57	22.7
Education Level				
Junior High School	25	30	55	21.8
High School	72	68	140	55.6
Higher Education	29	28	57	22.6
Maternal Occupation				
Housewife	92	88	180	71.4
Working	34	38	72	28.6
Number of Children				
≤ 2 children	86	84	170	67.5
> 2 children	40	42	82	32.5
Toddler Age (Months)				
0 - 12 months	28	30	58	23
13 - 24 months	42	40	82	32.5
25 - 36 months	35	38	73	29
> 36 months	21	18	39	15.5
Toddler Gender				
Male	65	62	127	50.4
Female	61	64	125	49.6
Birth Weight				
Low Birth Weight (< 2500g)	12	15	27	10.7
Normal (≥ 2500g)	114	111	225	89.3
Exclusive Breastfeeding History				
Yes	78	75	153	60.7
No	48	51	99	39.3
Immunization Status				
Complete	102	98	200	79.4
Incomplete	24	28	52	20.6

Table 2. Comparison of Maternal Knowledge Before and After Intervention

Group	Category	Pre-test n (%)	Post-test n (%)	p-value*
Intervention (AyoCenting Website)	Poor	95 (75.4)	9 (7.1)	0.001
	Moderate	29 (23.0)	40 (31.7)	
	Good	2 (1.6)	77 (61.2)	
Control (Physical Infographics)	Poor	50 (39.7)	16 (12.7)	0.014
	Moderate	66 (52.4)	73 (57.9)	
	Good	10 (7.9)	37 (29.4)	

*Wilcoxon Signed-Rank Test

Statistical analysis showed significant changes in the distribution of respondents' knowledge categories in both groups. The intervention group experienced a dramatic shift, with a majority of respondents reaching the "Good" category after using the AyoCenting website. The control group also exhibited significant improvement; however, the magnitude of the increase remained considerably lower than that of the intervention group. These results indicated that while both media were effective, the AyoCenting website served as a more powerful tool for knowledge enhancement.



Table 3. Comparison of Maternal Attitudes Before and After Intervention

Group	Category	Pre-test n (%)	Post-test n (%)	p-value*
Intervention (AyoCenting Website)	Non-supportive	84 (66.7)	67 (53.2)	0.003
	Supportive	42 (33.3)	59 (46.8)	
Control (Physical Infographics)	Non-supportive	55 (43.7)	54 (42.9)	0.812
	Supportive	71 (56.3)	72 (57.1)	

*Wilcoxon Signed-Rank Test

The data revealed a significant difference in how the two media influenced respondent support. The intervention group showed a notable increase in supportive attitudes, whereas the control group demonstrated negligible changes. Statistical testing confirmed that the AyoCenting website significantly improved support levels, while physical infographics had no statistically significant impact on changing attitudes. These findings suggested that the digital platform was more effective for fostering supportive behavior.

Table 4. Comparison of Maternal Motivation Before and After Intervention

Group	Category	Pre-test n (%)	Post-test n (%)	p-value*
Intervention (AyoCenting Website)	Low	0 (0)	0 (0)	0.001
	Moderate	23 (18.3)	8 (6.3)	
	Strong	103 (81.7)	118 (93.7)	
Control (Physical Infographics)	Low	0 (0)	1 (0.8)	0.086
	Moderate	23 (18.3)	17 (13.5)	
	Strong	103 (81.7)	108 (85.7)	

*Wilcoxon Signed-Rank Test

The distribution of respondents across motivation categories shifted significantly toward the highest level in the intervention group. In contrast, the change in the control group was minimal and did not reach statistical significance. These results further confirmed that the digital intervention effectively drove respondents toward stronger motivation compared to traditional physical infographics.

Table 5. Comparison Between Intervention and Control Groups

Variable	Group	Mean Rank	Sum of Ranks	U Statistic	p-value*
Knowledge	Intervention	158.42	19961	3916	0.001
	Control	94.58	11917		
Attitude	Intervention	142.15	17911	5966	0.002
	Control	110.85	13967		
Motivation	Intervention	135.6	17086	6791	0.018
	Control	117.4	14792		

*Mann-Whitney U Test

The statistical analysis revealed that the AyoCenting Website significantly outperformed physical infographics across all measured variables. For knowledge, attitude, and motivation, the intervention group consistently achieved higher mean ranks than the control group. Collectively, these results demonstrated that the digital platform was a superior medium for improving maternal knowledge, fostering positive attitudes, and increasing motivation toward stunting prevention.

Discussion

The demographic analysis of 252 respondents indicates a well-balanced distribution between the intervention and control groups, ensuring that the results of this study are minimally influenced by selection bias. The predominance of mothers in the early-to-mid adulthood stage (26–35 years) with a high school education background (55.6%) reflects a population with a mature cognitive capacity and high receptivity to new information. This age range is often characterized by high digital literacy and frequent smartphone usage, which creates a 'fertile ground' for the implementation of website-based health interventions. Furthermore, the significant percentage of toddlers in the critical 13–24 month age group



underscores the urgency of this study, as this period represents a 'window of opportunity' where improved maternal knowledge and practices can directly prevent permanent growth faltering or stunting (P2PTM Kemenkes RI, 2018).

The finding that most respondents were mothers aged 26–35 years with high school education suggests they belonged to a group with sufficient cognitive readiness and digital familiarity, which likely contributed to the effectiveness of the AyoCenting website intervention. Research shows that mothers commonly use smartphones as primary tools for accessing child health information, with a majority reporting regular use of mobile devices to search for and practice health-related knowledge in childcare contexts, indicating that smartphones have become integral to maternal health information behavior in Indonesia. Additionally, studies focusing on digital literacy and maternal technology use indicate that younger mothers (≤ 35 years) tend to exhibit greater comfort and proficiency with digital platforms, including internet browsing and use of online educational tools, compared to older counterparts, reflecting higher confidence and easier adaptation to digital health education. These patterns support the suitability of web-based health education for this demographic, as their existing engagement with smartphones and online resources provides a strong foundation for interactive, technology-mediated learning (Siti Masdah, Ayu Diana Meilantik, Cau Kim Jiu, Amelyadi, 2025).

The research findings reveal a dramatic improvement in maternal knowledge within the intervention group, with the 'Good' category surging from 1.6% to 61.2% ($p < 0.001$). While the control group also showed improvement ($p = 0.014$). The most prominent impact of the AyoCenting website was observed in the knowledge domain, where the intervention group showed a dramatic increase in the proportion of mothers categorized as having good knowledge following the intervention. Prior to the use of the AyoCenting platform, the majority of mothers were classified as having poor knowledge. After exposure to the web-based educational content—including interactive infographics, educational videos, and structured modules—the proportion of mothers achieving good knowledge increased substantially. This suggests that digital platforms such as AyoCenting provide a more effective medium for conveying complex health information compared to static materials. Evidence from systematic reviews indicates that digital patient education tools, especially those using text and image illustrations or video content, consistently result in significant improvements in patient knowledge outcomes, particularly in maternal health contexts (Schnitman et al., 2022).

One reason web-based education may outperform physical infographics is its ability to support repeated and self-paced learning, which enhances cognitive processing and retention of information. Unlike traditional printed media that present information in a single, fixed format, digital platforms allow learners to revisit materials, engage with multimedia content, and interact with educational modules as needed. Studies of various digital education interventions, including video-based and interactive online content, have reported significant increases in knowledge across diverse health topics—for example, maternal reproductive health and nutrition education—when compared to traditional formats. In addition to these cognitive advantages, the presentation of web-based content can reduce information overload and improve comprehension through the use of visually engaging and concise formats. Reviews of maternal health information delivery report that clarity, engaging presentation, and multimedia integration are key to enhancing understandability and retention, leading to deeper learning and more effective knowledge uptake (Li et al., 2025; Tanjung et al., 2025).

A pivotal finding in this study is the contrast in attitudinal shifts between the two groups. The intervention group demonstrated a significant increase in supportive attitudes ($p = 0.003$), whereas the control group remained statistically stagnant ($p = 0.812$). The significant increase in supportive attitudes toward stunting prevention observed in the AyoCenting website group but not in the control group highlights the importance of how information is delivered, not just what information is delivered. While physical infographics can effectively present facts, they lack the dynamic interaction and reinforcement mechanisms that digital platforms provide. This pattern aligns with findings from digital health research showing that multimedia and interactive education formats based on established behavior change frameworks can more effectively influence personal beliefs and intentions. For example, a quasi-experimental study using web-based education in stunting prevention found significant improvements in both knowledge and attitudes among mothers exposed to interactive online content versus standard methods, supporting the superior influence of digital media on attitude change (Andayani et al., 2024).



The observed difference between knowledge acquisition and attitudinal transformation can be explained by the Health Belief Model (HBM), a widely used theoretical framework in health education. According to the HBM, attitude and behavior change depend on individuals' perceptions of the benefits of an action, their confidence (self-efficacy) in performing it, and the presence of cues that motivate action. The model's constructs such as perceived benefits, cues to action, and self-efficacy are particularly relevant to understanding how digital platforms influence attitudes because they engage users repeatedly and interactively. The HBM has been applied in diverse health behavior research, including vaccination campaigns and preventive behaviors, demonstrating that enhancing perceived benefits and providing actionable cues can shift attitudes more effectively than passive information delivery (Alyafei A, 2024).

Moreover, studies investigating multimedia education based on HBM principles have shown that interactive, theory-driven digital interventions can lead to significant increases in attitude scores toward preventive behaviors. For instance, research on multimedia Health Belief Model-based education among pregnant women revealed significant improvements in constructs related to perceived benefits, self-efficacy, and motivation, which translated into positive changes in attitudes and intended behaviors. This supports the idea that digital platforms like AyoCenting through multimedia content and interactive features such as consultation can provide the necessary cues to action and reinforcement that encourage attitude change more effectively than static media (Shakerinejad et al., 2023).

Maternal motivation, the primary driver for health-seeking behavior, showed a highly significant enhancement in the intervention group ($p = 0.001$), reaching a 'Strong' level of 93.7% post-intervention. In contrast, the control group's motivation did not undergo significant change ($p = 0.086$). This pattern aligns with broader evidence indicating that digital health education and interactive platforms are effective in enhancing motivation and sustained behavior change. Systematic reviews and recent research on digital health interventions highlight that tools incorporating behavior change features, such as feedback, reminders, and personalized content, are frequently associated with improvements in motivational and health behavior outcomes. For instance, digital health studies designed to promote healthy behaviors through mobile apps and multimedia education have documented consistent increases in behavioral engagement and internal motivation among participants exposed to interactive content compared to those receiving static information (Shaluhayah et al., 2025).

One mechanism by which digital platforms enhance motivation is through self-efficacy and personalized engagement. Research has demonstrated that digital health literacy and interactive content strengthen confidence and belief in one's ability to perform health behaviors. Specifically, studies have shown that when individuals engage with web-based educational tools, their self-efficacy increases, which subsequently activates motivation and intention to take action. This mechanism suggests a pathway where digital competence and ease of use translate into greater confidence and behavioral commitment, reinforcing the motivational drive necessary for sustained preventive practices (Zhou et al., 2025).

Furthermore, systematic evaluations of digital health interventions note that behavior change techniques embedded in digital tools can directly influence both motivation and engagement, particularly when platforms provide continuous prompts or tailored interactions. Digital interventions that combine educational content with interactive features and professional support—such as daily consultation or progress monitoring—help users feel more supported and capable, contributing to stronger motivation. These findings underscore the value of digital platforms like AyoCenting in fostering not only knowledge and attitude change but also the internal motivational factors critical for long-term adoption of health behaviors, compared to traditional passive media like physical infographics (Er et al., 2026).

Comparative Effectiveness Analysis final stage of the statistical analysis, using the Mann-Whitney U test as shown in Table 5, provides conclusive evidence of the superiority of the AyoCenting website over conventional physical infographics. The results indicate a highly significant difference in post-test outcomes for knowledge ($p = 0.001$), attitude ($p = 0.002$), and motivation ($p = 0.018$) between the two groups. The substantially higher Mean rank in the intervention group across all variables confirms that the digital platform's interactive and multi-sensory approach creates a more profound impact on maternal empowerment than static media. This finding is consistent with broader evidence showing that interactive health education models, which encourage greater user engagement and participation, tend to produce stronger improvements in knowledge and behavioral determinants than traditional met-

hods. For example, a quasi-experimental study found that interactive health education led to significantly greater increases in community knowledge and positive attitudes compared to traditional health education approaches (Sidabutar et al., 2023).

Moreover, systematic reviews highlight the effectiveness and wide applicability of digital education tools in maternal health, demonstrating that such platforms frequently lead to significant gains in maternal health outcomes, including behavior change and emotional engagement. In a review of digital patient education used in maternal health, the majority of studies reported significant improvements in knowledge, emotional benefits, and behavioral changes following digital education interventions. These patterns support the idea that digital platforms like AyoCenting by integrating multimedia, repeated access, and interactive features can more effectively enhance cognitive, attitudinal, and motivational outcomes than static print media alone. Such findings reinforce the value of incorporating web-based tools into primary health education strategies to maximize both learning and practical adoption of health behaviors (Schnitman et al., 2022).

Overall, this study underscores the potential of website-based health education as an effective and scalable strategy for stunting prevention. By combining evidence based content, interactive features, and continuous consultation, the AyoCenting website addresses key limitations of traditional educational media. The findings suggest that integrating digital platforms into primary health care services may strengthen maternal capacity to prevent stunting and support long-term child health outcomes.

Conclusions

The AyoCenting website was significantly more effective than physical infographics in improving maternal knowledge, attitudes, and motivation toward stunting prevention. These findings suggest that interactive and multimodal digital education can enhance maternal empowerment across diverse demographic backgrounds. Strengthening nurse-led digital interventions and adopting family-centered approaches are essential strategies to support sustainable stunting prevention and child development outcomes.

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