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Digital Education Innovation to Accelerate Stunting Reduction: An Experimental Study of Nutrition Class Mentoring Through SIGINTING

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ABSTRACT

Stunting is a priority problem in Indonesia because it inhibits child growth and development, reduces intelligence, increases the risk of disease, and negatively impacts productivity and the nation's economy. Therefore, stunting prevention is included in the government's Asta Cita program to improve the quality of human resources. However, there is still a gap in the use of technology and monitoring of child growth and development in mothers with stunted children, so that innovative interventions in the SIGINTING application are needed to strengthen the nutritional information system and increase the effectiveness of mentoring and follow-up of stunting cases. The purpose of this study was to improve mothers' knowledge, attitudes, and skills in reducing stunting through nutrition class mentoring with digital educational innovations through the Stunting Response Information System Application (SIGINTING). This type of research is a Quasi-experimental study with a pre-test-post-test control group design, with a sample size of 84 people in each group. The sampling technique used stratified random sampling. Data analysis used the Wilcoxon test. The results showed that the mean value of the level of knowledge before the intervention in the treatment group was 68.7 and after the intervention became 88.79 with a p-value of 0.000. Meanwhile, the mean value of mothers' attitudes before the intervention in the treatment group increased from 64.14 to 74.11 with a p-value of 0.000. The mean maternal skills score before the intervention was 70,64, increasing to 88,79 after the intervention, with a p-value of 0.000. The combination of nutrition class support and the use of the SIGINTING application has proven effective in improving maternal knowledge, attitudes, and skills in reducing stunting rates. Recommendations include implementing regular nutrition classes for mothers of toddlers and utilizing the SIGINTING application as a digital educational medium.
Keywords : Stunting; Mentoring; Nutrition Class; Education; Application

INTRODUCTION

Stunting, a condition of stunted growth caused by chronic malnutrition from an early age, is one of the most significant obstacles to global human development (1). The World Health Organization (WHO) reported that in 2022, the prevalence of stunting reached 22.3%, or 149.2 million children worldwide, with 21.8% of these children living in Asia. The largest region in Asia is South Asia at 30.7%, followed by Southeast Asia at 27.4% (2). Meanwhile, Indonesia's stunting prevalence ranked fifth in Asia and second highest in ASEAN, after Timor Leste, with a prevalence of 21.5% in 2023 (3).

Several studies have shown that high stunting rates significantly impact the quality of human resources, both in the short and long term. Short-term impacts of stunting include impaired brain development and intelligence, impaired physical growth, and impaired metabolism. Meanwhile, long-term impacts include decreased academic achievement, decreased immunity so that people become sick easily, high risk of diabetes, obesity, stroke and work quality which impacts economic productivity (4,5,6,7).

Efforts to accelerate the reduction of stunting rates have become a national policy. This aligns with the Sustainable Development Goals (SDGs) target of achieving the Golden Indonesia vision by 2045. To realize this vision, the Indonesian government has also established Asta Cita as eight national development agendas, one of which focuses on improving the quality of human resources (8,9).

The challenge of realizing Asta Cita is evident in Kebumen Regency, which has the highest poverty rate in Central Java. The high poverty rate in Kebumen Regency is a major contributing factor to stunting, as poor families tend to struggle to meet children's nutritional needs and access adequate health services. Rowokele District has one of the highest stunting prevalence rates, at 18.4% compared to other districts in Kebumen Regency.

Many programs to accelerate stunting reduction, such as specific and sensitive nutrition interventions, health education, and nutritional assistance, have been implemented. However, a truly effective implementation model to ensure the success of these programs has not yet been found. Sentika et al. stated that stunting monitoring still focuses on the role of integrated health post (Posyandu) cadres (10). Mezmur et al. added that a more comprehensive approach should be implemented, such as holding nutrition classes to improve parental education about nutrition for children (11). Furthermore, Anjani et al. stated the need for app-based education as a stunting prevention effort using the asuh, asih, and asah (care, nurture, and sharpen) method (12).

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Nutrition class support and the use of a stunting monitoring app for mothers with stunted children have the potential to reduce stunting rates (13,14). However, the effectiveness of an app-based educational approach to nutrition class support requires further study. This research is relevant to conditions in Indonesia, particularly in Kebumen Regency, which has a stunting prevalence of 18.4%. Therefore, the results are expected to support policies to accelerate stunting reduction at the local and national levels. Therefore, this study aims to determine the effectiveness of nutrition class support through the SIGINTING app as a medium for nutrition education and monitoring in reducing stunting rates.

MATERIALS AND METHODS

This study was a "Quasi-Experimental" study with a "pre-test-post-test with Control Group Design." The study population was 263 mothers of stunted toddlers aged 2-5 years in Rowokele District. The subjects were divided into two groups: the treatment group, which received nutrition class support four times a month in each village and the use of the SIGINTING application. The control group received toddler class support in accordance with applicable service standards. The sample used in this study used a stratified random sampling technique. A minimum sample size of 84 respondents per group (intervention and control groups) was determined based on calculations using G*Power version 3.1. The independent variables in this study were nutrition class support and the SIGINTING application, while the dependent variables were the knowledge, skills, and attitudes of mothers of toddlers. The instruments used in this study consisted of knowledge, attitudes, and skills. The questionnaire used was validated by experts and tested for validity and reliability. The questionnaire consisted of 50 questions covering the definition of stunting, causes of stunting, prevention of stunting, sanitation and hygiene, balanced nutrition, nutritional adequacy rates for children aged 1-3 years and 4-6 years, and nutritious snacks for stunted children. Validity testing was conducted using the Pearson Product Moment test using SPSS. The questionnaire was considered valid if the calculated r value was greater than the table r value in a sample of 30 people. Reliability testing was considered reliable if the value was greater than 0.6 using Cornbach alpha analysis. There were 45 items out of 50 questions that were declared valid. As for the reliability test, the Cornbach alpha value was 0.703 > 0.6. The existing SIGINTING application was developed with additional features. Determining stunting through toddler height (H) and age (A) can categorize nutritional status. Before the intervention, the treatment and control groups were given a pretest.

The treatment group, consisting of 84 children, received nutrition class support four times a month, implemented through the provision of stunting material, the use of the SIGINTING application which contains features for toddler nutrition guidebooks, stunting books, and calculating height/age in children, balanced nutrition for stunted children, and a demonstration of a balanced menu for stunted toddlers. Meanwhile, the control group consisted of 84 mothers who received toddler class services according to applicable service standards. The posttest was conducted after one month of intervention. Data analysis was carried out using univariate analysis to describe the characteristics and variables to be analyzed by including all studied variables. In addition, bivariate analysis was carried out using the nonparametric Wilcoxon test where the data were not normally distributed. Data analysis was carried out using SPSS software.

Prior to the implementation of the study, respondents were given an explanation regarding the study and respondents who agreed to participate in the study were asked to sign an informed consent. This study has received ethical approval from the Ethics Commission Universitas Muhammadiyah Gombong with certificate number: 136.6/II.3.AU/F/KEPK/VIII/2025 and was funded by an external grant from the Direktorat Penelitian Dan Pengabdian Kepada Masyarakat Kementerian Pendidikan Tinggi, Sains, Dan Teknologi for the 2025 Fiscal Year.

RESULTS

Respondent Characteristics

Table 1. Frequency Distribution of Respondent Characteristics

Variable		Intervention Group		Control Group	
		n=84	%	N=84	n=84
Age					
	20-35	74	88.1	76	90.5
	<20 or >35	10	11.9	8	9.5
Education status					
	Junior high school	27	32.1	33	39.3
	Senior high school	50	59.5	45	53.6
	College	7	8.3	6	7.1
Parity status					
	Primipara	20	23.8	29	34.5
	Multipara	64	76.2	55	65.4

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Variable		Intervention Group n=84	%	Control Group N=84	n=84
Occupation status	Working	27	32.1	23	27.4
	Unemployed	57	67.9	61	72.6

Table 1 indicates that in the treatment group, the highest percentage for respondent characteristics was in the age range of 20–35 years, had a secondary education level, with multiparous parity status and most of the respondents were unemployed. Meanwhile, in the control group, the highest percentage was also in the age range of 20–35 years, had secondary education with multiparous parity status (65.4%), and the majority of respondents were unemployed.

Differences in Mothers' Knowledge Levels in the Treatment and Control Groups
The following table shows the mothers' knowledge levels in the treatment and control groups:

Table 2. Differences in Knowledge Levels in the Treatment and Control Groups

Group	Mean ± SD Pre	Mean ± SD Post	*p value*
Intervention	68.7 ± 14.491	88.79 ± 10.867	0.000
Control	72.8 ± 11.681	75.40 ± 11.200	0.001

Table 2 shows that the average value of the level of knowledge in the treatment group before the intervention was 68.7 and after the intervention increased to 88.79. Statistically, there was a significant increase with a value of 0.000 ($p < 0.05$), which means that the intervention given was very effective in increasing the level of knowledge of respondents. Meanwhile, in the control group, the average level of knowledge before the intervention was 72.8 to 75.4, which means there was a small increase that was not practically relevant, but statistically significant, namely there was a significant increase with a value of 0.001 ($p < 0.05$).

Differences in Mothers' Attitudes in the Intervension and Control Groups
The following table shows the attitudes of mothers in the treatment and control groups:

Tabel 3. Differences Attitudes in the Intervention Group and the Control Group

Group	Mean ± SD Pre	Mean ± SD Post	*p value*
Intervention	64.14±14.101	74.11±12.314	0.000
Control	56.67±10.500	57.49±10.154	0.038

Table 3 shows that the average attitude score in the treatment group before the intervention was 64.14 and after the intervention increased to 74.11. This increase was statistically significant with a value of 0.000 ($p < 0.05$), which means that the intervention given was effective in improving respondents' attitudes. Meanwhile, in the control group, the average attitude level before the intervention was 56.67 to 57.49, which indicates a small increase that is not very practically relevant, but is still statistically significant with a value of 0.038 ($p < 0.05$).

Differences in Mothers' Skills in the Treatment and Control Groups
The following table shows the mothers' skills in the treatment and control groups:

Table 4. Differences in Mothers' Skills in the Treatment and Control Groups

Group	Mean ± SD Pre	Mean ± SD Post	*p value*
Intervention	70.64±10.820	88.79±10.867	0.000
Control	72.80±11.661	75.40±11.200	0.001

Based on Table 4, the average maternal skill score in the treatment group before the intervention was 70.64 and increased to 88.79 after the intervention. This increase was statistically significant with a p value of 0.000 ($p < 0.05$), indicating that the intervention, a combination of nutrition classes and the SIGINTING application, was effective in improving maternal skills in preparing and providing balanced nutrition to toddlers. Meanwhile, in the control group, the average skill score before the intervention was 72.80 and decreased to 75.40 after observation, with a p value of 0.001 ($p > 0.05$). This indicates that there was no statistically significant change in maternal skills in the control group, so the intervention only had an impact on the treatment group.

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Comparison of Average Knowledge, Attitudes, and Skills between the Intervention and Control Groups after Providing Nutrition Class Education and Stunting Applications

Table 5. Comparison of Average Knowledge, Attitudes, and Skills in the Treatment and Control Groups

Variable	Group	Mean ± SD Post	Mean's difference	p value
Knowledge	Intervention	88.79 ± 10.867	-13.39	0.000
	Control	75.40 ± 11.200		
Attitudes	Intervention	74.11±12.314	-16.62	0.001
	Control	57.49±10.154		
Skills	Intervention	88.79±10.867	-13.39	0.001
	Control	88.79±10.867		

Statistically, Table 6 shows a significant influence between nutrition class assistance and the stunting application on improving knowledge, attitudes, and skills in mothers with stunted children. The results revealed that the average level of knowledge in the knowledge group (88.78) was higher than the control group (75.4). Meanwhile, the average attitude in the treatment group was 74.11 compared to the control group (57.49). The average skill in the knowledge group was 88.79 and the control group was 75.40. This indicates that providing education through nutrition classes and the stunting application contributed positively to improving knowledge, attitudes, and skills. Meanwhile, the results of the statistical analysis indicated a significant positive relationship between knowledge and the three variables, which showed a p-value <0.05.

DISCUSSION

This study involved respondents with diverse backgrounds, such as differences in age, education, the experience in caring for children, thus providing a comprehensive picture of the effectiveness of the SIGINTING application in reducing stunting rates. Based on the research results, the increase in respondents' knowledge indicates that digital educational innovation through the SIGINTING application is effective in accelerating mothers' understanding of stunting among toddlers. These results align with research by Aini et al. (2023), which found that providing education through the Stunting Detection Application improved pregnant women's knowledge and attitudes regarding stunting prevention (15). Similarly, research by Mediani et al. (2022) reported an increase in the knowledge of integrated health post (Posyandu) cadres regarding infant and young child feeding practices after receiving mobile application-based nutritional support (16). The highest increase in knowledge scores was found in questions regarding the definition of stunting, the long-term impact of stunting on child growth and development, and the importance of balanced nutrition. This can be seen from the high level of respondent participation in nutrition mentoring classes, where respondents frequently asked questions about the causes of stunting, good food menus for stunted children, and strategies for monitoring child growth. This interaction created more active two-way communication between researchers and respondents (17,18). According to Gubawa et al. (2021), the effectiveness of digital health education interventions is greatly influenced by group discussions, social support, and easy access to health information via mobile devices (19). Similarly, research by Wulandari (2021) found that WhatsApp-based educational applications can increase parental awareness about preventing childhood obesity through intensive group discussions (p-value <0.05) (20).

The attitudes of mothers of toddlers in the study showed an increase in statements of strongly agreeing to regularly attend toddler classes, being willing to prepare a balanced menu for stunted children based on the material provided, and having a commitment to regularly monitoring their child's growth even if there are no health complaints. Educational content delivered through the SIGINTING application in the form of infographics and short videos made it easier for respondents to understand health messages. Based on a literature study conducted by De Oliveira et al. (2020), 80% of respondents preferred mobile application-based nutrition learning media over printed modules because they could access images, videos, and interactive quizzes. In line with this, SIGINTING has been shown to provide benefits in increasing parental learning motivation and positive attitudes towards the program to accelerate stunting reduction (21,22). Attitude is closely related to behavior. The results of Mediani et al.'s (2022) study regarding the use of digital health education applications among Posyandu cadres showed a significant positive impact on cadres' attitudes towards stunting prevention at the village level. Online group discussion-based applications can increase parental involvement and community participation in health programs. In addition, it can increase maternal compliance with child feeding guidelines and family nutritional care practices (23,24).

Mothers' skills in preparing and providing balanced nutrition to toddlers before and after a nutrition class intervention combined with the SIGINTING application. These results indicate that the combination of digital education and face-to-face classes can strengthen mothers' abilities in understanding and practicing the principles of balanced nutrition. These results align with research conducted by Sari et al. (2021) on the use of an Android-based nutrition education application on the skills of mothers of toddlers. Digital applications have been shown

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to facilitate mothers in understanding healthy menus, meal portions, and correct food presentation methods (25). In addition, face-to-face nutrition classes provide a space for direct interaction, discussion, and cooking practice, thereby improving mothers' skills in preparing balanced nutritious meals for toddlers. Digital applications such as SIGINTING are easily accessible, affordable, and interactive, thus fostering a positive perception of the usefulness of the technology. Furthermore, nutrition classes provide real-world practical experiences such as menu preparation simulations and serving complementary foods.

The combination of the two results in stronger skills because mothers not only obtain information online but also can practice directly (26). Improved maternal skills were evident in statements that strongly agreed that they found it easier to obtain complementary feeding recipe guidance, understand balanced menu variations, and were able to combine animal and vegetable proteins after attending nutrition classes and using the SIGINTING app. Questionnaire evaluations also showed that most respondents were willing to continue attending nutrition classes and using the SIGINTING app on an ongoing basis. Respondents also suggested that educational content in the form of recipe videos, short tutorials, and hands-on practice in nutrition classes be provided regularly to strengthen the skills they have acquired. Appropriate educational messages through nutrition classes and digital media will influence mothers' beliefs, leading to positive attitudes and perceptions of the benefits and ease of use. Persuasive and interactive messages will attract mothers' attention, improve skills, and ultimately strengthen mothers' behavior in implementing balanced nutrition for stunted toddlers (23,26). However, the implementation of digital applications in rural areas faces challenges such as limited internet access, a lack of adequate devices, and varying levels of digital literacy, so tailored support strategies are needed so that all mothers can optimally utilize the applications.

CONCLUSION AND RECOMMENDATIONS

This study concluded that there was an increase in mothers' knowledge scores regarding stunting after receiving a digital educational intervention through the SIGINTING application. This improvement was significant in terms of understanding the definition of stunting, the long-term impacts of stunting, and the importance of animal protein in preventing stunting. Furthermore, mothers' attitudes also experienced positive changes, marked by an increased commitment to regularly attending nutrition classes, preparing healthy family menus, and regularly monitoring toddler growth. Furthermore, there was a difference in the average skills of mothers in preparing and providing balanced nutrition to toddlers before and after participating in the combined intervention of nutrition classes and the SIGINTING application. This combination proved effective because the SIGINTING application provided easy, affordable, and interactive access to information, while the nutrition classes provided hands-on experience in menu preparation and serving nutritious complementary foods.

Based on the findings of this study, it is recommended that mothers of toddlers utilize the SIGINTING application and nutrition classes as an integrated learning tool to improve knowledge, attitudes, and skills related to stunting prevention. Furthermore, health workers, particularly midwives and integrated health post (Posyandu) cadres, are expected to utilize this digital innovation to expand education to the community and facilitate regular nutrition classes. Future researchers are advised to develop this research by exploring a combination of digital applications and more innovative field practice methods, thereby strengthening the impact on changing maternal behavior in managing balanced nutrition for toddlers.

AUTHOR'S CONTRIBUTION STATEMENT

Author 1: background, developing research methods, writing research results. Authors 2 and 3: writing discussion results and conclusions, and supervising the overall content of the article.

CONFLICTS OF INTEREST

There are no conflicts of interest in this paper. This research has received ethics clearance from the Ethics Committee under license number 136.6/II.3.AU/F/KEPK/VIII/2025.

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