

Booklet preventing stunting based Android application (*Bocesting*) as a tool to enhance maternal nutritional behaviour and nutritional status

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Abstract

The most common health problem was the lack of nutrition, known as stunting. One approach to addressing nutritional issues in young children was through health education using the android method. The study aimed to analyze the differences in the influence of stunting prevention education using booklet media and an Android-based application on maternal nutritional behavior and nutritional status, with the ultimate goal of preventing stunting cases. The research design employed a quantitative approach,

specifically a Quasi-Experiment. Measurement tools included questionnaires assessing maternal nutrition behavior, with the samples divided into three intervention groups and one control group (n=51). Data analysis involved statistical tests, including Wilcoxon, Mann Whitney U, and Kruskal Wallis H. The results indicated that educational media using booklets significantly improved maternal nutrition behavior after the intervention ($p < 0.05$). However, there was no significant increase in the nutritional status of children ($p = 0.317$). Similarly, the Android application intervention group exhibited a significant improvement in maternal nutrition behavior ($p < 0.05$), while the nutritional status of the children did not significantly change ($p = 0.193$). A significant difference was observed in the impact of the media interventions between the booklet and Android application intervention groups and the control group regarding the enhancement of maternal nutritional behavior ($p < 0.05$) and children's nutritional status ($p > 0.005$). In conclusion, educational media in the form of booklets and Android applications can influence maternal nutrition behavior and children's nutritional status in the context of stunting prevention education.

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Introduction

Health problems in developing countries, including Indonesia, often revolve around nutritional issues, which indirectly contribute to the mortality of both mothers and children.¹ The age group under five years is particularly susceptible to nutritional challenges due to their relatively high growth requirements compared to adults.² One of the most prevalent health issues in this context is malnutrition, commonly referred to as stunting.³

Stunting is a chronic malnutrition problem caused by a prolonged lack of nutritional intake, leading to growth disorders in children, characterized by shorter height compared to the standard for their age.⁴ The government must address stunting seriously because it has the potential to reduce Indonesia's future human resources' productivity. It is crucial to reduce the incidence of stunting in toddlers as early as possible to avoid long-term adverse effects, such as hindered child development. Stunting can negatively impact brain development, leading to suboptimal intelligence levels in children.⁵ Stunting problems can actually be prevented by improving the diet to meet the nutritional requirements.⁶ Moreover, stunting incidents must receive specific attention from mothers, fathers, surrounding families, and the government.⁷

The measure of success in nutritional fulfillment is the child's nutritional status as indicated by their weight and height.⁸ According to the Indonesian government's targets, the goal is to reduce the prevalence of stunting to less than 14% of the total number of children under five by 2024 (PEPRES No. 18 Tahun 2020). The short stature of a child is often attributed to inherited

factors from both parents. Consequently, many people tend to accept it without taking preventive measures.⁹ However, it is essential to recognize that genetics is the least influential health determinant when compared to behavioral, environmental, and healthcare factors. Therefore, parents should promptly identify any developmental abnormalities in their child.¹⁰ The pattern of stunting is also influenced by behavioral aspects, particularly in the nursing and feeding practices, especially in toddlers.⁸

Indonesia has a high prevalence of stunting compared to other middle-income countries. According to the 2018 Basic Health Research, the rates of underweight, stunting, and wasting are 17.8%, 30.8%, and 10.24%, respectively.¹¹ The prevalence of stunting and underweight was significantly higher when assessed using the WHO standard compared to the national reference (53.9% vs 10.7% and 29.17% vs 17.7%; all $p < 0.001$).¹² Based on research conducted by Mubasyiroh and Aya in 2018 on the relationship between maternal behavior in fulfilling nutrition during a child's first 1000 days of life, also known as the Golden Period, and the nutritional status of young children in Sitanggal Village, Brebes district, it was found that the majority of young mothers exhibited inadequate behavior, at 51.0%, while most children had poor nutritional status, accounting for 49.0%. The results of the statistical test using the chi-square test indicated a p -value of 0.003, which is less than the significance level α (0.05). This suggests that there is a significant relationship between maternal behavior in providing nutrition during a child's first 1000 days and the nutritional status of the child.¹³

Referring to the Health Department Profile of Riau Islands Province, the prevalence of stunting cases in the province in 2020 was 7.2%, distributed across 7 (seven) districts/cities. Bintan district is one of the areas where the stunting rate remains high at 11.0%, affecting 15 Public Health Centers (PHCs). The world has now entered the era of 4.0, characterized by digitalization, the widespread use of social media, and the necessity of owning a smartphone.¹⁴ One approach to addressing the nutritional problems of young children is through health education using the Android method. This approach aligns with the findings of research conducted by Mukodri *et al.* in 2020, which indicated that the Android method can significantly assist pregnant mothers in improving their knowledge of balanced nutrition in a manner that is easy to use and efficient.¹

Building upon previous research regarding nutritional care patterns as part of stunting prevention efforts, using booklet media for prevention (Bocesting), this study aimed to investigate the impact of the Bocesting application on knowledge enhancement compared to traditional dissemination methods.¹⁵ Based on this, the author is interested in conducting research on a booklet-based stunting prevention approach, known as Bocesting, using an Android application as an educational medium to improve maternal nutrition behavior and the nutritional status of young children within the special community of Riau Islands, particularly in the area served by the Public Health Center (PHC) of Kampung Bugis in the complex village of Bugis, Tanjungpinang city. The aim of this study is to assess the difference in the effectiveness of providing stunting prevention education through booklet media and Android-based applications in enhancing maternal nutritional behavior and the nutritional status of toddlers, with the ultimate goal of preventing stunting in toddlers.

This research is of great importance as it represents an effort to prevent the increasing prevalence of stunting incidents in Indonesia. The design of the tool is aligned with current media trends, utilizing an Android-based application that is user-friendly and accessible at any time. This educational media platform is

expected to make a significant contribution to stunting prevention, particularly in the context of young children. Moreover, it serves as part of the broader efforts to support the implementation of a health system transformation program, with a particular focus on stunting prevention priorities.

Materials and Methods

Research design

This study employs a quantitative method (Quasi-Experiment) with an equivalent control group design, involving pretest-posttest and analytical analysis. The quasi-experimental design method is utilized to assess the improvement in maternal nutritional behavior and the nutritional status of toddlers.

Study participants

The target population for this study consisted of all mothers with toddlers in the service area of the Kampung Bugis Community Health Center, based on data from August 2023, totaling 109 individuals. The accessible population for this study included mothers with toddlers within the same service area of the Kampung Bugis Community Health Center who met the inclusion and exclusion criteria, as of August 2023, which amounted to 51 individuals. Throughout the study, none of the respondents dropped out, resulting in a total of 51 participants: 17 in the control group, 17 in the first experimental group, and 17 in the second experimental group.

Variable, instrument and data collection

The variables in this study included independent variables, which were education using booklet media and Android application media. The dependent variables consisted of maternal nutritional behavior and the nutritional status of toddlers, while the confounding variables in this study encompassed environmental and genetic factors. The research instrument used for data collection in this study included health education using stunting prevention booklet media, which was provided to mothers of toddlers in the form of booklets. These booklets contained information on the definition of stunting, factors contributing to stunting, characteristics of stunting, sanitation practices for preventing stunting, the impact of stunting, stunting prevention measures, and sanitation practices for stunting prevention. Health education was administered after pre-tests and post-tests at the Posyandu in August 2023, and the booklets were taken home by the mothers of toddlers. Follow-up was conducted through chat media every three days.

Health education with an *Bocesting* based android application media was also provided to mothers of toddlers in the form of an Android application. This application contained information on the definition of stunting, factors causing stunting, stunting characteristics, the impact of stunting, stunting prevention methods, and sanitation practices for stunting prevention. Health education sessions were conducted once a week for a month in a group format. Mothers of toddlers were able to download the Android application to learn and apply the information at home. Follow-up was carried out through chat media every three days.

The data collection tools used to measure changes in improving maternal nutrition behavior included questionnaires and checklist sheets for cognitive, affective, and psychomotor aspects. The determination of the nutritional status of toddlers in this study was based on anthropometric indices such as PB/U or TB/U, as well as scales and body length gauges.

Data analysis

The collected data were analyzed through univariate analysis to describe the frequency distribution of each variable, including the independent variables (booklet media and Android application media) and dependent variables (maternal nutritional behavior and nutritional status of toddlers). Bivariate analysis in this study included a Normality Test, conducted using the Kolmogorov-Smirnov test, which indicated that the data were not normally distributed on a categorical scale. For the analysis of pre-test and post-test values of the three groups, the Wilcoxon Signed-Rank Test, a non-parametric statistical method, was employed. The Mann-Whitney U analysis, another non-parametric statistical method, was used to compare two independent groups. Multivariate analysis was performed using Kruskal-Wallis H, a method used to assess the independent variable that had the most significant influence.

Results

Table 1 presents the characteristics of the control group, revealing that the majority of participants were in the age range of 0-23 months, comprising 9 people (52.9%), while the smallest age group was 24-59 months, with 8 people (41.1%). In the booklet

group, most participants fell into the age category of 0-23 months, with 10 people (58.8%), while the smallest age group was 24-59 months, consisting of 7 people (42.2%). For the application group, the majority of participants were in the 0-23-month age range, with 12 people (70.6%), while the smallest age group was 24-59 months, with 5 people (29.4%). Regarding gender characteristics, the control group, booklet group, and application group mostly comprised males, accounting for 11 in the control group (64.7%), 10 in the booklet group (58.8%), and 10 in the application group (58.8%). Exclusive breastfeeding was predominant in all groups, with 14 people (82.3%) in the control group, 13 people (76.4%) in the booklet group, and 13 people (76.4%) in the application group.

In terms of the age characteristics of mothers, the majority fell within the age group of 21-30 years in all three groups: 13 in the control group (76.4%), 12 in the booklet group (70.6%), and 11 in the application group (64.7%). Regarding the education of mothers, the majority had a senior high school education level: 7 people in the control group (41.2%), 10 people in the booklet group (58.8%), and 7 people in the application group (41.02%). When it comes to the occupation of mothers, the majority were employed in all groups: 17 people in the control group (100%), 17 people in the booklet group (100%), and 14 people in the application group (82.4%). In terms of parents' income, the majority had incomes equal to or less than the Regional Minimum Wage: 17 people in the control group (100%), 17 people in the

Table 1. Distribution of respondents based on toddler age, gender, exclusive breastfeeding, mother's age, mother's education, mother's occupation, mother's job, parent's income, nutritional status based on height according to age of toddler.

Variable	Control group (n=17)		Booklet group (n=17)		Boceesting based android application (n=17)	
	F	%	F	%	F	%
Toddler age						
0-23 Months	9	52.9	10	58.8	12	70.6
24-59 Months	8	41.1	7	41.2	5	29.4
Gender						
Male	11	64.7	10	58.8	10	58.8
Female	6	35.3	7	41.2	7	41.2
Exclusive breastfeeding						
Yes	14	82.3	13	76.4	13	76.4
No	3	17.7	4	23.6	4	23.6
Mother's age						
≤ 0 years	0	0	0	0	0	0
21-30 years	13	76.4	12	70.6	11	64.7
≥31 years	4	23.6	5	29.4	6	35.3
Mother's education						
Primary school	5	29.4	3	17.7	2	11.8
High school	5	29.4	4	23.5	6	35.2
Senior high school	7	41.2	10	58.8	7	41.2
College	0	0	0	0	2	11.8
Mother's job						
Work	17	100	17	100	14	82.4
Not working	0	0	0	0	3	17.6
Parent's income						
≤Regional minimum wage	17	100	17	100	14	82.4
Regional minimum wage	0	0	0	0	2	11.8
≥Regional minimum wage	0	0	0	0	1	5.8
Nutritional status						
Very short	2	11.8	5	29.4	3	17.6
Short	2	11.8	7	41.2	3	17.6
Normal	13	76.4	5	29.4	11	64.8
Total	17	100	17	100	17	100

booklet group (100%), and 14 people in the application group (82.4%). In the application group, the nutritional status of toddlers varied by age. The highest nutritional status was ‘normal’ nutritional status, accounting for 13 people (76.4%), while the lowest was ‘short’ and ‘very short’ nutritional status, involving a total of 2 people (11.8%). For the booklet group, the predominant nutritional status was ‘short,’ with 7 people (41.2%), whereas the lowest were ‘normal’ and ‘very short’ nutritional statuses, each with 5 people (29.4%). In the control group, the highest nutritional status observed was ‘normal’ nutritional status, encompassing 11 people (64.8%), while the lowest were ‘very short’ and ‘short’ nutritional statuses, each with 3 people (17.6%).

Based on Table 2, significant differences were observed in the Android group between pre-test and post-test scores for cognitive, affective, psychomotor, nutritional behavior, and maternal attitudes towards nutrition. However, no significant differences were found for nutritional status. In the booklet group, there were significant differences in the increase in pre-post test scores for cognitive, psychomotor, nutritional behavior, and attitudes, while

there were no significant differences for affective aspects and nutritional status. In the control group, there were no significant differences between pre-test and post-test scores.

Based on Table 3, the results show a significant improvement in nutritional behavior when comparing the booklet group to the control group. However, there is no significant difference in nutritional status when comparing the booklet group to the control group. Based on Table 4, the results indicate a significant comparison of maternal nutritional behavior between the Android application group and the control group, while nutritional status did not exhibit a significant difference.

Based on Table 5, the results reveal a more noticeable and significant increase in nutritional behavior in the Android group compared to the mothers in the booklet group. However, there were no significant differences in nutritional status improvement between the booklet media group and the Android application media education group. The Android treatment group demonstrated a higher level of knowledge about stunting compared to the other treatment groups. In Table 6, the Chi-Square value for maternal nutrition

Table 2. Distribution of differences in scores before and after intervention in the Booklet group, Android application group and control group (Wilcoxon test results) (n=51).

Research variable	Bocesting based android application			Booklet group			Control group		
	Pre (Mean)	Post (Mean)	p	Pre (Mean)	Post ((Mean)	p	Pre (Mean)	Post (Mean)	p
Cognitive	72.66	85.56	0.001	61.71	68.89	0.001	66.04	73.41	0.100
Affective	68.70	79.91	0.002	67.90	72.43	1.000	67.87	68.24	0.374
Psychomotor	78.11	92.14	0.001	71.98	82.59	0.193	82.22	82.59	0.121
Nutritional behavior	73.26	89.88	0.001	81.14	87.70	0.001	72.04	74.75	0.3050
Mother's attitude to nutrition	77.42	95.50	0.002	72.46	89.60	0.003	66.38	81.77	74
Nutritional status (tb/u)	0.770	0.881	0.317	0.671	0.665	0.193	0.481	0.415	0.076

Table 3. Comparative distribution of nutritional behavior improvement scores in the booklet group and control group (Man Whitney U test results) (n=51).

Variable	Booklet group (Mean)	Control group (Mean)	p	
			Pre	Post
Mother's nutrition behavior	87.70	74.75	0.378	0.002
Nutritional status	0.665	0.415	0.729	0.016

Table 4. Comparative distribution of nutritional behavior improvement scores in the Bocesting based android application and control group (Man Whitnet U test results) (n=51).

Variable	Bocesting based android application (Mean)	Control group (Mean)	p	
			Pre	Post
Mother's nutrition behavior	89.88	74.75	0.052	0.003
Nutritional status	0.881	0.415	0.432	0.655

Table 5. Comparative distribution of the value of improving nutritional behavior in the booklet group and the Bocesting based android application (Man Whitnet U test results) (n=51).

Variable	Booklet Group (Mean)	Bocesting based android application (Mean)	p	
			Pre	Post
Mother's nutrition	87.70	89.88	0.043	0.004
Nutritional status	0.665	0.881	0.144	0.144

behavior was 51.95 with a p-value of 0.0003. These results indicate a significant difference in the improvement of maternal behavior towards nutrition in the three research groups. However, no significant change was observed in nutritional status improvement. Regarding the advantages and disadvantages of educational media research, the Android application media offers benefits such as portability since it can be accessed on a smartphone, discussion forums, and independent nutritional status measurement. However, a limitation of this Android application is its inability to measure nutritional status using decimal numbers.

Discussion

Multivariate analysis in this study aimed to assess the varying degrees of influence of the booklet media intervention group, the Android application intervention group, and the control group on the improvement of maternal nutritional behavior and the nutritional status of toddlers. The results indicated that for maternal nutritional behavior, the Chi-Square value was 51.95 with a p-value of 0.0003, and for maternal attitudes towards nutrition, the Chi-Square value was 67.82 with a p-value of 0.001. Based on the study's findings, it can be concluded that there are significant differences in improving maternal behavior and attitudes towards nutrition within the three research groups. However, there was no significant change in improving nutritional status. Behavior can be described as an individual's response to a stimulus or action that can be observed and has specific characteristics such as frequency, duration, and purpose, whether it is consciously realized or not. Understanding the underlying reasons for an individual's behavior is essential before attempting to modify it.¹⁵

Based on the research conducted by providing education through booklet media and applications, it was observed that the nutritional behavior and attitudes of mothers in the Android group were significantly more pronounced compared to the nutritional behavior and attitudes of mothers in the booklet group. However, there was no significant difference in the improvement of nutritional status between the booklet media group and the Android application media education group. Booklets are essentially sheets of paper folded to provide concise descriptions of a problem, with short, easily understandable sentences and simple illustrations¹⁶. The booklet intervention is supported by Pangesti's research (2021), which demonstrates significant changes in maternal behavior regarding baby massage before receiving health education

using the demonstration method and booklets. This is evident from the analysis results, which indicate a p-value of 0.000 (less than 0.005).¹⁷ The concept of mobile-based electronic learning is a product of technological advancements through mobile media, leading to innovations in the field of health education. This is substantiated by Relawati's research in 2018, which highlights that smartphones and tablet PCs are devices suitable for mobile learning, enabling patients and families to access chronic kidney failure education at any time and from anywhere¹⁸. These results are achieved because Android media is easier to comprehend, as it includes an application menu that simplifies mothers' understanding of how to ensure proper nutrition for stunted toddlers.^{19,20} This improved understanding leads to significant enhancements in the mothers' behavior and attitudes.

The issue of malnutrition, particularly stunting, can be attributed to insufficient nutritional intake in toddlers. This deficiency in nutritional intake is not solely a result of food availability but is also connected to economic circumstances, poor sanitation, and the mothers' lack of knowledge about nutrition.²¹ Booklets are provided in both hard copy and soft copy formats through WhatsApp messenger, accessible on Android devices, to assist cadres and mothers of toddlers in enhancing their knowledge about child nutrition and preventing stunting.²² This is supported by research indicating that there is an effect of stunting education using Android applications on increasing maternal knowledge and attitudes.²³ This study also demonstrated that educational media in the form of booklets, providing dietary recommendations for both healthy and sick children, has been proven to enhance knowledge regarding proper nutrition to prevent stunting. This aligns with the results of research that indicate flipchart media and booklets focusing on the first 1000 days of life (HPK), with themes such as regular weighing and the appropriate introduction of complementary foods, can foster behavior that leads to improved health outcomes²⁴. We can conclude that the better our access to information about balanced nutrition, the more effectively we can implement balanced nutrition behaviors. This is because, when individuals receive information, their knowledge about balanced nutrition increases, enabling them to apply these behaviors properly.

In the present era, the development of science and technology is highly advanced and of better quality, making it easier for individuals to access information in their daily lives through sources such as the internet, radio, health posters, scientific books, health counseling workers, and more. The use of the internet for information retrieval is prevalent in society, as it is one of the most convenient and easily accessible media for finding information, including in the field of health.²⁵

This is supported by several studies that assert that education is a process aimed at eliminating undesirable (negative) behavior and replacing it with appropriate and productive behavior, which in turn leads to a healthy lifestyle.^{26,27} Booklet educational media about maternal parenting aids mothers with stunted toddlers in offering support, attention, and nutrition, which encompasses guidance on how to feed their children, provide nutritious food, maintain personal hygiene, and create a healthy environment. It also encourages them to make use of health services to support their child's well-being. Thus, the education provided plays a crucial role in shaping the mother's attitudes and actions.

The lack of awareness about the importance of nutrition can result in limited efforts to prevent stunting. Therefore, an individual's level of nutritional knowledge, whether high or low, will impact their nutritional attitudes and behaviors. If a parent possesses a high level of nutritional knowledge, they are more likely to exhibit positive nutritional attitudes and behaviors. One

Table 6. Distribution of Kruskal Wallis test results of booklet group, Bocesting based android application and control group (n=51).

Variable	Mean rank	Chi-square (χ^2)	p
Maternal nutrition behavior			
Booklet group	42.66	51.95	0.003
Bocesting based android application	86		
Control group	22.04		
Nutritional status of toddlers			
Booklet group	31.78	11.827	0.24
Bocesting based android application	45.44		
Control group	49.78		

limitation of this study is that it has not yet explored the dietary and sleep patterns in toddlers in relation to their nutritional status. We suggest that future researchers investigate these aspects to enhance the significance of study results.

Conclusions

Based on the results of the research and the discussion of 'Booklet preventing stunting (bocesting) based on an Android application as an educational medium for improving maternal nutrition behavior and nutrition status,' it can be concluded that there are significant differences in improving maternal behavior and attitudes toward nutrition within the three research groups. However, there is no significant change in nutritional status improvement. The more information we acquire about balanced nutrition, the better our application of balanced nutrition behavior becomes. This is because when individuals gain information, their knowledge about balanced nutrition increases, enabling them to implement balanced nutrition behaviors properly. It is hoped that healthcare workers can provide stunting education to mothers using educational media booklets and recommended applications as new tools for delivering effective health information to the community. These findings can also serve as valuable input for future researchers.

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