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THE EFFECT OF USING A DIGITAL NUTRITION APPLICATION ON THE KNOWLEDGE AND ATTITUDES OF MOTHERS WITH CHILDREN AGED 1–5 YEARS REGARDING UNDERNUTRITION

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Abstract

Undernutrition among toddlers remains a public health issue in Indonesia. Mothers' limited knowledge and attitudes toward child nutrition are key factors contributing to this problem. This study aimed to analyze the effect of a digital nutrition application on the knowledge and attitudes of mothers with children aged 1–5 years. A quantitative approach was used with a quasi-experimental design and a pretest-posttest control group. A total of 60 mothers participated, divided into an intervention group (using the digital nutrition app) and a control group (using printed leaflets). The results showed a significant increase in knowledge and attitude scores in the intervention group compared to the control ($p < 0.05$). Furthermore, most respondents perceived the digital nutrition application as more practical. In conclusion, the digital nutrition app had a positive effect on improving maternal knowledge and attitudes toward child undernutrition and was considered a practical tool for health education.

Keywords*: Undernutrition, Toddler Mothers, Digital Application, Knowledge, Attitude*

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INTRODUCTION

The toddler stage (1–5 years old) is often referred to as the *golden period* of child development, during which physical, cognitive, emotional, and behavioral growth occur rapidly. During this critical window, children are highly dependent on proper nurturing, stimulation (*asah*), affection (*asih*), and caregiving (*asuh*) to ensure their survival, optimal development, and future contribution as productive members of society (Judistiani et al., 2015).

Nutritional adequacy during this period is crucial. A balanced intake of macronutrients and micronutrients—energy, protein, vitamins, and trace elements—is essential to support optimal growth. Deficiencies or excesses in these nutrients may lead to serious developmental impairments (Kementerian Kesehatan RI, 2013). Based on national dietary recommendations, toddlers aged 1–3 years require approximately 1,200 kcal/day, while children aged 4–6 years require around 1,500 kcal/day with additional trace elements (Kementerian Kesehatan RI, 2012).

Despite public health efforts, malnutrition remains a persistent issue in Indonesia. In 2012, Indonesia was ranked among the five countries with the highest rates of child malnutrition, affecting nearly 900,000 toddlers (Kementerian Kesehatan RI, 2013). According to national health surveillance, malnutrition among children aged 0–59 months was 3.9%, with undernutrition at 13.8%, as reported in the 2018 Basic Health Research (Kementerian Kesehatan RI, 2018).

Multiple indirect factors contribute to this burden, including food insecurity, poor dietary practices, recurrent infections, limited access to health services, and inadequate sanitation (Alpin et al., 2021). In particular, maternal knowledge and caregiving practices significantly influence the nutritional status of children (Rahma & Nadhiroh, 2016). The lack of exclusive breastfeeding, poor dietary diversity, and suboptimal parenting contribute to increased risk of stunting, wasting, and other developmental delays (Diana, 2006).

Education and consistent health promotion are key strategies to prevent malnutrition. However, during the COVID-19 pandemic, health counseling services were disrupted due to social restrictions. Interviews conducted in 2025 at the Sentosa Baru Health Center revealed that most mothers of malnourished toddlers had never received recent nutritional education, highlighting a significant gap in outreach efforts. Many mothers reported limited recall of previously delivered information and expressed the need for more engaging and accessible health education tools.

In response to these challenges, there is growing potential in utilizing **digital applications** to support maternal education. Mobile-based nutrition apps can provide accessible, interactive, and personalized health education anytime and anywhere (Perdana et al., 2017). These apps are especially useful in areas where conventional counseling is not feasible or frequent.

Therefore, this research focuses on developing and evaluating a **digital nutrition application** aimed at increasing maternal knowledge and improving attitudes towards malnutrition in toddlers aged 1–5 years. This intervention not only serves as an educational platform but also enables health workers, especially midwives, to remotely monitor and guide nutritional practices effectively.

METHODS

Research Subjects

The subjects of this study were mothers of toddlers aged 1–5 years who lived in the working area of Sentosa Baru Public Health Center in 2025.

Research PopulationThe target population included all mothers with children aged 1–5 years within the Sentosa Baru Health Center coverage area. According to local midwives' records, there were 72 mothers meeting these criteria. The study was conducted between December 2024 and January 2025.

Sampling Technique

This study employed purposive sampling, where participants were selected based on specific inclusion and exclusion criteria relevant to the study's objectives. The sample size was determined using Slovin’s formula:

n=N1+N(d)2n = \frac{N}{1 + N(d)^2}n=1+N(d)2N

Based on this calculation, a minimum of 60 participants was required. The study divided the participants into two groups:

- 30 mothers in the intervention group using the digital nutrition application
- 30 mothers in the control group

All participants were screened to ensure they met the eligibility criteria.

Inclusion Criteria:

- Mothers with children aged 1–5 years
- Registered residents of the Sentosa Baru Health Center service area
- Owners of a smartphone or digital device
- Minimum education level: elementary school
- Able to operate the digital nutrition application

Exclusion Criteria:

- Mothers whose toddlers had special health conditions requiring specific medical interventions
- Research Design and Methods

This study applied a quantitative, quasi-experimental design, specifically the pretest-posttest with control group design. This design allows for the measurement of changes in knowledge and attitudes before and after the intervention in both the intervention and control groups.

Variables

- Independent variable: Use of the digital nutrition application
- Dependent variables: Mothers' knowledge, attitudes, and perceptions of practicality related to toddler malnutrition
- Confounding variables: Mother's age, education, employment, and household income

Operational Definitions

A summary of the variables, definitions, instruments, measurement results, and scales is presented below:

Variable	Definition	Instrument	Measurement	Scale
Digital Nutrition App	Digital tool used by midwives to deliver information on child nutrition	Android-based application	Usage of app	Nominal
Knowledge	Information mothers possess about toddler malnutrition	Questionnaire (Guttman scale)	Good, Fair, Poor	Ordinal
Attitude	Mothers' responses toward preventing toddler malnutrition	Likert scale questionnaire	Positive, Negative	Ordinal
Practicality	Mothers' perception of app usefulness	Questionnaire	Positive, Negative	Ordinal
Age	Respondent's age	Questionnaire	Risk (<20 or >35 years), Non-risk (20–35)	Nominal
Education	Educational level of the mother	Questionnaire	High (SMA or higher), Low (SD/SMP)	Nominal
Employment	Work status	Questionnaire	Working, Not working	Nominal
Income	Monthly household income	Questionnaire	< UMR / ≥ UMR (Rp1,880,650)	Nominal

Data Collection Procedures

Primary Data

Collected directly through pretest and posttest questionnaires assessing knowledge, attitude, and perceptions of the digital app, as well as interaction data stored in the app's server.

Secondary Data

Obtained from existing records including the child health register and other documents at the Sentosa Baru Health Center and local Posyandu services.

Research Instruments

- Knowledge Assessment: 10-item questionnaire using the Guttman scale (True/False). Scores were calculated and converted to percentage categories:
  - Good (76–100%)
  - Fair (56–75%)
  - Poor (<55%)
- Attitude Assessment: 10-item Likert scale questionnaire with responses ranging from "Strongly Agree" (4) to "Strongly Disagree" (1). Positive attitudes were scored ≥50%, while negative attitudes scored <50%.

Instrument Testing

- Validity: Tested using Pearson Product Moment correlation
- Reliability: Assessed using Cronbach's Alpha; considered reliable if $\alpha > 0.60$

Research Procedure

- Preparation:
  - Preliminary study to identify issues
  - Feasibility testing of the app using ISO 9126 standards
  - Development and validation of questionnaires
  - Ethical clearance approval

- Implementation:
    - Recruitment and informed consent
    - Pretest questionnaires distributed
    - Installation and training in use of the digital nutrition app
    - Intervention period: 14 days of app use
    - Posttest conducted on Day 15 and Day 30
    - Data processing and analysis

Data Processing Steps

1. Editing – Checking completeness and accuracy
2. Coding – Assigning numeric codes to responses
3. Tabulating – Organizing data into tables
4. Processing – Inputting data into analysis software
5. Cleaning – Checking for data entry errors
6. Presentation – Presenting data in structured formats

Data Analysis

Data were analyzed using SPSS with the following procedures:

- Normality Testing: Shapiro-Wilk test to assess distribution of variables
- Univariate Analysis: Descriptive statistics including frequency, percentage, mean, median, and standard deviation
- Bivariate Analysis:
    - Pre-post comparisons using:
        - Dependent t-test (if data are normally distributed)
        - Wilcoxon test (if not normally distributed)
    - Group comparisons using the Mann-Whitney test
    - Significance level set at $p < 0.05$
    - Research Setting and Timeline

The study was conducted in Sentosa Baru Health Center's coverage area during November–December 2024.

RESULT AND DISCUSSION

Community Health CenterSentosa Baru 2025 is located in Medan. Geographically, the Sentosa Baru 2025 Community Health Center covers an area of 123.43 km^2.

Respondent Characteristics

Characteristics of respondents in the Community Health Center Work AreaSentosa Baru 2025-2024 in this study were grouped based on age, education, occupation, and income. Respondent characteristics are described in Table 1:

Table 1 Characteristics of Respondents in the Community Health Center Work AreaSentosa Baru 2025 Period 2024

No	Demographic Data	Treatment Group n = 30	Control Group n=30
1	**Age (years)**		
	<20 and >35	13	14
	20 - 35	17	16
2	**Education**		
	Low (elementary, middle school)	12	13
	Higher (High School, University)	18	17
3	**Work**		
	Work	13	12
	Doesn't work	17	18
4	**Family income**	16	13
	< Minimum Wage (Rp1,880.65)	14	17
	> Minimum Wage (Rp1,880.65)		

Respondent characteristics inBoth groups based on age are mostly between 25 - 35 years old, most of them have high school education and are not working, family income is more or less balanced between <UMR and ≥ UMR.

Knowledge of Mothers of Toddlers

Knowledge data of mothers of toddlers aged 1–5 years on malnutrition before and after the use of the digital nutrition application compared to the control (Leaflet) in the working area of the Sentosa Baru Health Center in 2025-2024 between the treatment group and the control group can be seen in Table 2.

Table 2. Knowledge of Mothers of 1 Year Old Toddlers–5 Years

Knowledge about Malnutrition	Treatment Group		Control Group	
	Before n=30	After n=30	Before n=30	After n=30
Good	1	16	1	3
Enough	12	9	14	15
Not enough	17	5	15	12

Table 2 shows that in the treatment group, the knowledge of mothers of toddlers aged 1– 5 years of malnutrition before using the digital nutrition application, the majority of respondents were deficient, as many as 17/30. Post-test assessment of mothers' knowledge of malnutrition, good mothers increased significantly from 1 to 16 mothers of toddlers, while knowledge of deficient mothers decreased from 17 to 5 mothers ($p = 0.001$).

Control group of knowledge of mothers of toddlers aged 1– 5 years regarding malnutrition,

those who were good only increased from 1 to 3 mothers, while mothers who had poor knowledge only decreased from 17 to 15 mothers (p = 0.001).

Data on the attitudes of mothers of toddlers aged 1– 5 years of malnutrition before and after using the digital nutrition application compared to the control (leaflet) in the working area of the Sentosa Baru Health Center in 2025 and 2024 can be seen in Table 3.

Table 3 Attitudes of Mothers of Toddlers Aged 1-5 Years

Knowledge about Malnutrition	Treatment Group		Control Group	
	Before n=30	After n=30	Before n=30	After n=30
Positive	13	24	14	17
Negative	17	6	16	13

Table 3 treatment groups of attitudes of mothers of toddlers aged 1–5 years regarding malnutrition after using the digital nutrition application, negative attitudes decreased from 17 to 6 respondents, while positive attitudes after treatment increased from 13 to 24 mothers of toddlers (p = 0.001).

The control group of attitudes of mothers of toddlers aged 1–5 years regarding malnutrition after using the leaflet did not change much, positive attitudes increased in only 3 mothers of toddlers and negative attitudes changed to positive attitudes in only 3 mothers (p = 0.001).

Practical data on digital nutrition applications in conducting health education on malnutrition in toddlers aged 1 year– 5 years in the working area of the Sentosa Baru Health Center in 2025 can be seen in Table 4.

Table 4 Practicality of Digital Nutrition ApplicationsCompared with the Control (Leaflet)

Practicality		Frequency (n=30)
Digital Nutrition Application	Positive	22
	Negative	8
Leaflet	Positive	16
	Negative	14

Table 4 shows that the practicality of the digital nutrition application according to mothers of toddlers aged 1–5 years was mostly positive (22 out of 30 respondents). Meanwhile, the practicality of the leaflet according to mothers of toddlers aged 1–5 years in the control group was balanced between positive and negative (16 mothers were positive and 14 mothers were negative).

- *Discussion*

The results of this study demonstrate that the use of a digital nutrition application significantly improved both the knowledge and attitudes of mothers with children aged 1–5 years regarding undernutrition. This finding aligns with the growing body of literature that supports the effectiveness of digital interventions in public health education.

Effect of the Digital Nutrition Application on Knowledge

Prior to the intervention, mothers in the intervention group generally had low levels of knowledge about toddler undernutrition. This is likely due to limited access to reliable health information through mass media, electronic platforms, or regular health education sessions. After the introduction of the digital nutrition application, a substantial improvement in knowledge was observed. The number of mothers with good knowledge increased from 1 to 16, while those with poor knowledge decreased from 17 to 5. This change was statistically significant (p = 0.001), confirming the effectiveness of the digital intervention.

The observed increase in knowledge can be attributed to several factors. The application provided continuous, easily accessible, and engaging health information. It supported self-paced learning, enabling mothers to revisit content as needed. Furthermore, since the majority of mothers had at least a high school education, they were likely able to navigate and absorb the app's content effectively.

These findings are consistent with studies by Nilatulizah et al. (2018), which showed improved maternal knowledge following the use of digital applications related to child development, and research by Rahmawati (2006), who found that structured health education can significantly improve knowledge, attitudes, and behaviors of mothers regarding child nutrition.

According to Wawan (2010), information is a key determinant of knowledge. The more accessible and relevant the information, the more likely individuals are to understand and apply it. In this study, the application served as a vital channel of health information, supplementing traditional forms of education such as counseling and printed media.

This is also in line with Klansja and Pratt's findings, which emphasized the effectiveness of smartphone-based applications in health education due to their mobility, usability, and capacity for personalized content delivery. These digital features likely contributed to increased maternal knowledge in the intervention group.

Effect of the Digital Nutrition Application on Attitude

In addition to knowledge, the digital nutrition application significantly influenced mothers'

attitudes toward preventing undernutrition. After the intervention, positive attitudes increased from 13 to 24 respondents, while negative attitudes declined from 17 to 6. These findings suggest that the application not only improved understanding but also reshaped perceptions, beliefs, and readiness to take action.

Azwar (2008) emphasized that attitudes are shaped by several factors, including personal experience, information, and social influence. In this case, the combination of health information and interactive features within the app may have contributed to a shift in how mothers perceive the importance of proper nutrition. Furthermore, the information provided may have challenged existing misconceptions and encouraged behavior change through reinforcement.

This finding supports the study by Nainggolan (2012), which indicated a strong relationship between maternal attitudes and child nutritional status. Likewise, Rakhmawati (2014) found that poor attitudes toward child feeding are often associated with inappropriate feeding practices. Conversely, studies such as those by Yulizawati (2012) found no direct link between maternal attitudes and child nutritional outcomes, possibly due to external factors such as food availability or economic constraints.

It is worth noting that in the control group, which received only leaflets, there was minimal change in attitudes. This may be due to the passive nature of printed materials, which lack interactive elements or personalization. In contrast, digital tools can offer reminders, tailored content, and a sense of engagement, all of which contribute to attitude change.

Perceived Practicality of the Digital Nutrition Application

The digital nutrition application was also evaluated in terms of practicality. Most mothers in the intervention group found the app easy to use and beneficial. The majority (22 out of 30) reported a positive experience with the application, which was designed for Android-based smartphones.

This finding highlights the increasing potential of mobile health (mHealth) solutions in maternal and child health programs. The application was perceived as efficient, allowing real-time interaction with health personnel and providing timely reminders and relevant content. It also contributed to increased satisfaction with health services, supporting better compliance with nutrition-related recommendations.

These findings align with existing research by Masithah (2005), which emphasized that practical and engaging health tools can positively affect parenting practices, especially related to nutrition. Moreover, the user-friendliness of mobile apps enhances their feasibility for large-scale public health implementation, particularly in urban and semi-urban settings with high smartphone penetration.

Implications for Public Health Practice

This study provides strong evidence that integrating digital tools into community health programs can enhance maternal knowledge and attitudes, especially regarding child nutrition. The digital nutrition application proved to be an effective medium for delivering health education, likely due to its accessibility, engaging content, and interactivity.

Healthcare providers, particularly midwives and community health workers, can adopt similar digital tools to support behavior change and improve child health outcomes. In addition, collaboration between technology developers and health practitioners is essential to ensure that applications are evidence-based, culturally appropriate, and user-friendly.

CONCLUSION

This study demonstrates that the use of a digital nutrition application significantly improved the knowledge and attitudes of mothers with children aged 1–5 years regarding undernutrition in the working area of the Sentosa Baru Public Health Center in 2025. The intervention group, which received education through the mobile application, showed greater improvements in both knowledge and attitudes compared to the control group, which received only printed leaflets.

The digital nutrition application was not only effective in enhancing mothers' understanding of child nutrition but also positively influenced their attitudes, motivating them to adopt better practices in preventing undernutrition. Moreover, the application was perceived as practical and user-friendly, suggesting its potential for wider adoption in community-based health programs.

These findings support the integration of mobile health (mHealth) technologies into maternal and child health interventions, particularly in areas where conventional health education methods face limitations. Digital applications can serve as innovative tools to support health workers in delivering accessible, engaging, and efficient health education to improve child nutritional outcomes.

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