THE EFFECT OF THE SI-ABI APPLICATION (SAHABAT ANAK STUNTING) ON MOTHERS' BEHAVIOR IN MEETING THE NUTRITIONAL NEEDS OF STUNTED TODDLERS

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ABSTRACT

Stunting is a nutritional problem associated with inadequate nutritional intake and family caregiving practices. The use of digital technology through educational applications has the potential to improve mothers' knowledge, attitudes, and behaviors regarding nutritional fulfillment among stunted toddlers. Objective: This study aimed to analyze the effect of Si-ABi (Sahabat Anak Stunting Application) on mothers' knowledge, attitudes, and behaviors regarding nutritional fulfillment among stunted toddlers. Methods: This study employed a quasi-experimental pre-test–post-test control group design. The sample consisted of 68 mothers of stunted toddlers, comprising 34 respondents in the intervention group and 34 in the control group. The intervention group received education through the Si-ABi application, while the control group received routine health education. Knowledge, attitudes, and stunting prevention behaviors were assessed before and after the intervention. Results: Following the intervention, the proportion of mothers with good knowledge in the intervention group increased from 32.4% to 82.4%, positive attitudes increased from 23.5% to 73.5%, and good stunting prevention behaviors increased from 22.1% to 88.2%. Statistical analysis showed significant differences between the intervention and control groups in knowledge (p=0.001), attitudes (p=0.003), and stunting prevention behaviors (p=0.001). Conclusion: Si-ABi significantly improved mothers' knowledge, attitudes, and behaviors regarding nutritional fulfillment among stunted toddlers. Recommendation: Further research should involve a larger sample size, a longer follow-up period, and objective measurements of maternal behavior and child growth status to evaluate the long-term effectiveness of Si-ABi.

Keywords: *Si-ABi; Stunting; Nutrition; Maternal Behavior; Digital Health Application.*

INTRODUCTION

Stunting is a chronic growth disorder resulting from prolonged inadequate nutritional intake and remains one of the major challenges to human resource development globally (Azriani et al., 2024). Stunted children are commonly found in low- and middle-income countries, particularly among families with limited socioeconomic resources (Lameky, 2024). By 2030, approximately 90 million children under five years of age are projected to experience stunting worldwide (World Health Organization [WHO], 2023). In Indonesia, the prevalence of stunting has also remained a significant public health concern, previously reported at 30.0% (Mediani et al., 2022). Based on the 2024 Indonesian Nutritional Status Survey (Survei Status Gizi Indonesia/SSGI), the national prevalence of stunting

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decreased from 21.5% in 2023 to 19.8% in 2024. In absolute terms, approximately 4.48 million children under five years of age were estimated to be affected by stunting in 2024. Although this indicates a declining trend, the figure means that approximately one in five children under five in Indonesia still experiences stunting. Therefore, efforts to prevent and address stunting, particularly through improving nutritional adequacy and strengthening mothers' caregiving and feeding practices, need to be continuously enhanced.

Aceh remains one of the provinces with the highest prevalence of stunting in Indonesia, ranking fifth nationally. In North Aceh (Aceh Utara), stunting remains a significant public health concern, with 1,562 cases (3.7%) reported in 2025 (Aceh Utara, 2025). The high prevalence of stunting is influenced by inappropriate cultural practices related to child-rearing and caregiving (Aminah & Suhastini, 2019). Maternal parenting practices and knowledge of child nutrition are among the key factors contributing to the risk of stunting among children under five years of age (Mursal, Akbar, & Novia, 2023). In addition, food taboos rooted in cultural beliefs may adversely affect maternal and child health, potentially resulting in inadequate nutritional intake, impaired growth and development, and an increased risk of stunting (Yasir et al., 2024). Although various prevention and intervention programs have been implemented, challenges in addressing stunting persist, particularly in communities with limited access to health and nutrition information, inadequate nutritional knowledge, and inappropriate childcare and feeding practices (Terttiaavini, 2024).

Furthermore, monitoring children's growth and development remains challenging due to irregular attendance at community health centers (Puskesmas), resulting in the lack of continuous and comprehensive growth-monitoring data (Fitriami & Galaresa, 2022). Therefore, this study focuses on developing an innovative solution through the utilization of digital technology. The proposed application is designed to record key child health parameters and provide educational information on nutrition, childcare practices, and age-appropriate growth and development. Accordingly, the Si-ABi (Sahabat Anak Stunting) application aims to improve mothers' behaviors in fulfilling the nutritional needs of stunted children under five years of age.

METHOD

This study employed a quantitative research approach using a randomized controlled trial (RCT) with a pretest–posttest design. Participants were allocated into two groups: an intervention group and a control group. The study aimed to determine the effect of using the Si-ABi application on mothers' behavior in fulfilling the nutritional needs of stunted children under five years of age. The study began with the design and development of a technology-based intervention, namely the Si-ABi application. The application was developed to support mothers in accessing nutritional information and guidance related to the care and nutritional needs of stunted children. Population, Sample, and Study Setting. The study population consisted of all mothers who had children under five years of age. Participants were selected using a random sampling technique based on predetermined inclusion and exclusion criteria. The inclusion criteria were: (1) willing to participate in all stages of the study until completion; (2) owning a smartphone or other digital device (*gadget*) capable of accessing the Si-ABi application; (3) able to read and write; and (4) having a child under five years of age diagnosed with stunting. The exclusion criteria were: (1) participants who were absent from one or more study

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sessions; and (2) children with chronic diseases. A total of 90 respondents were included in the study and randomly allocated into two groups: 34 participants in the intervention group, who received the Si-ABi intervention, and 34 participants in the control group, who received the standard intervention or usual care.

Data were collected using questionnaires comprising two components: 1) Demographic Data Questionnaire, which included age, sex, pregnancy history, history of antenatal visits to a midwife during pregnancy, educational level, family socioeconomic status, and age gap between children. 2) Maternal Behavior Questionnaire, The Maternal Behavior Questionnaire was developed by the researchers based on the concepts of child growth and development, breastfeeding, complementary feeding (MP-ASI), dietary diversity, meal frequency and portion size, child feeding practices, and local community cultural practices. The questionnaire was used to assess maternal behavior in fulfilling the nutritional needs of stunted children under five years of age. Before being used in the study, the questionnaire was assessed for content validity by experts and tested for reliability to ensure that the instrument was valid and reliable for measuring maternal behavior related to child nutritional fulfillment.

RESULTS AND DISCUSSION

RESULTS

Table 1. presents the distribution and characteristics of mothers with children under five years of age (n = 68).

Category	Intervention group		Control group	
	n	%	n	%
Age				
- Age 21–30 years	14	41.2	16	47.1
- Agea 31-40 years	20	58.8	10	29.4
- > 40 years			8	23.5
Gender Children				
- Male	16	47.1	14	41.2
- Female	18	52.9	20	58.8
Obstetric History				
- First pregnancy	5	14.7	11	32.4
- Second pregnancy	16	47.1	14	41.2
- Third pregnancy or more	13	38.2	9	26.5
History of Antenatal Care				
- < 4 Visite	15	44.1	27	79.4
- > 4 Visite	19	55.9	7	20.6
Education				
- Elementary School	3	8.8	-	
- Junior High School	4	11.8	5	14.7
- Senior High School	23	67.8	22	64.7
- Higher Education	4	11.8	7	20.6
Economic				
- Low	15	44.1	16	47.1
- Moderate	19	55.9	16	47.1
- High	-	-	2	5.9
Age Between Children				
- > 2 years	8	23.5	15	44.1
- 3-5 years	17	50.0	18	52.9
- > 6 years	9	26.5	1	2.9

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Based on Table 1, the characteristics of respondents in the intervention group showed that the majority of mothers were aged 31–40 years (58.8%), had female children (52.9%), and were in their second pregnancy (47.1%). Most mothers had more than four antenatal care visits to a midwife (55.9%), had completed senior high school education (67.8%), had a moderate socioeconomic status (55.9%), and had an age gap of 2–5 years between children (50.0%).

In the control group, the majority of mothers were aged 21–30 years (47.1%), had female children (58.8%), and were in their second pregnancy (41.2%). Most mothers had fewer than four antenatal care visits to a midwife (79.4%), had completed senior high school education (64.7%), had low and moderate socioeconomic status (47.1% each), and had an age gap of 3–5 years between children (52.9%).

Table 2. Distribution of Maternal Knowledge, Attitudes, and Practices in Stunting Prevention Before and After the Intervention the Control and Intervention Groups (n = 68)

Nutrition in Stunted Children	Control Group				Intervention Group			
	Pre-test		Post-test		Pre-test		Post-test	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Knowledge								
- Good	19	27.9	19	27.9	22	32.4	28	82.4
- Moderate	12	17.6	12	17.6	10	14.7	6	17.6
- Poor	3	4.4	3	4.4	2	2.9	-	-
Attitude								
- Positive	9	13.3	9	13.3	16	23.5	26	73.5
- Negative	25	36.8	25	36.8	18	26.5	8	23.5
Stunting Prevention Practices								
- Good	19	27.9	19	27.9	15	22.1	30	88.2
- Moderate	13	19.1	13	19.1	19	27.9	4	11.8
- Poor	2	2.9	2	2.9	-	-	-	-

Based on Table 2, in the control group, the majority of respondents had a good level of knowledge at both pre-test and post-test, with 19 respondents (27.9%) in each assessment. Regarding attitudes, most respondents demonstrated a negative attitude, with 25 respondents (36.8%) at both pre-test and post-test. Meanwhile, for stunting prevention practices, the majority of respondents were categorized as having good practices, with 19 respondents (27.9%) at both pre-test and post-test. In the intervention group, before receiving the Si-ABi intervention, the majority of respondents had a good level of knowledge, comprising 22 respondents (32.4%), while 16 respondents (23.5%) demonstrated a positive attitude, and 19 respondents (27.9%) had moderate stunting prevention practices. Following the Si-ABi intervention, improvements were observed across all indicators. The number of respondents with good knowledge increased to 28 (82.4%), those with a positive attitude increased to 26 (73.5%), and those with good stunting prevention practices increased to 30 (88.2%).

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Table 3. Effect of Si-ABi (Sahabat Anak Stunting Application) on Maternal Behavior in Meeting the Nutritional Needs of Stunted Children

Stunted toddlers	Timepoint	Control Group (Mean ± SD)	Intervention group (Mean ± SD)	P-value
Knowledge	Pretest	7.44 ± 1.48	7.79 ± 1.38	0.001
	Posttes	7.44 ± 1.48	34.85 ± 3.86	
Attitude	Pretest	30.82 ± 2.32	32.65 ± 4.97	
	Posttes	30.82 ± 2.32	34.85 ± 3.86	0.003
Knowledge	Pretest	30.35 ± 3.79	31.71 ± 4.10	
	Posttest	30.35 ± 3.79	34.90 ± 3.26	0.001

Knowledge scores in the intervention group increased from 7.79 ± 1.38 at pretest to 34.85 ± 3.86 at posttest, whereas the control group remained at 7.44 ± 1.48. The p-value of 0.001 (<0.05) indicated a statistically significant difference between the control and intervention groups following the use of Si-ABi. Regarding attitudes, the intervention group showed an increase from 32.65 ± 4.97 to 34.85 ± 3.86, while the control group remained at 30.82 ± 2.32. The p-value of 0.003 (<0.05) indicated a statistically significant difference in attitudes following the intervention. For stunting prevention practices, the intervention group increased from 31.71 ± 4.10 to 34.90 ± 3.26, whereas the control group remained at 30.35 ± 3.79. The p-value of 0.001 (<0.05) demonstrated a statistically significant difference in stunting prevention practices between the two groups. Overall, the findings indicate that Si-ABi had a statistically significant effect on mothers' knowledge, attitudes, and stunting prevention practices related to meeting the nutritional needs of stunted children under five years of age, with all *p*-values below 0.05. The strongest statistical effects based on the *p*-values were observed for knowledge and stunting prevention practices (p = 0.001), while attitude showed a significant effect with p = 0.003.

DISCUSSION

Discussion of Respondents' Characteristics

This study involved 68 mothers, comprising 34 participants in the intervention group and 34 in the control group. The respondents' characteristics included maternal age, child sex, pregnancy history, antenatal care visits to a midwife, educational level, socioeconomic status, and the age gap between children. Maternal, socioeconomic, healthcare-related, and child-related factors are important determinants of stunting (Beal et al., 2018). Most mothers in the intervention group were aged 31–40 years (58.8%), whereas the majority of mothers in the control group were aged 21–30 years (47.1%). The sex distribution of the children was relatively balanced, although female children represented a slightly higher proportion in both groups. Maternal age is not necessarily directly associated with stunting, whereas child sex may influence the risk of stunting (Kiik & Nuwa, 2021; Titaley et al., 2019). A second pregnancy history represented the largest proportion in both groups, accounting for 47.1% in the intervention group and 41.2% in the control group. Meanwhile, more than four antenatal care visits were more common in the intervention group (55.9%), whereas the control group was predominantly characterized by fewer than four visits (79.4%). The frequency of antenatal care visits is an important factor associated with the risk of stunting, as these visits provide opportunities for mothers to receive health and nutrition education (Kiik & Nuwa, 2021). Most mothers had completed senior high school education, accounting for 67.8% in the intervention group and 64.7% in the

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control group. Maternal education may enhance the ability to access, understand, and utilize health information; however, the implementation of appropriate nutritional practices is also influenced by socioeconomic conditions and the family environment (Beal et al., 2018). The respondents' socioeconomic status was predominantly low to moderate. Therefore, the nutritional recommendations provided through Si-ABi should emphasize foods that are nutritious, affordable, readily available, and culturally appropriate, particularly those based on locally available foods (Meiyetriani et al., 2026). The most common age gap between children was 2–5 years, accounting for 50.0% in the intervention group and 52.9% in the control group. Birth spacing is an important factor to consider in stunting prevention because a short interval between births may increase the risk of growth impairment in children (Meiyetriani et al., 2026).

Levels of Knowledge, Attitudes, and Stunting Prevention Practices

The results showed that the use of Si-ABi improved mothers' knowledge in the intervention group, with the proportion of respondents demonstrating a good level of knowledge increasing from 32.4% to 82.4%, whereas no substantial change was observed in the control group. These findings indicate that Si-ABi can serve as an effective digital health education medium, facilitating mothers' access to information related to nutrition and stunting prevention (Putri et al., 2026).

Regarding attitudes, the proportion of respondents with a positive attitude increased from 23.5% to 73.5% in the intervention group, while the proportion in the control group remained unchanged at 13.3%. These findings suggest that education delivered through the Si-ABi application not only improves mothers' knowledge but may also contribute to the development of more positive attitudes toward meeting the nutritional needs of children under five years of age (Setiawan et al., 2026). Changes were also observed in stunting prevention practices, with the proportion of respondents classified as having good practices increasing from 22.1% to 88.2% in the intervention group, while no change was observed in the control group. These findings suggest that improvements in mothers' knowledge and attitudes may be accompanied by positive changes in their practices for preventing stunting (Ningrum & Rosanti, 2024).

Overall, the improvements observed across all three domains indicate that Si-ABi has the potential to serve as a digital health education medium that supports positive changes in maternal behavior. Its accessibility and the ability to provide information repeatedly represent important advantages of digital media in facilitating and reinforcing health education (Ainiyyah et al., 2026).

Effect of Si-ABi on Mothers' Knowledge, Attitudes, and Practices

The results showed that the use of Si-ABi (Sahabat Anak Stunting Application) had a statistically significant effect on mothers' knowledge, attitudes, and practices related to meeting the nutritional needs of stunted children under five years of age. Following the intervention, the intervention group demonstrated higher scores than the control group, with $p = 0.001$ for knowledge, $p = 0.003$ for attitudes, and $p = 0.001$ for stunting prevention practices. These findings indicate that the Si-ABi intervention produced meaningful changes across the cognitive, affective, and behavioral domains of mothers' nutritional practices for stunted children.

The improvement in knowledge following the use of Si-ABi indicates that the application can serve as an effective educational medium, enabling mothers to access information on nutrition and stunting prevention in a more convenient and

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systematic manner. Digital media offer important advantages because health information can be accessed flexibly and reviewed repeatedly according to users' needs. Previous research on digital applications for stunting management has demonstrated that app-based interventions can improve mothers' knowledge regarding stunting prevention (Erika et al., 2024). These findings support the use of digital technology as a strategic approach to expanding access to health education for mothers and families.

Changes in knowledge also represent an important component in the development of health-related behaviors. Mothers who receive adequate information regarding children's nutritional needs are better equipped to determine appropriate food choices, feeding frequency, and nutritional practices. Nutrition education delivered through digital media has been shown to improve mothers' knowledge and several aspects of child-feeding practices (Rachmah et al., 2023). Therefore, the improvement in knowledge achieved through Si-ABi may serve as an important initial step in the process of changing maternal nutritional behaviors.

Regarding attitudes, the use of Si-ABi resulted in a statistically significant change. This finding indicates that providing information through the application not only improves mothers' understanding but may also foster more positive attitudes toward the importance of meeting children's nutritional needs and preventing stunting. Attitude is an important factor in the process of behavioral change, as acceptance of health information may influence an individual's readiness to apply the information in daily life. Structured nutrition education interventions have been reported to improve both mothers' knowledge and attitudes toward appropriate child-feeding practices (Majidah, Sulistiyawati, & Paramashanti, 2021).

Changes in stunting prevention practices in the intervention group indicate that Si-ABi has the potential to provide benefits not only in terms of knowledge and attitudes but also in promoting the application of acquired information in daily practices. This is particularly important because the effectiveness of health education can ultimately be assessed by mothers' ability to translate the knowledge they acquire into appropriate practices for meeting their children's nutritional needs. Previous research on nutrition education interventions among mothers of children under five has demonstrated that such interventions can improve behaviors related to stunting prevention (Rahmadani et al., 2025).

The effectiveness of Si-ABi may be attributed to the characteristics of digital media, which allow mothers to access health information repeatedly and independently. Unlike conventional education, which is generally delivered at a specific time and place, digital applications enable health materials to be revisited whenever mothers need additional information. This approach is increasingly relevant to public health interventions because digital technology can expand the reach of health education while enhancing user engagement. Previous research on digital media-based nutrition education has demonstrated improvements in knowledge, attitudes, and practices following the intervention (Simanjuntak et al., 2022).

In addition to accessibility, the effectiveness of Si-ABi may be influenced by the delivery of content tailored to the needs of mothers caring for stunted children. Information that is relevant to a child's specific condition may increase mothers' attention and motivation to understand and apply the educational content provided. Research on education interventions based on the Theory of Planned Behavior has shown that interventions designed around users' needs and

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psychological factors can improve various determinants of child-feeding practices (Rachmah et al., 2023). These findings underscore the importance of developing health applications that not only provide information but also facilitate and encourage meaningful behavioral change.

Overall, the findings indicate that Si-ABi has the potential to serve as an innovative digital health education medium for improving mothers' knowledge, attitudes, and practices in meeting the nutritional needs of stunted children under five years of age. The application can complement health education provided by healthcare professionals by offering information that can be accessed continuously and independently. The implementation of Si-ABi within healthcare services could involve nurses, midwives, Posyandu cadres, and nutritionists as part of family-based support for stunting prevention and management. These findings further underscore the importance of utilizing digital technology as an innovative approach to family-centered stunting interventions.

This study demonstrated that Si-ABi (Sahabat Anak Stunting Application) had a statistically significant effect on mothers' knowledge, attitudes, and practices related to fulfilling the nutritional needs of stunted children under five years of age. Following the intervention, the Si-ABi group showed significant improvements across all three domains compared with the control group, with $p = 0.001$ for knowledge, $p = 0.003$ for attitudes, and $p = 0.001$ for stunting prevention practices. These findings indicate that Si-ABi has the potential to support improvements in maternal health behavior related to stunting prevention.

The unique contribution of this study lies in the development and application of a digital nutrition education intervention that integrates evidence-based nutritional information with locally available foods and cultural practices relevant to the Aceh context. Unlike conventional nutrition education that may primarily provide general information, Si-ABi provides practical and repeatable nutrition education that can be accessed according to mothers' needs. This context-specific approach may facilitate the translation of nutritional knowledge into attitudes and daily feeding practices and represents an important contribution to the development of locally responsive strategies for stunting prevention.

The findings extend previous research by demonstrating that a locally adapted digital health education intervention can address multiple dimensions of maternal behavior, including knowledge, attitudes, and practices, rather than focusing solely on knowledge improvement. Si-ABi therefore has the potential to complement existing community-based stunting prevention programs and maternal and child health services, particularly in settings where locally available and affordable foods are important considerations.

This study has several limitations, including a relatively small sample size, a limited intervention period, and the use of self-reported questionnaires to assess behavioral outcomes. Consequently, the sustainability of behavioral changes and their translation into improvements in children's growth outcomes could not be fully determined. Future studies should involve larger samples, longer follow-up periods, and objective assessments of maternal practices and child growth status to further evaluate the effectiveness, sustainability, and generalizability of Si-ABi.

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