

ORIGINAL

Impact of SIMPATIK Educational Intervention on Nutritional Behavior and Dietary Diversity in Toddlers : A Quasy Experimental

Impacto de la Intervención Educativa SIMPATIK en el Comportamiento Nutricional y la Diversidad Dietética en Niños Pequeños: Un Cuasi-Experimental

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ABSTRACT

Introduction: malnutrition in toddlers remains a public health concern in Indonesia, including Jambi City, where the prevalence still exceeds the national target. Inadequate maternal knowledge and limited dietary diversity are among the key factors contributing to nutritional problems in early childhood. Digital-based education platforms offer new opportunities to improve maternal knowledge and child feeding practices, yet their application in Indonesia is still limited.

Objective: this study aimed to evaluate the effectiveness of the SIMPATIK Educational Intervention on Nutritional Behavior and Dietary Diversity in Toddlers

Method: this study employed a quasi-experimental design with a pretest-posttest approach, without a control group, involving 60 mothers of toddlers from the Talang Banjar Health Center area in 2024. Data were collected using validated questionnaires to assess maternal knowledge and 24-hour food recalls to measure dietary diversity, supported by the SIMPATIK web-based educational platform. Statistical analysis was performed using the Wilcoxon test with a 95 % confidence interval.

Results: the mean maternal knowledge score increased from $8,17 \pm 3,40$ to $10,77 \pm 2,81$ ($p = 0,001$; 95 % CI: 2,136-1,130), while the mean dietary diversity score rose from $5,08 \pm 1,80$ to $6,71 \pm 2,71$ ($p = 0,001$; 95 % CI: 3,352-1,847) between the pre-intervention and post-intervention phases.

Conclusion: the SIMPATIK program enhances both maternal knowledge and dietary diversity among children under five in Jambi City, demonstrating its effectiveness as a digital tool for delivering nutrition education within the community.

Keywords: Intervention; Diet; Toddlers; Postpartum Mothers; Nutrition Education.

RESUMEN

Introducción: la malnutrición en los niños pequeños sigue siendo un problema de salud pública en Indonesia, incluyendo la ciudad de Jambi, donde la prevalencia aún supera la meta nacional. El conocimiento materno insuficiente y la limitada diversidad dietética se encuentran entre los factores clave que contribuyen a los problemas nutricionales en la primera infancia. Las plataformas educativas basadas en medios digitales ofrecen nuevas oportunidades para mejorar el conocimiento materno y las prácticas de alimentación infantil, aunque su aplicación en Indonesia todavía es limitada.

Objetivo: este estudio tuvo como objetivo evaluar la efectividad de la Intervención Educativa SIMPATIK sobre el comportamiento nutricional y la diversidad dietética en niños pequeños.

Método: este estudio empleó un diseño cuasi-experimental con enfoque pretest-posttest, sin grupo de

control, involucrando a 60 madres de niños pequeños del área del Centro de Salud Talang Banjar en 2024. Los datos se recopilaban mediante cuestionarios validados para evaluar el conocimiento materno y recordatorios alimentarios de 24 horas para medir la diversidad dietética, apoyados por la plataforma educativa web SIMPATIK. El análisis estadístico se realizó utilizando la prueba de Wilcoxon con un intervalo de confianza del 95 %.

Resultados: la puntuación media del conocimiento materno aumentó de $8,17 \pm 3,40$ a $10,77 \pm 2,81$ ($p = 0,001$; IC del 95 %: 2,136-1,130), mientras que la puntuación media de diversidad dietética subió de $5,08 \pm 1,80$ a $6,71 \pm 2,71$ ($p = 0,001$; IC del 95 %: 3,352-1,847) entre las fases de preintervención y postintervención.

Conclusión: el programa SIMPATIK tiene el potencial de mejorar tanto el conocimiento materno como la diversidad dietética en niños menores de cinco años en la ciudad de Jambi, lo que demuestra su utilidad como herramienta digital para la entrega de educación nutricional dentro de la comunidad.

Palabras clave: Intervención; Dieta; Niños Pequeños; Madres Posparto; Educación Nutricional.

INTRODUCTION

As a developing country, Indonesia is committed to supporting the Sustainable Development Goals (SDGs), which aim to eliminate all forms of malnutrition.⁽¹⁾ Malnutrition remains a critical public health issue that must be urgently addressed to achieve key SDG targets.⁽²⁾ Among the SDGs' primary objectives is the goal to end hunger by 2030, ensuring that impoverished and vulnerable populations, including infants, have access to safe, nutritious, and sufficient food, thereby eradicating hunger and malnutrition among children under five years of age.⁽³⁾

Investing in nutrition is essential for developing human resources critical to national progress. However, from 2007 to 2021, malnutrition rates among children under five showed minimal improvement. The prevalence of malnutrition fluctuated over this period: 17,9 % in 2007, 19,6 % in 2010, 17,7 % in 2013, 7,4 % in 2018, and 7,1 % in 2021, with increases in 2022 (7,7 %) and 2023 (8,5 %). These figures surpass the target range of 6,8 % to 7,3 % set by the Medium-Term Development Plan (RPJM). Additionally, in 2023, Jambi City recorded a malnutrition prevalence of 6,6 %, also exceeding the RPJM target for 2019-2024.⁽²⁾

The quality and diversity of a child's diet are essential in providing the energy and nutrients required for healthy growth and development into adulthood. Malnutrition in early childhood can lead to irreversible damage.⁽⁴⁾ Research indicates that factors such as low parental education, limited household income, low birth weight and length, insufficient breastfeeding duration, poor complementary feeding practices, frequent infections, irregular clinic visits, and limited guidance from healthcare providers contribute significantly to malnutrition among children under five.^(5,6)

Several determinants have been identified in previous studies, including low parental education, household income constraints, poor complementary feeding practices, and limited support from health services.^(4,5,6) While these factors interact in complex ways, parental education especially maternal education emerges as a key determinant. Mothers and caregivers are primarily responsible for selecting, preparing, and providing food, which directly influences dietary diversity and child nutrition.^(7,8)

Low maternal education is often associated with limited understanding of children's nutritional needs. Mothers with lower levels of education tend to have restricted access to health information, a limited understanding of the importance of dietary diversity, and inadequate skills in selecting and preparing nutritious foods. This condition results in monotonous feeding patterns that are less appropriate for the child's age and often fail to meet the recommended standards for energy as well as macro and micronutrient adequacy. Consequently, children are at greater risk of experiencing nutritional deficiencies that may lead to malnutrition, either in the form of undernutrition or growth faltering.^(4,6)

Nutrition education has been demonstrated to enhance mothers' knowledge of food options for children under five.^(9,10) Several studies indicate that such education not only increases maternal awareness but also improves the diversity and quality of children's diets.⁽¹¹⁾ In Kenya, health workers who assisted mothers with complementary feeding practices reported improvements in maternal knowledge and feeding practices, which contributed to better dietary adequacy among toddlers.⁽¹²⁾ Additionally, the use of nutrition action cards has been found to enhance dietary diversity among children under five⁽¹³⁾ while home visits for nutrition education have also led to improved dietary diversity.⁽¹⁴⁾

Although these studies demonstrate the potential of nutrition education, most interventions still rely on traditional methods such as home visits or printed media. In the context of Indonesia, there remains a significant gap in research exploring the effectiveness of web-based nutrition education platforms. Given the rapid growth of smartphone use and internet access in Indonesia, exploring digital strategies becomes highly relevant to strengthen maternal knowledge and improve child feeding practices.

This study seeks to address this gap by evaluating the impact of SIMPATIK, a web-based platform primarily designed to deliver self-paced, interactive, and accessible nutrition education for mothers of toddlers. Beyond its educational content, the SIMPATIK website accessible via smartphones also offers features for tracking and reporting dietary diversity and nutritional status. It is part of the web-based application Sistem Edukasi MP-ASI Buah Hatiku (SIMPATIK), which supports mothers in practicing complementary feeding for toddlers. Additionally, the app contributes to the development of a health information system that aids public health initiatives.

This research introduces an innovative educational intervention that combines digital learning with structured mentoring, aiming to assess the impact of the SIMPATIK website on dietary diversity among children under five in Jambi City. By doing so, it provides new insights into the integration of digital technology in nutrition education efforts within Indonesia.

METHOD

Study design

This study employed with a quasy experimental design to assess the impact of the SIMPATIK educational website on dietary diversity, without the use of a control group. The website, developed in 2014, has undergone testing by material and technology experts, leading to several feature enhancements. These improvements include the addition of educational videos, audio features in the menu section, a nutritional status assessment tool, password-protected viewing, and a food source search function.

Setting

This study was conducted from June to July 2024 in the working area of Talang Banjar Public Health Center (PHC), Jambi City. The study site was selected in collaboration with local authorities, PHC staff, health cadres, integrated health services (posyandu), and mothers of toddlers. Site selection took into account infrastructure readiness, internet access, and community support to ensure the success of the SIMPATIK web-based educational intervention.

Participants

A total of 60 mothers of toddlers participated in this study. Although no a priori calculation was performed, a post-hoc analysis was conducted to evaluate the study's power. Based on the assumptions of a paired sample t-test with a significance level of 0,05, 80 % power, and a medium effect size (Cohen's $d = 0,5$), the calculation indicated that approximately 60 participants were needed to detect a meaningful difference. Participants were selected using a simple random sampling method from the population of mothers living in the working area of Talang Banjar Public Health Center (PHC), Jambi City. All participants met the inclusion criteria: mothers with children aged between 6 and 59 months, residents of the PHC service area for at least six months, and having toddlers who were in good health and not undergoing medical treatment for more than three days during the study period. The exclusion criteria included mothers whose children had a history of serious health problems or chronic illnesses, mothers who could not provide accurate or complete information about their child's diet, and those unable to access or use the SIMPATIK educational website.

Variables, validity and reliability of instruments

This study assessed two key variables dietary diversity and maternal knowledge to evaluate the impact of the SIMPATIK website intervention. Dietary diversity was measured using both nominal and ordinal scales. The dietary diversity score was calculated based on the toddler's food consumption over the past 24 hours, as reported through a 24-hour food recall. The Individual Dietary Diversity Score (IDDS) was employed to measure this diversity, comprising nine main food groups: starchy staple foods, green vegetables, vitamin A-rich fruits and vegetables, other fruits and vegetables, offal, meat and fish, eggs, nuts, whole grains, and dairy products. A score of 1 was assigned to each food group consumed, and a score of 0 was given if the group was not consumed. The highest possible score was 9, representing consumption from all nine groups, while the lowest score was 0, indicating no consumption from any group. Based on the total score, dietary diversity was categorized into three levels: low (0-3), medium (4-6), and high (7-9). To ensure validity, the food categories were reviewed by a nutritionist.

For the maternal knowledge variable on complementary feeding, an ordinal scale was used, where mothers responded to questions designed to assess their understanding of nutrition and complementary feeding practices. The questionnaire covered topics such as the timing of complementary feeding, appropriate foods for toddlers, and the importance of dietary diversity for child development. Based on the number of correct answers, maternal knowledge was categorized into three levels: low (0-5), medium (6-10), and high (11-15). The highest possible score was 15 (indicating all correct answers), while the lowest score was 0 (indicating all incorrect answers). Content validity was used to test the relevance of the questions, ensuring they accurately measured maternal knowledge of complementary feeding. Reliability was assessed using Cronbach's Alpha,

which yielded a satisfactory result of 80,2, indicating strong consistency in the measurement of maternal knowledge. Consequently, both variables were assessed using valid and reliable measurement tools, facilitating an accurate evaluation of the intervention's impact on toddler diet and maternal knowledge.

Data collection

The website was developed using a prototyping model, encompassing phases such as system requirements, site design, implementation, and evaluation. The SIMPATIK application is accessible at <https://litmas.poltekkesjambi.ac.id/simpatik/>, with user instructions available at <https://link.kemkes.go.id/demosimpatik>. SIMPATIK is designed to educate mothers about complementary feeding for toddlers. To begin, mothers create an account, log in, and input their child's data, including name, date of birth, and gender. The site features a 'My Baby's Nutrition' menu, which includes sub-menus for food groups such as staple foods, animal products, vegetables, and fruits, along with their nutritional content based on standard toddler portions. Additionally, there is a section for tracking toddlers' food consumption history and educational content aimed at improving dietary diversity, which can be compared to the recommended nutrient intake for toddlers. The site also allows mothers to assess their toddler's nutritional status based on weight, height, and age categories. Furthermore, the website provides nutrition information, educational resources on toddler feeding, and a Q&A section for mothers to consult with nutritionists.

Dietary diversity was assessed through interviews and daily 24-hour food recalls completed by mothers via the SIMPATIK website. The data collected were used to calculate the Individual Dietary Diversity Score (IDDS), which includes nine food groups: starchy staples, green vegetables, vitamin A-rich fruits and vegetables, other fruits and vegetables, offal, meat and fish, eggs, nuts, whole grains, and dairy products. A score of 1 was assigned if the toddler consumed foods from all nine groups, and a score of 0 was given otherwise. The average dietary diversity score was then calculated. The IDDS questionnaire was tested for validity and reliability, yielding a Cronbach's alpha value of 70,2 %.

On the first day (pretest), mothers were surveyed about their knowledge of complementary feeding and their toddler's eating habits over the past 24 hours. Enumerators recorded daily variations in food consumption. During weeks 1, 2, and 3, nutrition workers at the puskesmas provided educational sessions on complementary feeding. On day 30, mothers' nutritional knowledge and the variations in their toddlers' food consumption were reassessed (figure 1).

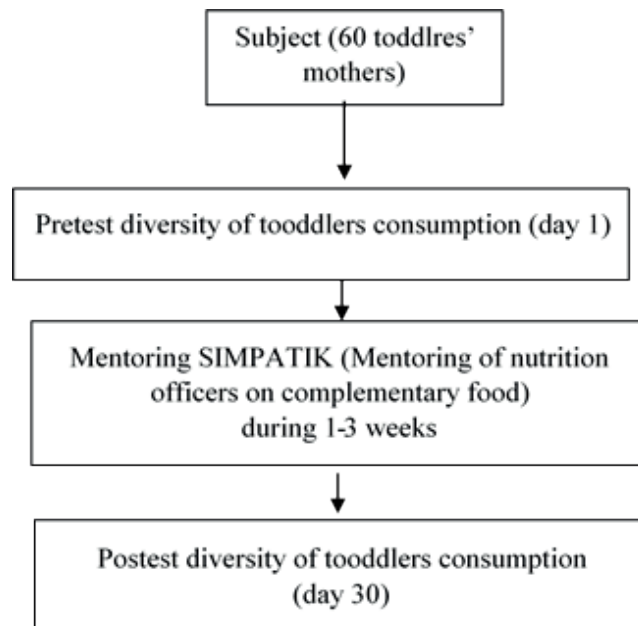


Figure 1. Phases of intervention delivery

Ethical Statement

This study obtained ethical approval from the Health Research Ethics Commission of the Jambi Ministry of Health Polytechnic with number LB.02.06/2/468.1/2023.

Statistical Analysis

Initial data analysis was conducted using descriptive statistics to display the frequency, mean, and standard deviation of each variable. This was followed by a normality test using the Kolmogorov-Smirnov test. The

results of the parametric analysis indicated that the data were not normally distributed ($p < 0,05$) for both the knowledge variable ($p = 0,000$) and the consumption variation variable ($p = 0,000$). As a result, inferential data analysis was performed using the Wilcoxon test at a 95 % significance level. Additionally, the Chi-square test was used to examine the correlation between respondent characteristics (such as age, education level, and other demographic factors) and both maternal knowledge and food consumption variation at baseline.

RESULTS

Table 1 presents the demographic characteristics of the mothers in the study. The largest age group was 24-29 years, comprising 23,3 % of the sample. The 30-35 years age group accounted for 25 %, while 20 % of the mothers were aged 18-23 years, and 18,3 % were aged 36-41 years. In terms of education, the majority of mothers (41,7 %) had completed high school or vocational school, followed by 20 % with a junior high school education and 13,33 % with only primary school education. A significant proportion of mothers (43,3 %) were housewives, reflecting their primary role in the care and feeding of their children. Additionally, 46,7 % of the mothers were multigravida (had more than one pregnancy), indicating that most had experience in child-rearing. The most common family structure was having one child, which represented 30 % of the sample. Most of the mothers (61,7 %) had delivered their children through normal delivery, suggesting that a majority of the toddlers in this study were born without surgical intervention.

Analysis of the relationship between respondent characteristics and knowledge variables was conducted using the Chi-square test. Significant results (p -value $< 0,05$) were observed for several factors, including age, education level, and food consumption variation.

Table 2 shows that the mean food consumption variation among under-fives was 5,08 points before the intervention and increased to 6,71 points afterward. Similarly, maternal knowledge had a mean score of 8,17 before the intervention, rising to 10,77 after the intervention. Statistically significant changes were observed using the Wilcoxon Signed-Rank Test, with the SIMPATIK nutrition education leading to improvements in both food consumption variety ($p < 0,05$) and maternal knowledge ($p < 0,05$).

Table 1. Distribution of Respondent characteristics

Characteristics	Frequency	Percentage (%)	p-value of Knowledge	p-value of variation in food consumption
Age Range (years)			0,000	0,010
18 - 23	12	20		
24 - 29	14	23,3		
30 - 35	12	20		
36 - 41	11	18,3		
42 - 47	11	18,3		
Level of Education			0,003	0,002
Elementary	25	41,7		
Junior school	5	8,3		
High school	18	30		
College	12	20		
Occupation			0,752	0,184
Housewife	26	43,3		
Professional Workers	3	5		
Entrepreneur	20	33,3		
Others	11	18,3		
Parity			0,471	0,470
Primigravida	32	53,3		
Multigravida	28	46,7		
Number of children			0,463	0,496
0	18	30		
1	18	30		
2	15	25		
3	8	13,3		
4	1	1,7		
Types of delivery			0,204	0,494
Vaginal	23	38,3		
Caesarean	37	61,7		

Table 2. Impact SIMPATIK nutrition education on food diversity among toddlers

Variables	N	Mean $\pm$ SD	95 % CI (Lower - Upper)	Z (Wilcoxon)	p-value
Variation in food consumption	60	Before: 5,08 $\pm$ 1,80 After: 6,71 $\pm$ 2,71	1,847 - 3,352	-6,21	0,001
Knowledge	60	Before: 8,17 $\pm$ 3,40 After: 10,77 $\pm$ 2,81	1,130 - 2,136	-6,45	0,001

DISCUSSION

The results indicated that nutrition education through the SIMPATIK platform significantly increased the variety of food consumption among toddlers in Jambi City. Maternal education plays a crucial role in enhancing knowledge about appropriate food choices for toddlers.⁽¹⁵⁾ The continuous incorporation of diverse nutritional ingredients and examples of complementary foods is essential for successfully increasing food variety.⁽¹⁶⁾ Furthermore, the increased food variety provided by mothers is closely linked to their role as primary caregivers, with more time to focus on ensuring toddlers receive appropriate nutrition.⁽¹⁷⁾

Nutrition education delivered through a website, combined with mentoring techniques, is an innovative approach that can enhance nutrition knowledge, motivation, and behaviors related to providing complementary foods for toddlers. Through the SIMPATIK platform, both maternal knowledge and dietary diversity among children under five improved. This finding aligns with research⁽¹⁴⁾ which demonstrated that nutrition education, supported by nutrition officers, can increase the diversity of toddler diets by 4,19 points. Nutrition workers play a critical role in supporting complementary feeding by conducting home visits throughout the day, offering motivation, support, and reminders to mothers regarding appropriate feeding practices. This intervention empowers mothers to adopt age-appropriate complementary feeding strategies,⁽¹⁸⁾ the difference in effect size may be due to variations in intervention intensity, duration, participant characteristics, or the level of direct support from nutrition officers. Consistent with previous studies, research in Yogyakarta showed that nutrition education, paired with mentoring, significantly improved mothers' knowledge about toddler feeding.⁽¹¹⁾ Similarly, a study in India found that mothers who received nutrition education increased the variety of their toddlers' diets.⁽¹⁹⁾ Providing accurate education and social support to parents or caregivers is vital to ensure they receive clear and consistent information, helping to prevent misinformation about infant feeding.^(20,21)

The SIMPATIK website was developed to provide mothers of children under five with easy access to comprehensive information on complementary feeding. This eliminates the need for mothers to search for nutrition-related data, such as the nutrient content of foods, nutritional status, and variations in toddler diets relative to recommended nutritional standards. Web-based nutrition education proves effective in conveying information, as it is engaging, promotes quick interaction, and offers flexibility. This technology-driven approach enhances health knowledge, with studies indicating that such interventions can foster balanced nutrition behaviors.⁽²²⁾ Furthermore, nutrition education delivered through smartphones and other devices has been shown to improve maternal nutrition knowledge, increase dietary variety and intake among children under five, and enhance their overall nutritional status.^(13,18,23)

Nutrition education via the website follows a three-step process that incorporates two-way communication: 1) Researchers, enumerators, and nutrition officers serve as mentors, collecting information from mothers of children under five; 2) Mentors analyze the gathered data to identify the challenges mothers face; and 3) Researchers and nutrition officers offer guidance on using the website, deliver nutrition education, and provide personalized advice based on the specific issues encountered by each mother.^(24,25)

This study had several limitations that should be acknowledged. First, the duration of the intervention may not have been sufficient to induce lasting behavioral changes, particularly in parenting and feeding practices. Some participants also experienced difficulties accessing and navigating the website due to unfamiliarity with digital platforms; to address this, guidance and assistance were provided by the research team. Recruitment of participants posed another challenge, as many mothers had limited availability, requiring flexible appointment scheduling. Lastly, the nutritional values presented on the website were based on 100g portions, which may not reflect toddlers' actual food intake. Future improvements should consider adapting portion sizes and nutritional information to better align with typical toddler consumption.

Despite its limitations, this study demonstrates that SIMPATIK effectively facilitates access to nutrition education and aids in assessing dietary variation among children under five. The findings suggest that SIMPATIK can enhance mothers' nutritional knowledge and improve dietary diversity in young children. These results support existing theories on the effectiveness of nutrition education and contribute to the broader understanding of its impact on children's diet and knowledge. The SIMPATIK website proves to be a valuable tool for nutrition programs, offering a means to monitor and promote dietary variation in children under five.

CONCLUSION

The study results indicate that the SIMPATIK program has the potential to improve maternal knowledge and dietary diversity among children under five in Jambi City, making it a potentially useful digital tool for delivering nutrition education within the community.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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