

The "ROSHE" Nutrition Education Model for Families in Stunting Prevention Efforts

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ARTICLE INFO	ABSTRACT
Manuscript Received: 01 Dec, 2025 Revised: 25 Jun, 2026 Accepted: 12 Jul, 2026 Date of Publication: 16 Jul, 2026 Volume: 9 Issue: 7 DOI: 10.56338/mppki.v9i7.9423	Introduction: Stunting is a growth disorder in children caused by chronic undernutrition, recurrent infections, and inadequate psychosocial stimulation. A child is classified as stunted when their height-for-age falls more than two standard deviations below the median of the Child Growth Standards. Stunting has serious short-term consequences, including impaired brain development, reduced intelligence, delays in physical growth, and metabolic disturbances. In the long term, it contributes to decreased cognitive and learning performance, weakened immunity, and greater susceptibility to illness. Methods: This study aimed to develop and analyze the impact of implementing the ROSHE nutrition education model on the cognitive abilities and attitudes of families in preventing stunting. The research utilized a Research and Development (R&D) design guided by the ADDIE approach to create the "ROSHE" educational model for families. Data collection involved needs analysis, one-to-one testing, and small-group testing through interviews and observations, while field testing employed validated pre-test and post-test questionnaires. The initial phase focused on analyzing stunting-related issues, followed by contextual and literature-based data gathering relevant to family-centered stunting prevention efforts. Results: During the design stage, the Health Belief Model served as the primary theoretical foundation, integrated with the Social Cognitive Theory (SCT) and the Technology Acceptance Model (TAM). This integration produced a conceptual framework for the initial version of the ROSHE model, which was validated by three experts in information technology, educational technology, and nutrition science. One-to-one and small-group evaluations indicated that the model was easy for families of stunted children to use. Field test results demonstrated an increase in average knowledge and improvements in attitudes after the intervention. The Wilcoxon test yielded a p-value of 0.000, indicating a significant difference in knowledge and attitude changes before and after participation. Conclusion: The ROSHE nutrition education model effectively enhances family knowledge and attitudes in efforts to prevent stunting.
KEYWORDS	
ROSHE Nutrition Education Model; Stunting; Knowledge; Attitude	

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INTRODUCTION

Stunting is a growth and developmental disorder experienced by children as a result of poor nutrition, recurrent infections, and inadequate psychosocial stimulation (1). Children are classified as stunted when their height-for-age is more than two standard deviations below the median of the Child Growth Standards. Globally, the prevalence of stunting among children under five is high, with Asia accounting for 50% of cases in 2018. In Mongolia, the prevalence was 6.1% in 2020, while in Uganda it reached 29% in 2021 (2).

According to the 2018 National Basic Health Research (RISKESDAS), Indonesia's stunting prevalence among children under five was 30.8%, placing the country fifth in the world for malnutrition (3). Jambi Province recorded a prevalence of 21.03%, ranking sixth nationally. Other regions with high prevalence include West Sulawesi (48%), Probolinggo (49.43%), Bogor (25.6%), and Jambi (21.03%) (4). The 2022 Indonesian Nutrition Status Survey (SSGI) reported a national prevalence of 21.0%. Although the nutritional problems, particularly stunting, in Jambi Province have quantitatively shown a decline compared to the previous year, there has actually been no significant improvement in the quality of nutrition and stunting management (5).

In 2013, the prevalence of stunting in Tanjung Jabung Timur Regency was recorded at 49%. This figure decreased to 40.9% in 2018 and experienced a sharp decline in 2020 to 7.11%, then slightly decreased again to 7.0% in 2021 (6). In the same year, Geragai Subdistrict recorded the highest stunting prevalence at 24.58%, an increase from 19.07% in 2020 (7).

At the village level, Rantau Karya Village recorded the highest stunting rate at 37.7%, followed by Suka Maju Village at 30.4%, Lagan Ulu Village at 28.6%, and Pandan Sejahtera Village at 27.0%. Tanjung Jabung Timur Regency is one of the areas in Jambi Province designated as a stunting-handling locus. The villages identified as stunting loci in 2022 include Sungai Tering, Pandan Sejahtera, Pemusiran, Nibung Putih, Rawa Sari, Kota Raja, Rano, Kota Baru, Catur Rahayu, and Rasau Desa. Therefore, it can be concluded that Pandan Sejahtera Village is included in the list of stunting-locus villages for 2022 (8).

Based on the results, the educational intervention based on the HBM improved the knowledge and feeding behavior of mothers and improved Growth Disorders of child. This study showed the educational intervention based on the HBM improved Hence, this model can act as a framework for designing and implementing educational interventions for prevention of growth disorders in 6–12 month children. Monitoring the regular growth of children from birth, increasing public knowledge through mass media, and involving husbands play an important role in preventing growth disorders. However, to accurately assess the success and survival rates, further studies on mothers of children with short stature (indicating chronic malnutrition) or mothers of children with growth disorder over one year of age (given that the effect of food compared to breast milk on child growth increases after one year of age) are highly recommended (9).

Findings from research conducted by (10) show that the use of booklet media in nutrition education for mothers can improve their understanding of child nutrition. This finding is consistent with (11), who stated that nutrition education delivered through booklet methods can increase mothers' knowledge levels. Compared to other media, booklets have two main advantages: they can be studied at any time because they are in book form, and they are able to contain more comprehensive information. The use of booklets as a health education medium is considered effective because it can disseminate information in a relatively short amount of time, thereby improving the knowledge of pregnant women. Mothers who possess good nutritional knowledge tend to be more capable of optimally fulfilling their children's nutritional needs (12).

This is in line with a study by (13), who developed a mobile application to provide nutritional knowledge to parents. Although the application demonstrated potential in improving understanding of nutrition, the study did not specifically target interventions during the first one thousand days of life, which is a critical period for child growth. In addition, the application was not designed to reach the broader community in efforts to prevent stunting. These findings indicate an opportunity to develop a more targeted mobile application focusing on nutrition education and stunting prevention, particularly for mothers and young children in Indonesia. This is in line with research conducted by Nurcahyanti et al, which researched the effectiveness of using the mobile application "stunting mobile" in increasing the understanding of parents, especially mothers, regarding the need for food intake to prevent stunting. The research results show a significant increase in knowledge after education through this

application, thus proving that the use of mobile applications can be an effective nutrition education medium in the context of stunting prevention (14).

Although previous studies have reported the effectiveness of booklets and mobile applications in improving nutrition knowledge, most interventions focused only on information delivery and did not integrate behavioral change theories, self-assessment, growth monitoring, and interactive learning features within a single platform. Therefore, development of a comprehensive digital nutrition education model remains necessary.

METHOD

The method used in this study was a mixed-methods approach, which integrates qualitative and quantitative research designs within a single, unified study. The qualitative component focused on the process of conceptualizing the nutrition education model for families in stunting prevention, while the quantitative component involved field trials applying the developed educational model. Design and development research that emphasizes the process of developing the conceptual model and product is more oriented toward qualitative research, whereas design and development research that examines the impact of using the model or product is more oriented toward quantitative research (15).

The ADDIE model is a systematic and structured framework used to organize the sequence of activities in design and development research. The ADDIE framework can be fragmented according to the stages required by the researcher. This study aims to develop a nutrition education model for families in an effort to prevent stunting. The research design used in this study refers to the ADDIE model as described by (15). The ADDIE model consists of five stages for developing a product: analysis, design, development, implementation, and evaluation.

The product developed in this study is a tool that contains a nutrition education model for stunting prevention, accessible anytime and anywhere, named ROSA Health Education (Registration, Overcome, about Stunting, and Apply). The contents of the developed product include educational materials related to nutrition for stunting prevention, quizzes to assess knowledge, analysis or measurement results of height and age, as well as animated videos about nutrition and stunting prevention. The “ROSHE” nutrition education model for families in preventing stunting is implemented as illustrated in the diagram below:

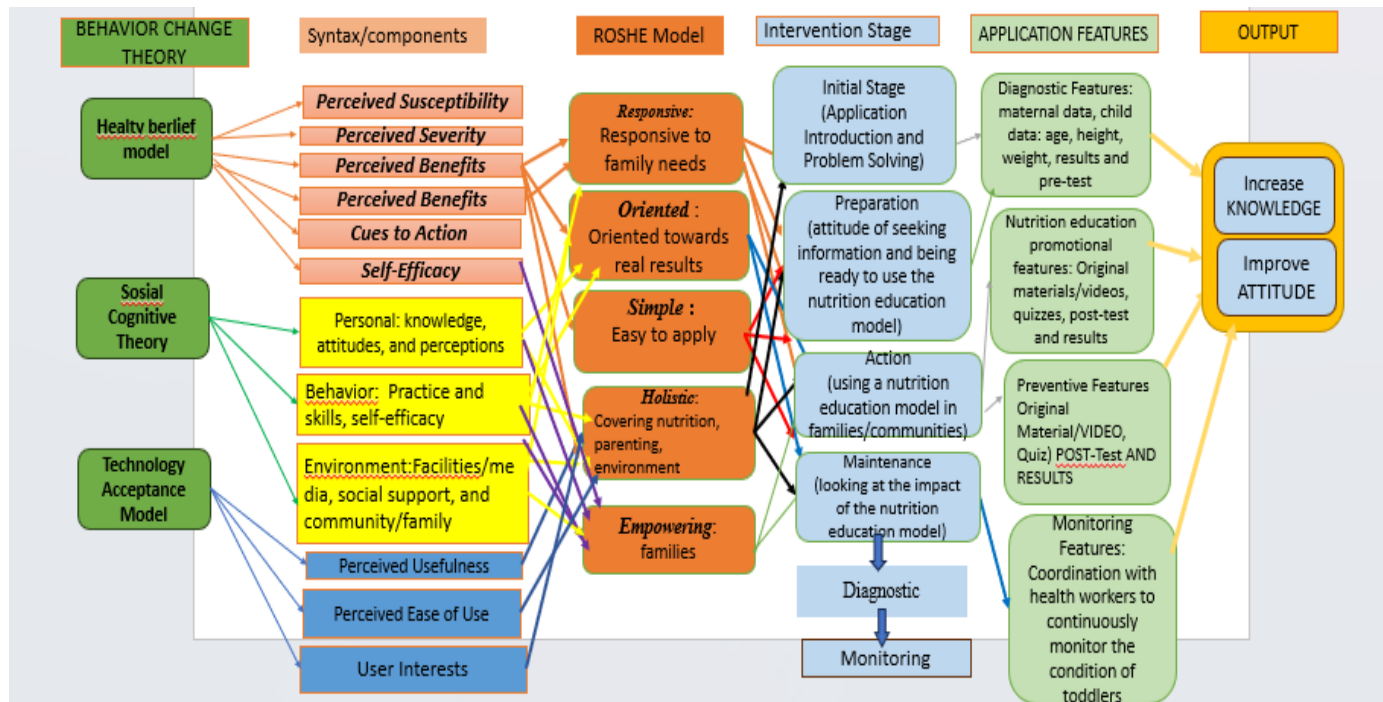


Figure 1. Construct for the Implementation of the “ROSHE” Nutrition Education Model

Research Location

This study was conducted in Tanjung Jabung Timur Regency, Jambi Province, Indonesia. Despite a gradual decline, stunting prevalence in the region remained consistently above 20% from 2018 to 2021, indicating a continued public health concern requiring targeted intervention. Tanjung Jabung Timur Regency is served by several primary health care centers (puskesmas), each responsible for community health services within their designated catchment areas.

For the purposes of this study, three primary health care centers areas with persistently high stunting rates were purposively selected: the Dendang Health Center area, the Nibung Putih/Muara Sabak Barat Health Center area, and the Kampung Laut Health Center area. These locations were identified based on regional health surveillance data indicating higher-than-average stunting prevalence compared with other sub-districts within the regency.

Ethical Approval

This study has received ethical approval from the Health Research Ethics Committee (Approval Number LB.02.06/2/1145/2024); therefore, all research procedures were conducted in accordance with applicable ethical principles.

RESULTS

Results of the Development of the “ROSHE” Nutrition Education Model

This study employed a research and development (R&D) design, utilizing a mixed-methods approach that integrated both quantitative and qualitative data analysis techniques. The primary product developed in this research was the “ROSHE” nutrition education model designed for families as a strategy to prevent stunting. The ROSA Health Education (ROSHE) model was created using the ADDIE development framework, incorporating learning theories, behavior change theories including the Health Belief Model (HBM), Social Cognitive Theory (SCT), and the Technology Acceptance Model (TAM) as well as the stages of the Transtheoretical Model. The purpose of this integration was to improve knowledge, attitudes, and nutritional practices among mothers of young children, particularly in making appropriate dietary choices and understanding stunting. The learning theories applied in this study are closely related to the behavior change theories employed, particularly the Health Belief Model (HBM), which consists of several key constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. These constructs served as the foundation for designing the educational components within the ROSHE model. The development model used in this study was the ADDIE model by Dick and Carey (1996), which consists of five stages of development ([16](#)), namely:

Analyze

The analysis conducted by the researchers consisted of a needs analysis and a context analysis. The needs analysis was carried out through interviews with experts, including the Head of the Nibung Putih Polindes, the nutrition officer at the Kampung Laut Public Health Center, and midwives responsible for the stunting program. The results of this analysis indicated that current stunting-related activities primarily include routine posyandu examinations, the provision of supplementary food (PMT), and physical assessments from pregnancy through early childhood, followed by documentation of the findings. Educational activities were provided only in response to specific complaints and were not implemented regularly, particularly with regard to nutrition education aimed at preventing stunting. The context analysis was conducted using an online survey distributed via Google Forms. From the 18 respondents, all expressed agreement regarding the development of a nutrition application, and it was noted that no such application had been previously used, except for certain tools accessible only to specific health workers.

Design

Table 1. Storyboard of the “ROSHE” Nutrition Education Model

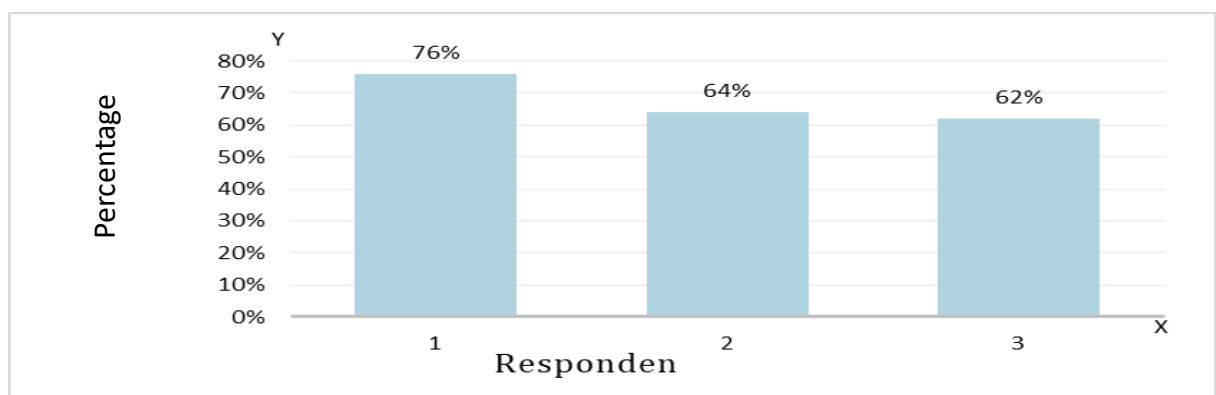
Step	Description	Action
1. Opening the Application	Access or download the ROSA Health Education application using the provided link.	Click LOGIN
2. Register / Create New Account	Fill in the registration form to create a new user account.	Click REGISTER
3. Login to the Application	Enter username and password to access the system.	Click LOGIN
4. Diagnostic Menu / Stunting Check	Input required data: mother’s name, child’s name, height/length, age, sex.	Click CHECK
5. Results	System displays: stunted / severely stunted / normal.	Click NEXT
6. Pre-test Menu	Complete Knowledge and Attitude assessments and view results.	—
7. Promotive (Education) Menu	Access educational content on nutrition, stunting, and animated videos.	Click NEXT
8. Post-test Menu	Complete Knowledge and Attitude post-tests and view results.	—
9. Final Menu	Displays comparison of pre-test and post-test outcomes.	Click FINISH
10. Logout	Exit the application.	Click LOGOUT
11. Admin Menu	Admin login to access monitoring and respondent database.	Login (admin/admin123)

Development

The validation process for this study involved three independent experts: a content/concept specialist, a technology expert, and an instrument specialist. Each expert evaluated the appropriateness, accuracy, and feasibility of the components incorporated into the ROSHE nutrition education model application for family-based stunting prevention. Several iterative revisions were carried out based on the experts’ feedback. Upon completion of these revisions, all experts concluded that the model met the required standards of validity and was therefore suitable to be implemented in the field trial phase with respondents.

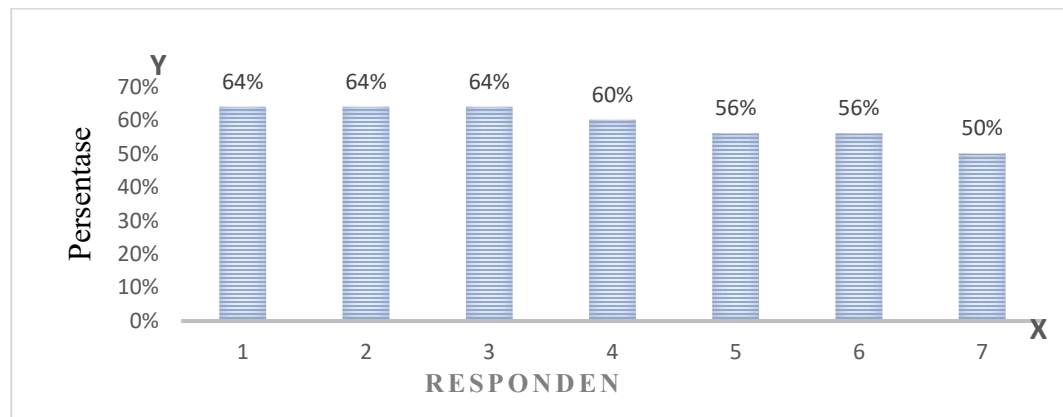
Implementation

One-to-one tryout



Based on the findings illustrated in Diagram 1, the one-to-one evaluation demonstrated that the majority of respondents rated the nutrition education media as “highly satisfactory” (>67%), while the remaining two respondents provided a “satisfactory” rating (>60%). These results indicate that the application was well-received and could be navigated effectively by users. Overall, the one-to-one tryout suggests that the nutrition education model is user-friendly, and its procedures are clear, accessible, and easy for respondents to comprehend.

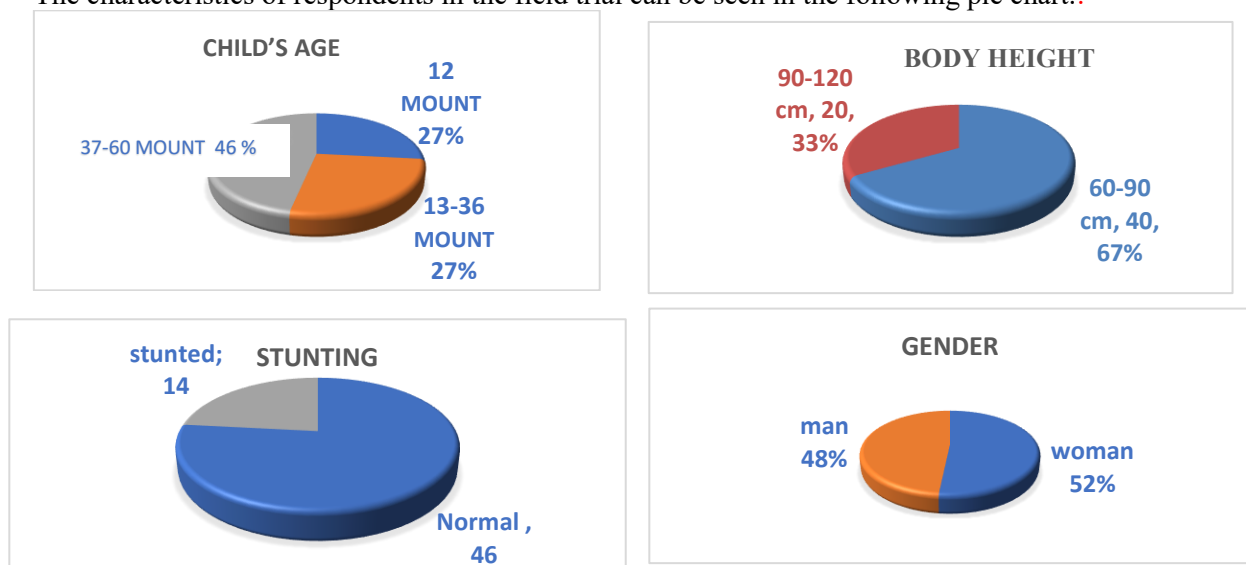
Small-group tryout



The results presented in the figure indicate that the small-group tryout (diagram 2) yielded an average score of 59%, suggesting that the application was generally well-accepted, easy to operate, and perceived to be of good quality. However, three respondents scored below the average threshold (<59%). Field observations revealed that these respondents required additional guidance when using the application, primarily because they were unfamiliar with this type of digital media and were using such an application for the first time. These findings highlight the importance of considering users' digital literacy levels when implementing technology-based educational interventions.

Field trial

The characteristics of respondents in the field trial can be seen in the following pie chart.:



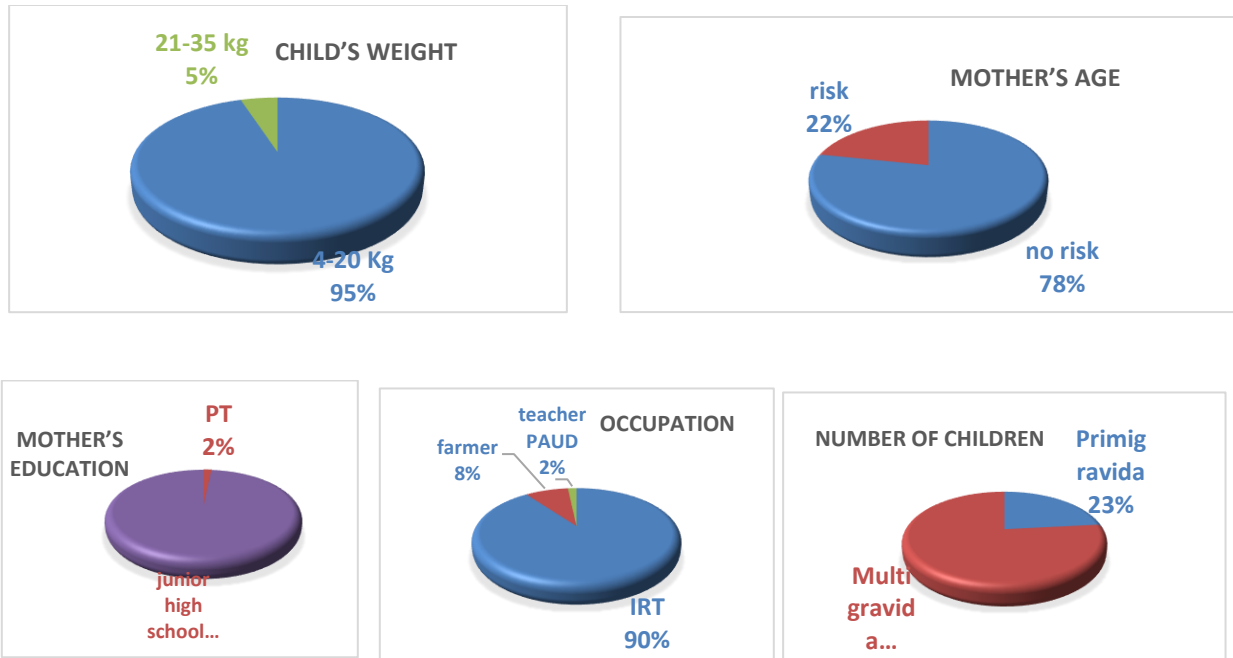


Table 2. Bivariate Analysis of Knowledge and Attitude Domains

Domain	Data normality (p)	Average pretest-posttest score	Average value of difference	P	G
Knowledge					
1. Pre-test	0,034	60.17		0.000	0,6
2. Post-test	0,000	82.75	20.58		
Attitude					
1. Pre-test	0,318	60.12	12,76	0.000	0,6
2. Post-test	0,000	72.88			

The field trial showed that prior to the implementation of the nutrition education model, the average knowledge score was 60.17. During the pretest, mothers demonstrated limited understanding of stunting and were still uncertain about the appropriate age for breastfeeding, the correct age to introduce complementary feeding, the types of suitable foods, and the nutritional content required for young children. Field observations also revealed inappropriate feeding practices, such as a child being given rice with grilled meatballs or processed sausages, accompanied by tea or packaged drinks, and another infant being fed bananas before six months of age.

Following the intervention, there was a significant increase in the mothers' average knowledge score to 80.75, with a mean difference of 20.58 ($p = 0.000$). After the intervention, mothers showed improved understanding of stunting, the recommended age for exclusive breastfeeding, the appropriate timing for introducing complementary feeding, suitable types of foods, and the nutritional composition needed to ensure balanced nutrition for their children. In the attitude domain, the findings indicated that prior to the implementation of the nutrition education model, the average attitude score was 60.12. At this stage, mothers of young children were still unsure about the appropriate foods to provide for stunted children, the recommended portion sizes, the types of foods that should be introduced, and how to create variety in meals to ensure adequate and balanced nutrition. In addition, some mothers rarely—or in certain cases, never—brought their children to the posyandu to monitor growth and development. Following the implementation of the model, there was a significant increase in the average attitude score to 72.88, with a mean difference of 12.76 ($p = 0.000$). After the intervention, mothers demonstrated a better understanding of the importance

of dietary diversity for young children and reported increased motivation to visit the health center or posyandu regularly for monthly growth and developmental monitoring of their child.

The n-gain test was conducted to determine whether the use or implementation of a particular method can be considered effective. The n-gain categories are as follows: $g < 0.3$ (low), $g \leq 0.7$ (moderate), and > 0.7 (high). Based on these categories, the results of the bivariate analysis (Table 5.5) show that the domain obtained an n-gain value of 0.6 (< 0.7), which falls into the moderate category, indicating that the method used demonstrated moderate effectiveness in the intervention.

Evaluation

Impact of the “ROSHE” Nutrition Education Model in the Field Trial

The findings of this study demonstrate that the ROSHE nutrition education model effectively improved mothers' knowledge and attitudes related to stunting prevention. Before the intervention, the majority of mothers exhibited limited understanding of key nutritional concepts, improper feeding practices, and insufficient awareness of the risks and long-term consequences of stunting.

This is in line with research by Risna et al. that nutrition education has been proven effective in improving maternal knowledge and behavior and preventing stunting in toddlers (17). This initial condition aligns with previous studies showing that inadequate maternal knowledge and suboptimal feeding behaviors are major contributors to stunting in low-resource settings.

According to research by Siti Hardiyanti et al entitled Effectiveness of Family Nutrition Education on the Incidence of Stunting: Systematic Review, family nutrition education can increase knowledge and understanding of diet and nutrition for toddlers, family nutrition education followed by training can further improve behavior in providing healthy nutrition for toddlers (18).

The significant increase in post-intervention knowledge and attitude scores ($p = 0.000$) indicates that the educational content and delivery of the ROSHE model were successful in facilitating learning. The n-gain score of 0.6, classified as moderate effectiveness, suggests that while the intervention did not achieve the highest possible level of behavioral shift, it produced substantial cognitive and perceptual improvements. These findings confirm that digital, structured, and theory-driven interventions can be effective tools for strengthening early childhood nutrition practices.

The theoretical foundation underlying ROSHE, primarily the Health Belief Model (HBM), Social Cognitive Theory (SCT), and the Technology Acceptance Model (TAM) played an essential role in shaping the learning experience and behavioral outcomes. The observed improvements align with key HBM constructs. Increased perceived susceptibility and severity helped mothers recognize the vulnerability of their children to stunting and understand its lifelong consequences. Enhanced perceived benefits and reduced perceived barriers contributed to a greater likelihood of adopting appropriate feeding practices, while the digital features served as cues to action, prompting mothers to reflect on and modify their behavior.

The SCT components further strengthened learning outcomes. The inclusion of animated videos, practical examples, and interactive assessments supported observational learning, enabling mothers to visualize appropriate feeding practices and compare them with their own. The system's feedback mechanisms enhanced self-efficacy, giving mothers confidence that they could apply the recommended practices within their daily routines.

TAM concepts were also evident in respondents' acceptance and use of the ROSHE application. Despite some participants requiring guidance due to limited digital literacy, overall usability and perceived usefulness remained high. Mothers reported that the application was easy to navigate, the information was clear, and the digital format increased accessibility compared to conventional counseling methods. This indicates that technology-based interventions can complement existing health services, especially in rural or underserved communities.

According to research conducted by Feny Ditya et al. Implementation of effective stunting prevention interventions must be multisectoral and include family planning, premarital couples and women with early pregnancies as the main target focus for stunting prevention (19). Additionally, field observations highlighted behavioral changes that extended beyond test scores. After the intervention, mothers demonstrated better decision-making related to complementary feeding, selection of nutrient-dense foods, and consistent growth monitoring visits

to the posyandu. These behavioral shifts underscore the effectiveness of combining theoretical frameworks with practical, user-friendly digital tools (20).

The materials on nutrition for stunting prevention, the knowledge assessment quizzes, the analysis of height–age measurements, and the animated videos on nutrition and stunting prevention are directly related to improving mothers’ knowledge and influencing their attitudes toward preventing stunting (21). A study conducted in India reported that mothers who received educational interventions on stunting demonstrated increased understanding of stunting and the strategies for its prevention in young children (22). Providing accurate information to mothers and caregivers is essential in education and social support, as it ensures clear and consistent reference materials and helps prevent misinformation within families and communities regarding appropriate feeding practices for young children (23).

The “ROSHE” nutrition education model application offers interactive learning materials, texts, images, videos, and quizzes that facilitate users’ comprehension and processing of information. This approach promotes conceptual understanding rather than mere memorization. Repetition of content, practice through quizzes, and immediate feedback within the application help strengthen users’ cognitive structures. As a result, this model has effectively enhanced the knowledge of mothers with young children by supporting an active and meaningful learning process that can be directly applied in daily caregiving practices.

In line with the study by (24), maternal knowledge significantly increased after receiving nutrition education through interactive digital media containing text, images, videos, and quizzes. This improvement in knowledge is attributed to several factors: the interactivity of the media, which encourages mothers to engage actively in the learning process rather than passively receiving information; the use of visualizations and practical examples (images/videos), which helps mothers understand nutritional concepts more concretely and retain information more easily; immediate feedback from quizzes, which reinforces understanding and corrects misconceptions; and repeated exposure to the material within the application, which strengthens long-term memory retention.

This interactive and engaging learning process makes the educational experience more meaningful, thereby increasing mothers’ motivation to understand the content deeply. In addition, according to research conducted by Rosnah et al., the implementation of counseling to increase nutritional knowledge in mothers of toddlers has proven to be effective, especially in implementing balanced nutrition in the 1000 HPK and the use of local food in efforts to prevent stunting (25).

Therefore, it can be concluded that the improvement in knowledge occurs because interactive educational media facilitate active, engaging, and meaningful learning, which strengthens mothers’ conceptual understanding of nutrition and stunting prevention (26).

DISCUSSION

The development of the “ROSHE” nutrition education model for families in stunting prevention serves as a monitoring tool that enables mothers to track their children’s growth and development, as well as to apply the guidance provided within the application. This represents new knowledge synthesized from several health behavior theories and developed through a process aligned with the ADDIE intervention model proposed by Dick, W., Carey, L., & Carey (25). In summary, the integration of HBM, SCT, and TAM within the ROSHE model provides a robust and comprehensive approach to influencing maternal knowledge, attitudes, and behavior. The moderate n-gain results, along with significant pretest–posttest improvements, confirm that the model is effective and has strong potential for scalability. These findings support the continued development and implementation of digital nutrition education interventions to reduce stunting, particularly in regions with limited access to in-person counseling and health education services. A limitation of this study is that the implementation of the ROSHE Nutrition Education Model was confined to families in a single study area; therefore, generalizing the findings to a broader population requires caution. Furthermore, the model’s effectiveness was evaluated based on changes in knowledge and attitudes following the intervention, meaning it does not yet capture long-term behavioral changes or the impact on reducing the incidence of stunting. The use of an Android-based application requiring internet access may also limit its implementation among communities with limited access to devices and network connectivity.

CONCLUSION

The development of the “ROSHE” nutrition education model for families in stunting prevention produces several conclusions, as follows:

Development of the Education Model

The development of the education model used the Research and Development (R&D) method, following a systematic development procedure that resulted in a family-based stunting prevention education model named “ROSHE.” The model was declared feasible by three expert validators: an information technology expert, an educational technology expert, and a nutrition science expert. The “ROSHE” model was subsequently tested through several stages: a one-to-one tryout with 3 respondents, a small-group tryout with 7 respondents, and a field trial involving 60 respondents.

Stages of the “ROSHE” Education Model

One of the novelties of this study is the development of the “ROSHE” education model, which consists of structured stages for implementing health education interventions. The stages are as follows:

Community health workers (kader) and health personnel responsible for mothers with young children are invited to the health center (puskesmas).

Introduction and explanation of the purpose of the meeting, followed by the presentation of the “ROSHE” product to community health workers and health personnel responsible for mothers with young children for the implementation of the research activities. For respondents who are unable to attend, the researcher, together with health personnel and community health workers, will visit the respondents at their homes.

Conducting a pre-test to assess the respondents’ baseline knowledge and attitudes using the application. After completing the pre-test, respondents proceed through the following stages: 1) Precontemplation stage. 2) Contemplation (information-seeking) stage. 3) Preparation stage. 4) Action stage. 5) Maintenance stage.

Features available in the “ROSHE” application: 1) Promotive feature. 2) Preventive feature. 3) Diagnostic feature. 4) Monitoring feature.

The impact of using the “ROSHE” nutrition education model on families as a stunting prevention effort is demonstrated by an increase in knowledge, as shown by the comparison of pre-test and post-test results. The findings indicate a significant difference in mean knowledge scores, with a p-value of 0.000.

The impact of using the “ROSHE” nutrition education model on families as a stunting prevention effort is also reflected in the improvement of respondents’ attitudes, as evidenced by the comparison of pre-test and post-test results, showing a significant difference with a p-value of 0.000. The study further shows that the ROSHE model successfully improved family attitudes toward stunting prevention, enabling them to better understand what stunting is, its consequences, its characteristics, nutritious foods, the impact of nutrition, and the efforts required to provide adequate nutrition for young children.

AUTHOR CONTRIBUTIONS

The author contributed to the conceptualization of the research, the development of the ROSHE nutrition education model, the formulation of the methodology, data collection and analysis, interpretation of results, and manuscript writing, and approved the final version of the article for publication.

CONFLICT OF INTEREST

The authors declare no conflict of interest regarding the research or publication of this article.

STATEMENT ON THE USE OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES

The author used generative AI technology solely to assist with language editing and improving the manuscript's readability. The author bears full responsibility for all research ideas, data collection and analysis, interpretation of results, and the scientific content of the article.

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