

WhatsApp-Based Nutrition Telemedicine to Improve Knowledge Attitude Practice (KAP) of Mothers with Stunted Children in Indonesia

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ABSTRACT:

Stunting remains a significant public health challenge, especially in developing countries, and is often exacerbated by insufficient parental supervision of children's nutritional needs. Leveraging familiar technologies like WhatsApp Telemedicine for Mothers of Stunted Children (WA-TESTA) can improve mothers' knowledge, attitudes, and practices related to the care and prevention of stunting in children under two years old. This research aimed to assess the effectiveness of the WA-TESTA program in improving mothers' knowledge about stunting, their attitudes towards the prevention of stunting and their practices in caring for stunted children (KAP) under two years old in Banyumas Regency, Indonesia. A quasi-experimental design was employed, involving 202 mothers from 10 villages, randomly divided into an intervention group (101 participants) receiving weekly support via the WA-TESTA app for three months and a control group (101 participants) that did not receive any intervention. Data analysis was performed using independent t-tests, paired t-tests, mann-whitney, chi-square, and general linear model. The findings indicated significant improvement in the KAP scores of the intervention group (KAP p-values: 0.001), while the control group showed no notable changes (p-values for knowledge: 0.260, attitudes: 0.538, and practices: 0.394). The intervention and control groups differed significantly regarding knowledge (p-value = 0.001), attitudes (p-value = 0.001), and practices (p-value=0.002). The WA-TESTA initiative effectively engaged mothers, helping them recognize the importance of adopting supportive attitudes toward the prevention of stunting. The result also highlights the essential role of nutrition in stunting prevention.

1. Introduction

A condition known as stunting occurs when a child's height is significantly below the typical age group. It is an essential biomarker of growth retardation induced by chronic undernutrition in the first 1,000 days of life, from conception to two years old. Childhood stunting has immediate and long-term consequences, including higher morbidity and death rates, as well as impaired child development and learning ability. It also increases the risk of noncommunicable diseases, making people more prone to central obesity, reduces energy expenditure, and increases the possibility of diabetes, hypertension, and dyslipidemia. It can also lead to lower job capability and poor maternal reproductive outcomes in adulthood.

One potential contributor to stunting is inadequate child-feeding practices, with mothers playing a crucial role in household responsibilities, particularly in child-rearing (UNICEF, 2023). Many mothers still do not thoroughly prioritize the quality and quantity of food given to their children (Kemenkes RI, 2021). Nutrition education programs can help improve mothers' knowledge of meeting their children's nutritional demands (Wahyuningsih et al., 2022).

In today's digital age, the healthcare sector is increasingly utilizing telemedicine or telehealth, which is defined as the provision of health services where distance plays a crucial role, and healthcare professionals facilitate the use of information and communication technology (ICT) (Satriawan, 2018).

There is an urgent need to develop digitally based nutrition education innovations, particularly those utilizing the principles of nutrition telemedicine. Telehealth has consistently proven effective in healthcare delivery and offers additional benefits for rural communities. (Haskas, 2020).

Previous studies have explored stunting education through Android apps and social media platforms. However, these studies have not addressed the development of a WhatsApp-based nutrition telemedicine model specifically for stunting nutrition education. This gap presents an opportunity for further research in this field. (Friska & Andriani, 2021), (Rianti et al., 2020), (Alderman et al., 2019), (Amaliah, 2018), (Rufaindah & Patemah, 2021).

In 2022, Indonesia reported a stunting prevalence of 21.6% among children, equating to 6,637,680 out of 30,730,000 children under the age of two years old being affected (Kementerian Kesehatan RI, 2021) (Wahyuningsih et al., 2022). The Indonesian government aims to lower this prevalence to below 14% by 2024 (Satriawan, 2018). Based on the 2018 Primary Health Research (RISKESDAS) data, the prevalence of stunting in the Banyumas Regency is 32%, which is above the national average prevalence of 21.6%. This indicates that one out of three under-two-age children in Banyumas Regency is stunted. However, all mothers in the community own a mobile phone. This research seeks to evaluate the effects of WhatsApp-based nutrition telemedicine on improving mothers' KAP in caring for stunted children under two years old.

2. Objectives

This study aimed to implement the WA-TESTA education model to assist mothers of stunted children under two years old and assess its effectiveness in improving mothers' knowledge about stunting, their attitudes towards the prevention of stunting and their practices in caring for their stunted children under two years old (KAP) in the Banyumas Regency.

Ethical Approval and Permission

The Health Research Ethics Committee of the Faculty of Public Health, Diponegoro University, approved the study with approval number 086/EA/KEPK-FKM/2023. The participants provided their informed consent and agreed to participate in the study after being given a detailed explanation, confirmed by their signatures.

3. Methods

Design

This quasi-experimental research took place between June and August 2024 in Banyumas Regency, Central Java, Indonesia, using a pre-and post-test control group design. The stunting locus data of ten villages were obtained from the 2022 Banyumas District Health Office health profile and are mapped in Figure 1. Ten stunting locus villages were divided into five control groups (CG) and five intervention groups (IG) (Table 1). The table also showed the number of respondents in each village.



Figure 1. Stunting Locus Villages in Banyumas Regency

Table 1. Frequency Distribution of Stunting Locus Villages

No.	Village namef	(%)
Stunting Locus		
A IG		
1	Cindaga	19 (18.81)
2	Kasegeran	23 (22.77)
3	Panusupan	22 (21.78)
4	Kracak	15 (14.85)
5	Darmakradenan	22 (21.78)
Total		101 (100.00)
B CG		
1	Kalisalak	20 (19.80)
2	Randegan	21 (20.79)
3	Kaliwedi	22 (21.78)
4	Karangsari	17 (16.83)
5	Adisana	21 (20.79)
Total		101 (100.00)

Source: health profile of Banyumas District Health Office

f: percentage from the total respondents (number of stunted children respondents under two years old)

IG: intervention group, CG: control group

Population and Sample

This study's population consisted of mothers who had stunted children under two years old and lived in the 10 stunting locus villages (Table 1). Two hundred two mothers with stunted under two met the criteria of having stunted under two, living in the stunting locus during the study, participating in all research activities, and having a cell phone, all of whom became subjects in this study (total sample). The 202 subjects were then placed into the IG or CG based on their residence location.

Intervention development

In this study, the IG received a WhatsApp-based nutritional telemedicine program designed to educate caregivers via WhatsApp about nutritional care for stunted children under two years old. The content of the messages and discussions in this platform was created by three experts, consisting of an information technology expert from Universitas Dian Nuswantoro, a nutritionist from Universitas Diponegoro, and a health promotion expert from Universitas Gajah Mada, who developed the application for this program. The pilot implementation of the program involved 36 mothers of stunted children under two years old who live in the area of Mandirancan Village, Kebasen District, Banyumas Regency.

Two questionnaires were utilized to assess the feasibility of the system and user satisfaction with WhatsApp-Based Nutrition Telemedicine: The System Usability Scale (SUS) and the User Experience Questionnaire (UEQ). The SUS evaluates the system's user-friendliness and comprises ten questions, split into five positive (odd-numbered) and five negative (even-numbered) items. These questions cover various dimensions, including learnability (Q1-2), efficiency (Q3-4), memorability (Q5-6), error management (Q7-8), and overall satisfaction (Q9-10). Participants rated their experiences on a 1-5 on a Likert scale; a score of five indicates strong agreement, and one indicates strong disagreement. The total SUS score can vary from 10 to 50.

The User Experience Questionnaire (UEQ) aims to assess the quality of enjoyable and pleasant user interactions with the system. It consists of 26 questions categorized into six dimensions: Attractiveness (Q1-6), Perspicuity (Q7-10), Efficiency (Q11-14), Dependability (Q15-18), Stimulation (Q19-22), and

Novelty (Q23-26). Respondents chose from seven options on a Likert scale of 1 to 7. The overall UEQ score can range from 26 to 182. The findings of the WhatsApp-based nutrition telemedicine trial, which utilized the SUS and UEQ questionnaires, are shown in Table 2.

Table 2. WA-TESTA Trial Using SUS and UEQ Questionnaires for Mothers of Stunted Children Under Two Years Old

Aspects	Mean	Category
System Usability Scale (SUS)		
Easy to understand	60.42	Ok
Efficient	51.39	Ok
Easy to remember	58.33	Ok
Error	57.29	Ok
Satisfaction	46.53	Poor
User Experience Questionnaire (UEQ)		
Attractiveness	1.25	Above average
Clarity	0.88	Below Average
Efficiency	1.2	Above Average
Accuracy	1.26	Above Average
Stimulation	1.34	Above Average
Novelty	0.99	Above Average

Intervention delivery

The intervention was given to mothers of stunted children under two years old 24 times, twice a week, for 3 months with the assistance of cadres. During the first visit, the mother was given a link via WhatsApp, after which the mother was asked to click so that she would get a reply from the application in the form of several menu options. During the first visit, the mother is asked to fill out a profile menu that includes her name, age, and address, as well as the child's name, age, sex, vitamin A administration, deworming status, breast-feeding, complementary feeding, and frequency of illness. Next, the mother is asked to select the Monthly Report Menu containing the child's height and weight. Afterward, the mother is asked to complete the Weekly Report, which covers the adequacy of staple foods, side dishes, vegetables, fruits, drinking water, and breast milk or infant formula. Subsequently, the mother selects the Diagnosis and Recommendation Menu, which displays a recap report containing the child's name, gender, weight, and height, along with the calculation results (tall, normal, short, very short) and essential educational recommendations for the mother to review, such as Stunting Education, Complementary Breastfeeding Education, Exclusive Breastfeeding Education, Growth and Development Education, Immunization Education, Nutrition Fulfillment Education, and Clean and Healthy Behaviors Education. Additionally, if the mother wants to consult with a midwife, she can send the Consultation Menu, which is automatically linked to the midwife.

All respondents in the CG and IG continued to receive routine government assistance, which consists of ready-to-eat food. Concurrently, mothers also received support from the Community Health Center (Puskesmas) and the local village authority in the form of high-protein raw materials such as eggs, beef, and milk for children under two years old. They also received counseling. The difference between the CG and IG was the WA-TESTA provision for the intervention group. WA-TESTA was administered on a schedule as presented in Table 3.

Table 3. WhatsApp-Based Nutrition Telemedicine Intervention Delivery Schedule

No	Application Features	Schedule
1	Monthly Report	Three times every week for three months
2	Weekly Report	Two times every week for three months
3	Education	Two times every week for three months
4	Diagnosis	Two times every week for three months

Research Variables

The dependent variables in this study encompass mothers' knowledge, attitudes, and practices concerning caring for stunted children under two years old. Knowledge is gained from understanding, which occurs when a person experiences a particular object through the five senses: sight, hearing, smell, taste, and touch. This understanding was assessed using a validated questionnaire of 25 questions on the definition, causes, and prevention of stunting, complementary breastfeeding, nutritional, vitamin adequacy, and healthy hygiene behaviour in children under two years old. A score of 1 was given for correct answers, while incorrect answers received a score of zero. Knowledge scores can range from 0 to 25, with the final score expressed as a percentage from 0 to 100.

Attitude is defined as a person's internal reaction or response to a stimulus or object. Attitudes reflect feelings of pleasure or displeasure, like or dislike, toward an object, whether physical, social, or conceptual. This attitude is formed through the learning process and is influenced by experience, environment, and other factors. Attitudes are measured using a pretested Likert scale questionnaire (1-4) with 15 items. The range of attitude scores is 15 to 60, with the final score expressed as a percentage from 0-100.

Practice refers to the actual behaviour or a person's observable response to a stimulus or object, encompassing all activities performed directly. This behaviour reflects how an individual applies their KAP, which is influenced by factors such as motivation, perception, and the environment. Practice is evaluated using a pre-tested questionnaire with 15 items, where correct answers are scored as one and incorrect answers as zero. The practice score can range from 1 to 15, with the final score as a percentage from 0 to 100.

Before being used, the instruments measuring knowledge, attitudes, and practices were tested on 30 mothers of stunted children under two years old living in Mandirancan Village, Kebasen Subdistrict, Banyumas Regency. In the knowledge measurement instrument, out of 25 questions, 25 questions were deemed valid ($r_{\text{count}} > r_{\text{table}}$). The reliability test produced a Cronbach's Alpha value of 0.751 (>0.6), indicating that all questions in the knowledge assessment are reliable. In the attitude assessment, all 15 questions were valid ($r_{\text{count}} > r_{\text{table}}$). The reliability analysis for the attitude instrument resulted in a Cronbach's Alpha of 0.671 (>0.6), confirming that all attitude questions are reliable. Similarly, all 15 questions in the practice assessment were deemed valid ($r_{\text{count}} > r_{\text{table}}$), and the reliability measurement produced a Cronbach's Alpha value of 0.632 (>0.6), signifying that all questions in the practice instrument are also reliable.

Other variables studied were age, education, parent's occupation (father and mother), fathers income, and number of children in the family as confounding variables. Age is the length of time lived in years from birth to the time of the study. Education was the last formal education completed by the subject or husband at the time of the survey, categorized into elementary, junior, senior high school, and university. Occupation is any business owned by the subject and father that earns money, which is categorized into occupational choices as "laborers, private employees, and self-employed, while the

subject is categorized into two, namely working and not working. Fathers income refers to the total amount of money the father earns in a month, measured in rupiah (Rp) and Uncertain.” The number of children under two years old shows children under two years old living together and sharing food, categorized as “one (1) and two or more (2).

Data Analysis

The gathered data were analyzed using SPSS version 26.0 from IBM Corp. The normality of the data concerning the mother's knowledge, attitudes, and practices of stunted children under two years old was evaluated using the Kolmogorov-Smirnov test. The pre-test and post-test results were compared using paired samples t-test outcomes within each group, while an independent samples t-test and Mann-Whitney test were used to compare the CG and IG. Furthermore, a multivariate analysis using a general linear model (GLM). This analysis explores the relationship between various factors, including independent and confounding variables, and their impact on the dependent variable. The dependent variables in this study were knowledge, attitude, and practice. The confounding variables included parents age (father and mother), education, occupation, fathers income, and number of children under two years old (eight independent variables).

4. Results

Table 4 summarizes the characteristics of parents with stunted children under two years old, including education, age, occupations (father and mother), fathers income, and the number of children under two years old before the intervention. The CG had an average maternal age of 32.35 ± 5.9 years, while the intervention group (IG) had an average age of 31.77 ± 5.5 years. The IG tended to have a slightly younger mean age than the CG. Still, both groups had almost the same standard deviation (SD) value, indicating that the age range in both groups was reasonably similar. Most mothers in both groups had completed junior high school, with a significantly higher percentage in the IG (48.5%) than the CG (42.6%). Additionally, the CG demonstrated a higher proportion of individuals with a college education (10.9%) than the IG (9.9%). Likewise, the CG had more participants with primary school education (19.8%) than the IG (16.8%).

Most participants in both groups were non-employed, with a slightly more significant percentage in the CG (95.0%) compared to the IG (92.1%). The average age of the fathers in the CG was 34.31 ± 6.5 years, while in the intervention group, it was 34.72 ± 7.5 years, indicating that the average ages of fathers in both groups were quite similar.

In both groups, most fathers had completed junior high school, with a higher percentage in the IG (37.6%) than in the CG (33.7%). The predominant occupation for father's in both groups was laborer, with 64.4% in the CG and 77.2% in the IG. However, the two groups had no statistically significant variation in occupational distribution ($p > 0.05$).

The average monthly fathers income for participants in the CG was IDR $1.232.364 \pm 1.274.524$, while for the IG, it was IDR $1.387.624 \pm 1.198.142$. Although the fathers income of the IG was slightly higher than the CG, this difference was likewise not statistically significant ($p > 0.05$). Most families in both groups had one child, 88.1% in the CG and 86.1% in the IG. The IG had a higher percentage of families with two children (13.9%) than the CG (11.9%). Table 4 presents the parental characteristics for the CG and IG.

Table 4. Characteristics of Mother with Stunted Children Under Two Years Old in Intervention and Control Group

Characteristics	CG		IG		p-value
	f (%)	Mean (±SD)	f (%)	Mean (±SD)	
Mothers age (y)	-	32.35±5.9	-	31.77±5.5	0.479 ^a
Mothers Education					0.859 ^c
Elementary School	20(19.8)	-	17(16.8)	-	
Junior High School	43(42.6)	-	49(48.5)	-	
Senior High School	27(26.7)	-	25(24.8)	-	
Bachelor	11(10.9)	-	10(9.9)	-	
Mothers Occupation					0.390 ^c
Employed	5(5.0)	-	8(7.9)	-	
Non-Employed	96(95.0)	-	93(92.1)	-	
Fathers age (y)	-	34.31±6.5	-	34.72±7.5	0.673 ^a
Fathers Education					0.818 ^c
Elementary School	33(32.7)	-	27(26.7)	-	
Junior High School	34(33.7)	-	38(37.6)	-	
Senior High School	29(28.7)	-	30(29.7)	-	
Bachelor	5(5.0)	-	6(5.9)	-	
Fathers Occupation					0.113 ^{c*}
Labor	65(64.4)	-	78(77.2)	-	
Private Employee	16(15.8)	-	12(11.9)	-	
Self-employed	20(19.8)	-	11(10.9)	-	
Fathers Income- (IDR/m)		1.232.364 ±1.296.597	-	1.387.624 ±1.198.142	0.087 ^{b*}
Number of Children Under Two Years Old (Person)					0.674 ^c
1 (one)	89(88.1)	-	87(86,1)	-	
2 (two)	12(11.9)	-	14(13.9)	-	
Total	101(100.0)		101(100.0)		

Sig. P-value < 0,05; *sig at p<0.25 (multivariate candidate); a: independent t-test; b: Mann-Whitney; c: chi square; CG, control group (101 respondents), IG, intervention group (101 respondents).

Table 5 presents the analysis of differences in KAP from the pre-test and post-test of the WA-TESTA intervention in the CG and IG. In the CG, the pre-test mean score for knowledge was 71.03, while the post-test score was 71.66, leading to a mean difference (Δ Pre-test Post-test) of 0.63. The p-value for the change observed comparing the CG pre-test and post-test was 0.260, suggesting that this difference was not statistically significant. In contrast, the IG had a pre-test mean score of 71.70, which increased to 78.52 in the post-test, yielding a mean difference of 7.28. The p-value for IG change was 0.001, indicating a significant increase in mothers' knowledge about stunting and demonstrating the effectiveness of the intervention.

Regarding the attitude variable, the CG had a pre-test average of 70.88 and a post-test mean of 70.46, resulting in a mean difference of -0.42, indicating a slight decline in attitude. The p-value for the change was 0.538, showing that this change was not statistically significant. Conversely, the IG had a pre-test mean score of 71.78, which increased to 76.81 in the post-test, with a mean difference of 6.03.

The p-value for this attitude change was 0.001, indicating a statistically significant improvement in mothers' attitudes towards the prevention of stunting in children under two years old.

For the practice variable, the CG had a pre-test average of 71.21, which increased to 71.56 in the post-test, resulting in a mean difference of 0.35. The p-value for the change was 0.394, which indicates that the change in practices within the CG was not statistically significant. In the IG, the pre-test mean score was 72.92, which rose to 75.52 in the post-test, yielding a mean difference of 2.64. The p-value for this change was 0.001, indicating a statistically significant improvement in the practice of caring for stunted children under two years old.

The pre-test knowledge scores did not differ significantly between the CG and IG (p-value=0.375), suggesting that both groups showed comparable knowledge about stunting levels at the start of the study. However, the post-test results showed a statistically significant difference (p-value=0.001), indicating that the intervention significantly enhanced knowledge compared to the CG.

Likewise, the pre-test attitude scores showed no significant difference between the two groups (p-value=0.292). However, the post-test scores showed a significant difference (p-value=0.001), indicating that the intervention substantially improved mothers' attitudes towards the prevention of stunting in children under two years old in the IG compared to the CG.

The pre-test practice scores also did not reveal a significant difference among the groups (p-value = 0.156), suggesting that the practice conditions were similar at the study's outset. In contrast, the post-test scores demonstrated a statistically significant difference (p-value=0.002), and the improvement in scores (Δ Pre-test Post-test) was also significant (p-value=0.000). The IG exhibited a more considerable enhancement in the practice of caring for stunted children under two years old than the CG, both in the post-test (p=0.002) and in score improvement (Δ Pre-test Post-test, p=0.001). This confirms the intervention's effectiveness in improving practices, indicating that it successfully facilitated better practice changes. The analysis results of the differences in mothers' knowledge about stunting, their attitudes towards the prevention of stunting in children and their practices in caring for stunted children under two years old before and after the intervention in CG and IG are presented in Table 5.

Table 5. Differences in Knowledge, Attitudes, and Practices of Mothers with Stunted Children Under Two Years Old Between Intervention and Control Group before and after WA-TESTA intervention

Group	Mean($\pm$ SD)		
Variables	CG	IG	p-value
Knowledge			
Pre-test	71.03 $\pm$ 5.63	71.70 $\pm$ 5.13	0.375^b
Post-test	71.66 $\pm$ 6.53	78.52 $\pm$ 5.49	0.001^b
p-value^a	0.260^a	0.001^a	
Change (Δ)	0.63 $\pm$ 5.62	6.82 $\pm$ 5.16	0.001^c
Attitude			
Pre-test	70.88 $\pm$ 6.58	71.78 $\pm$ 5.49	0.292^b
Post-test	70.46 $\pm$ 5.78	76.81 $\pm$ 7.13	0.001^b
p-value^a	0.538^a	0.001^a	
Change (Δ)	-0.43 $\pm$ 6.92	5.03 $\pm$ 8.59	0.001^b
Practice			
Pre-test	71.21 $\pm$ 7.97	72.92 $\pm$ 9.08	0.156^b
Post-test	71.56 $\pm$ 9.25	75.52 $\pm$ 8.40	0.002^b
p-value^a	0.394^a	0.001^a	
Change (Δ)	0.35 $\pm$ 4.19	2.64 $\pm$ 2.25	0.001^c

Sig. P-value < 0,05; ^a paired t-test; ^b independent t-test; ^c Mann Whitney; CG: Control Group, IG: Intervention Group.

Knowledge, Attitudes, and Practices for Caring and Preventing Stunting in Children Under Two Years Old

Tables 6-8 display the multivariate analysis of confounding variables using the general linear model (GLM). This analysis explores the relationships between various factors, including independent and confounding variables, and their impact on the dependent variables. This study's dependent variables are knowledge, attitude, and practice. In contrast, the confounding variables consist of the parental (mother and father) age, education, occupation, father's income, and number of children under two years old (eight independent variables).

The eight independent variables were selected using bivariate analysis, independent t-test, Mann-Whitney, and chi-square to determine their effect on the knowledge, attitude, and practice. The bivariate analysis revealed that two independent variables, i.e., fathers occupation and fathers income, had a p-value of less than 0.25 and were consequently incorporated into the multivariate modeling candidates. While the fathers job and income were considered, only the fathers income variable was analyzed using GLM, because the income variable is the result obtained from the fathers job. Table 6 summarizes the analysis of income's impact on mothers' knowledge. The results show that knowledge improved significantly in the intervention group compared to the control group, with the control group reflecting a difference of -6.148 and the intervention group at zero after adjusting for income. The adjusted R-squared value of 0.244 indicates that their income levels can explain 24% of the variability in knowledge differences between the groups. The relationship between income and mothers' knowledge for those with children under two years old in both groups is detailed in Table 6.

Table 6. GLM Analysis of Income on Knowledge of Mothers with Stunted Children Under Two Years Old

Parameter	β	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	6.519	.679	9.595	.000	5.179	7.858
Father's Income CG & IG	.002	.003	.729	.467	-.004	.008
[Group=1.00]	-6.148	.762	-8.070	.000	-7.650	-4.646
[Group=2.00]	0 ^a	.	.	.	.	.
Adjusted R Squared= .244						

sig: significant at $p < 0.05$; Significant; Confidence Interval: range of values; CG: control group; IC: intervention group; β : direction of Effect; t: the value of the t statistic; a: not applicable

Table 7 displays the income analysis findings, concerning the attitudes of mothers with children under two years old. The results from the GLM analysis indicate that the increase in positive attitude was more significant in the intervention group compared to the control group, after accounting for confounding variables. Notably, the control group exhibited a difference of -5,400, while the intervention group showed a difference of 0. The adjusted R squared value of 0.103 suggests that 10% of the variability in the difference in knowledge between the control and intervention groups can be explained by the income variable associated with both groups. Further details regarding the

relationship between income and mothers' attitudes in the control (CG) and intervention (IG) groups are summarized in Table 7.

Table 7. GLM Analysis of Income on the Attitude of Mothers with Stunted Children Under Two Years Old

Parameter	β	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	4.614	.982	4.697	.000	2.677	6.552
Father's Income CG & IG	.003	.004	.691	.491	-.006	.012
[Group=1.00]	-5.400	1.102	-4.902	.000	-7.572	-3.228
[Group=2.00]	0 ^a	.	.	.	.	.
Adjusted R Squared= .103						

sig at $p < 0.05$: Significant; Confidence Interval: range of values; CG: control group; IC: intervention group; β : direction of effect; t: the value of the t statistic; a: not applicable

Table 8 summarizes the analysis of confounding variables related to mothers' income with children under two years old and their practices. The Generalized Linear Model (GLM) analysis revealed a greater increase in practices in the intervention group compared to the control group, with the control group showing a difference of -2.355 and the intervention group a difference of 0, after adjusting for income. The adjusted R-squared value of 0.113 indicates that 11% of the variability in knowledge differences between the groups can be explained by income. Further details on the relationship between income and maternal practices can be found in Table 8.

Table 8. GLM Analysis of Father's Income on Attitude of Mothers with Stunted Children Under Two Years Old

Parameter	β	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	3.145	.420	7.514	.000	2.326	3.982
Father's Income CG&IG	-.004	.002	-1.987	.048	-.007	-2.793E-5
[Group=1.00]	-2.355	.471	-5.004	.000	-3.283	-1.427
[Group=2.00]	0 ^a	.	.	.	.	.
Adjusted R Squared= .113						

sig at $p < 0.05$: Significant; Confidence Interval: range of values; CG: control group; IC: intervention group; β : direction of effect; t: the value of the t statistic; a: not applicable

Table 9 presents the findings from the comparative analysis of stunting status in children under two years old of age within the intervention group (IG), examining the changes observed before and after implementing the WA-TESTA intervention. It was found that 56% of children under two years old had a stunting status of “Very Short”, and 44% had a stunting status of “Short”. This indicates that most individuals have conditions that need to be improved before assistance is provided. After the assistance for approximately three months, there was a decrease in the percentage of individuals with “Very Short” stunting status to 27%, while the rate of individuals with “Short” stunting status increased slightly to 49%. This change indicates an improvement in the stunted status of the children under two years old after the mentoring. The p-value of 0.000 suggests this status variable’s difference between before and after mentoring is highly statistically significant. This indicates that the change did not occur by chance but was most likely caused by the mentoring intervention. The findings indicate a notable enhancement in the nutritional status of certain individuals following the implementation of the mentoring program. It can be inferred that the mentoring initiative positively improved nutritional status and decreased the prevalence of stunted children under two years old. The variable representing stunted status exhibited the most substantial improvement, as evidenced by a significant reduction in the percentage of individuals classified with a “Very Short” status.

Table 9. Comparison of Stunting Status of Children Under-Two Years Old at the Beginning of Intervention and the End of Assistance

Characteristics		Beginning of Intervention		End of Intervention		p-value
		f	(%)	f	(%)	
Stunting Status	Very Short	57	(56.0)	27	(27.0)	0.000
	Short	44	(44.0)	49	(48.0)	
	Normal	0	(0.0)	25	(25.0)	
	High	0	(0.0)	0	(0.0)	

f: frequency; %: percentages; p-value significant at $p < 0.05$

5. Discussion

Stunting remains a significant public health issue, particularly in developing countries, and is primarily linked to chronic undernutrition during critical growth periods. This research aimed to evaluate the effectiveness of the WhatsApp Telemedicine for Mothers of Stunted Children Two Years Old (WA-TESTA) program in improving the KAP of mothers with children under two in Banyumas Regency, Indonesia. The results showed that the intervention significantly improved mothers' knowledge about stunting, their attitudes towards preventing stunting, and their practices in caring for stunted children under two years old of age in the IG group compared to the CG group.

Testing the WA-TESTA Model Design

The results indicate that the average System Usability Scale (SUS) score of 54.79 suggests that while the WA-TESTA application is functional, users faced challenges, highlighting the need for enhancements to create a more intuitive user experience. This finding corresponds with other studies emphasizing the importance of user-friendly interfaces in health applications. For example, usability issues can undermine the effectiveness of digital health interventions. Improving the interface design

and ensuring that features meet user needs is crucial for enhancing usability (Nugroho et al., 2022)(Lihawa et al., 2021)(Hyzy et al., 2022). Furthermore, the User Experience Questionnaire (UEQ) assessment indicated that while most aspects were above average, clarity was below average. This suggests that developers should prioritize improving the clarity of information presentation to enhance user engagement and understanding.

The SUS and UEQ research questionnaires indicated that the system was sufficient for monitoring the growth and development of stunted children under two years old. The results show that while the stunting growth and development monitoring system has good usability, it requires improvement in several areas to enhance the overall user experience. Improvement efforts will focus on aspects that received negative ratings so that the system can be more effective in monitoring children's health (Ridwan et al., 2024) (Kusumo & Suranto, 2023) (Priyono et al., 2023).

Differences in Knowledge, Attitudes, and Practices of Mothers of Stunted Children Under Two Years Old Towards Handling Stunting between CG and IG

The study showed that the intervention significantly affected mothers' KAP. The findings suggest that the WA-TESTA intervention effectively influenced mothers' knowledge, attitudes, and practices in managing stunted children under two years old.

The IG experienced a significant increase in knowledge compared to the control group. This phenomenon may be due to the lack of access to information such as education. Previous studies have shown that health-related articles and social media campaigns can significantly increase awareness about stunting, even among those who do not participate in formal programs. This emphasizes the role of community participation and informal learning in building mothers' knowledge and attitudes. (Hutabarat & Simamora, 2022).

The intervention group showed a significant increase in knowledge. This highlights the effectiveness of structured interventions such as WA-TESTA in providing targeted education and support. The significant increase in knowledge in the intervention group suggests that regular education is needed to foster deeper understanding and commitment to stunting prevention.

Despite the absence of formal intervention, the observed changes in the CG's attitudes may be influenced by various external factors, including social interactions and community health campaigns. This aligns with findings from past studies, which suggest that broader social factors can shape mothers' attitudes. Previous studies have also shown that the influence of education and community support can shape mothers' knowledge.

The study's pre-test and post-test results indicated a significant improvement in mothers' knowledge in the intervention group after the intervention, indicating that the program successfully increased their understanding of stunting management. In this case, the intervention was conducted using the WA-TESTA model design, and the intervention with the application media for handling stunting in mothers was proven to improve maternal knowledge significantly. The application intervention for handling stunting in mothers enhanced mothers' knowledge substantially.

This aligns with findings from earlier research, which indicated that digital interventions can significantly improve mothers' awareness of stunting. The effectiveness of the WA-TESTA model in boosting mothers' knowledge highlights the promise of digital health solutions in tackling public health issues (Rusana et al., 2023) (Kurniawan, 2024).

Other research has found that digital media such as flipcharts, brochures, movies, and WhatsApp social media can improve the understanding of mothers of stunted children under two years old. These media can be used singly or in combination to increase mothers' knowledge about stunting (Isyti'aroh et al., 2024).

WA-TESTA educational intervention model showed that attitudes in the IG also improved significantly compared to the CG. Evidence of the influence of these attitudes was observed when the intervention group was provided with more detailed information regarding stunting, including its

causes, risks, and prevention methods. For instance, education emphasized the significance of proper nutrition throughout the first 1,000 days of life (also known as the golden period), appropriate feeding practices for infants and young children, and the importance of sanitation and access to clean water. More intensive interventions usually involve regular monitoring and direct guidance by health workers/Integrated Service Post Cadres. This makes mothers feel more supported and more likely to implement behavioral changes. On the other hand, control groups may only receive basic information without ongoing assistance or monitoring, which may have a limited impact on behavior change. Intervention group programs often increase mothers' knowledge and awareness about stunting (Naila Fauziatin, Apoina Kartini, 2019). Adequate knowledge leads to a change in attitude, where mothers become more proactive in preventing stunting, for example, by ensuring their infants receive proper nutrition and practice good health habits. Intervention groups also often receive training or workshops that focus on strengthening mothers' capacity to manage the health and nutrition of their infants, for example, recognizing signs of malnutrition, accessing appropriate health services, and making decisions that support their child's health. This knowledge and practical skills can increase mothers' confidence and willingness to prevent stunting actively, compared to the CG, who did not get similar training.

The results suggest that awareness and positive attitudes towards stunting can be cultivated through informal channels, emphasizing the need for a multifaceted approach to health education. (Ichlasia & Faisal, 2023).

In addition, the results of this study also show that practices in the intervention group increased significantly compared to the control group. After the intervention, the knowledge of mothers who have stunted children under two years old increased, which will change the mothers' attitudes to be more positive and further change their practices in caring for stunting children properly.

The results demonstrated that mothers in the intervention group experienced a notable enhancement in their practices related to stunting management. This finding aligns with a study on the Community Health Center (Puskesmas) in Kandang Subdistrict, Bengkulu City, which offers the First 1000 Days of Life (HPK) Movement Program, which found that after the intervention, there were beneficial changes in mothers' KAP concerning the nutritional requirements of children under two and young children (Lasmadasari et al., 2023). All stakeholders, including the community, must support efforts to prevent stunting. Additionally, effective coordination between health workers and the community is crucial for the success of the intervention, ensuring that stunting prevention practices can be sustained over time (Lasmadasari et al., 2023).

In the mother empowerment program through family support, the post-test results showed an increase in family support practices from 83% to 94%. This indicates that the health education provided has succeeded in increasing mothers' awareness and involvement in handling stunting (Rokhaidah et al., 2023)(Triana et al., 2023).

Tackling stunting necessitates a holistic strategy that incorporates community education and engagement initiatives. This study's findings reinforce that successful interventions should be customized to address the community's demands. As noted by Prendergast and Humphrey, a strong monitoring system is crucial for tracking stunting rates and assessing the effectiveness of interventions. The mentoring program linked to the WA-TESTA model has demonstrated the potential to enhance the nutritional condition of children under two, as evidenced by a decrease in the prevalence of stunting (Prendergast & Humphrey, 2014)(Wali et al., 2020).

Effect of Confounding Variables on Knowledge of Mothers of Stunted Children Under Two Years Old

The analysis showed that the increase in knowledge, attitudes, and practices was higher in the IG than in the CG after controlling for confounding variables. This indicates that the intervention had a more significant positive impact on increasing the knowledge of mothers with stunted children under two years old in the IG. This aligns with previous research showing that education-based interventions can increase community knowledge and awareness of health issues, including stunting and child growth (Kaur et al., 2024). These results show that the intervention conducted through the WA-TESTA model effectively increases parents' knowledge about stunting. This is in line with the theory of behavior change which states that increased knowledge can trigger changes in attitudes and behavior. Therefore, sustainable and evidence-based intervention programs are needed to increase public knowledge and awareness about child health, especially in the context of stunting prevention (Bandura, 1997).

In addition, the intervention successfully improved mothers' attitudes in the IG more effectively. This finding aligns with previous research showing that education-based interventions and social support can influence individual attitudes towards health and parenting behaviors (Rogers et al., 2019). This is also in line with behavior change theory which states that increased knowledge and skills can trigger changes in attitudes (Siquaeira et al., 2022). Therefore, sustainable and evidence-based intervention programs are needed to improve parents' attitudes and behaviors in caring for children's health, especially in preventing stunting and other health problems. Bandura's research emphasizes the importance of self-efficacy in influencing attitudes and behaviors, which may explain why interventions that provide appropriate support and information can improve parents' positive attitudes towards child health (Bandura, 1997).

The practice variable indicated that the intervention succeeded in improving the practices of mothers in the IG more effectively. This finding is in line with previous research which showed that interventions based on education and practical support can improve the implementation of good health practices among parents (Kaur et al., 2024). This is also in line with the theory of behavior change, which states that increased knowledge and skills can lead to changes in practice (Siquaeira et al., 2022). Therefore, sustainable and evidence-based intervention programs are needed to improve parents' practices in caring for children's health, especially in preventing stunting and other health problems. Research by Bandura emphasizes the importance of self-efficacy in influencing practices and behaviors, which may explain why interventions that provide appropriate support and information can improve parents' positive practices in caring for children's health (Bandura, 1997).

Comparison of Stunting Status of Children Under Two Years Old at the Beginning of Intervention and the End of Assistance

The results showed that the mentoring program positively improved the status stunting of children under two years old and reduced the prevalence of stunting. The stunting status variable showed the most significant improvement, with the percentage of individuals with a "Very Short" status significantly reduced. (BKKBN, 2023). Assistance was provided through a series of visits, including education on stunting recognition, detection, parenting, and nutritious supplementary feeding. These activities were designed to improve parents' knowledge and skills in caring for children under two (Isyti'aroh et al., 2024).

The link between mentoring using the WA-TESTA model design or specific applications is also supported by Indrayani et al.'s research, where the communication and mentoring strategy for families at risk of stunting in Wedomartani Village, Kapanewon Ngemplak Sub-District, is one of the Regions in Yogyakarta, Indonesia focuses on using technology applications to help reduce stunting. One of the applications used is *Elsimil*, which allows the assistance team to provide information and counseling and monitor the status of families at risk of stunting. Elsimil helps collect data in real-time, making it easier for health workers to intervene quickly if a nutritional problem is detected. The use of this

application facilitates monitoring and evaluation of child development. This allows assistants to provide timely nutrition interventions, such as nutritious food packages or referring families to health services if needed. This intensive monitoring contributes to a reduction in stunting status in a relatively short period. Mentoring helps reduce stunting rates and improves parents' knowledge about child nutrition and health (Indrayani & Nurtyas, 2024)(Firma Novita, M. Si Cikik Sikmiyati, MM Asep Sopari, 2022).

Overall stunting is a complicated problem influenced by various causes that require concerted actions from governments, non-governmental organizations, and communities. By addressing the root causes and implementing effective interventions, developing countries can significantly reduce stunting rates and improve their populations' overall health and productivity (Prendergast & Humphrey, 2014). Several international studies related to stunting cases in developing countries and the factors that cause stunting align with this study's results.

The study conducted by Prendergast and Humphrey explored stunting as a “stunting syndrome” characterized by growth retardation in early childhood, leading to increased risk of morbidity, reduced physical and cognitive abilities, and higher susceptibility to metabolic diseases in adulthood (Prendergast & Humphrey, 2014).

Additionally, the study by Rao et al. in India highlights the influence of socioeconomic factors on the frequency of stunting, emphasizing the necessity for targeted interventions that cater to the specific challenges encountered by various communities. The results of this research add to the increasing evidence that stresses the significance of collaborative efforts among governments, NGOs, and communities to tackle stunting effectively (Rao et al., 2023).

Limitations: This study has not analyzed other media information factors. This is important because it can provide additional insights related to stunting and improve the KAP of mothers with children under two years old. The stunting status in the control group after three months was not studied, so a comparison between the control and intervention groups could not be made.

Although the present study shows encouraging outcomes, it has several limitations, such as limited sample size and the possibility that external factors may have affected the control group's KAP. Furthermore, the usability challenges highlighted by the SUS and UEQ indicate that the application needs additional improvements to boost user experience and engagement.

The WA-TESTA program has successfully improved mothers' knowledge, attitudes, and practices in handling stunted children under two years old in Banyumas Regency, Indonesia. This demonstrates the potential of digital health solutions to address public health issues.

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