Original Article

The Effect of Digital Media-Based Nutrition Education on Animal-Based Food Feeding Behavior Among Parents of Toddlers: A Quasi-Experimental Study

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ABSTRACT

Background: Low consumption of animal source foods (ASF) among children under five years children in Indonesia contributes to the high prevalence of stunting. Digital media–based nutrition education can potentially improve parental ASF feeding behavior. However, empirical evidence on its effectiveness in semi-urban and rural settings, particularly studies directly measuring parental behavioral change, remains limited. This study aimed to analyze the effect of digital media–based nutrition education on parental ASF feeding behavior among under-five children.

Methods: This quasi-experimental one-group pretest–posttest study involved 150 parents of under-five children in Sukadana Village, Ciamis Regency, West Java, Indonesia, selected through stratified purposive sampling by hamlet. Inclusion criteria: parents with children <5 years old, having smartphone access, willingness to participate in the intervention, and provision of written informed consent. Exclusion criteria: incomplete pretest or posttest questionnaire data. The intervention consisted of a ±10-minute educational video on the importance of ASF, its sources, safe preparation, and tips to increase consumption, validated by nutrition experts. Feeding behavior was measured using a structured questionnaire (20 items; 3-point Likert scale; Cronbach's alpha = 0.82). Data were analyzed using paired sample t-tests and effect size calculation (Cohen's d) with 95% confidence intervals (CI) in SPSS v26.

Results: Digital media–based nutrition education significantly improved parental ASF feeding behavior ($p < 0.001$), with a large effect size (Cohen's d = 0.91; 95% CI: 0.69–1.12). The proportion of good behavior increased from 28.0% to 84.0%, while fair and poor behaviors decreased from 43.3% to 12.7% and from 28.7% to 3.3%, respectively.

Conclusion: Digital media–based nutrition education is efficacious in improving parental ASF feeding behavior in semi-urban settings. This strategy has the potential to be integrated into stunting prevention programs in primary healthcare, community health posts, and community-based interventions. Recommendation: Implementation should be accompanied by healthcare worker support and continuous monitoring to ensure sustainable behavior change

Keywords: Animal Source Food; Digital Media; Indonesia; Parent Behavior; Toddler.

Implications for Practice:

- Integration into Primary Care: Digital media–based nutrition education can be incorporated into routine primary healthcare and community health post (posyandu) programs to improve parental ASF feeding behavior and support stunting prevention.

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Implications for Practice:

- Scalable and Cost-Effective: The intervention's low cost and wide accessibility via smartphones make it a practical strategy for reaching parents in both urban and rural settings without significant additional resources.
- Enhancing Health Worker Efficiency: Health professionals can use validated educational videos to standardize nutrition messages, reduce variability in counseling, and allow more time for individualized patient support.

Introduction

Malnutrition is recognized as a significant public health concern among under-five children under five, especially in low- and middle-income countries (LMIC) (Birhanu et al., 2024). Malnutrition problems are usually characterized by high rates of stunting, wasting, and underweight (World Health Organization, 2023). Although sub-national data for LMIC show considerable improvement, mortality rates were relatively increased in under-five children under five due to undernutrition (Wakefield et al., 2021). This condition also worsens due to socio-economic disparities, food insecurity, and increased vulnerability to infection among children (Ahmad et al., 2020; Katoch, 2022). Indonesia, as part of LMIC, also faces similar problems, with high rates of stunting (21,5%) as reported by the Ministry of Health of the Republic of Indonesia in 2023 (Kementerian Kesehatan RI, 2023). Although various stunting prevention programs have been launched, these efforts seem insufficient to reach the WHO standard, stunting prevalence is that the prevalence of stunting should be less than 20% (World Health Organization (WHO), 2024). Considering this problem may have long-term impact on physical and cognitive development, nutritional problems in children remain a priority that needs to be addressed (Marliany et al., 2022).

Nutritional intake is a key component in maintaining a healthy nutritional status, thereby supporting the growth and development of under-five children (Anggraeni et al., 2022; Mey et al., 2020; Wulandary & Sudiarti, 2021). Adequate intake of essential nutrients such as protein, vitamins, and minerals during pregnancy and the first 1000 days of life can prevent chronic malnutrition, which is the leading cause of stunting (Ashari et al., 2023; Rizkika et al., 2023). A recent study from Indonesia found that inadequate feeding practices, low dietary diversity, and low intake of animal source foods (ASF) were determinants of child stunting (Haryani et al., 2023). Several studies also argue that low intake of ASF is driven by several factors, including socio-economic limitations, insufficient knowledge about nutrition, and cultural factors (Daba et al., 2024; Fite et al., 2022; Hamza et al., 2022). In alignment with the government efforts to reduce socio-economic disparities, families with under-five children under five need to be encouraged to actively participate in improving nutritional intake through adequate nutritional education (Pavithra et al., 2019). Despite the important role of both parents in nurturing their children, mothers are more likely to play an essential role in household affairs especially in improving nutritional intake (Kueppers et al., 2018). Improving mothers' knowledge regarding nutritional aspects would have a significant effect on childcare practices and influence food choices (Ashari et al., 2023; Fatima et al., 2020). Therefore, it is important to improve parental knowledge about nutrition to improve ASF intake.

Although many nutritional education programs have been carried out conventionally, such as direct counselling at integrated health posts or other health

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services, the level of understanding and changes in parent behavior in fulfilling ASF intake in under-five children is not yet optimal (Fitriyani et al., 2024). Previous studies highlight that low maternal education level and restriction on mothers' ability to access vital information regarding under-five children nutritional needs are ultimately affecting their children dietary intake and overall health (Yanti et al., 2023). Improving access to nutritional information for parents with under-five children under five can be achieved through several strategies. According to previous evidence, utilizing interactive platforms such as mobile apps and websites can engage parents or caregivers to monitor their children's eating habits (Morales-Cahuancama et al., 2024). These platforms also include gamification elements that make learning about nutrition fun, thereby increasing user engagement and information retention (Dallagiacoma et al., 2023).

Along with the development of technology, digital media offers great potential in reaching the wider community in effective and efficient manner. According to We Are Social 2023, internet penetration in Indonesia reached 76.8%, with most users being active on social media. This shows that digital media has a potential to reach wide range of users and can be used as an effective educational tool (Assabila & Sefrina, 2022).

Although various studies have identified the important role of ASF in preventing stunting and demonstrated the potential of digital media in promoting nutrition, most studies in Indonesia still focus on nutrition education in general without distinguishing specific ASF components. Additionally, few studies directly measure changes in parental behavior regarding ASF provision following digital media-based interventions. Theoretical frameworks such as the Health Belief Model, which can explain the mechanisms of behavioral change, are rarely integrated into intervention designs. Existing research also tends to be conducted in urban areas, leaving the effectiveness of such strategies in semi-urban or rural areas with high stunting prevalence largely unexplored.

In this study, the Health Belief Model (HBM) was used as a conceptual framework to understand the factors that influence changes in parents' behavior in providing ASF to toddlers. The HBM explains that health behavior is influenced by perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The digital media-based nutrition education intervention in this study was designed to increase perceived benefits and self-efficacy, while reducing perceived barriers related to ASF provision, by providing cues to action through visual content, easy-to-understand language, and educational messages relevant to the local context.

This study aims to analyze the impact of nutrition education through digital media on parents' behavior in providing animal-sourced foods to toddlers in Indonesia. This study is expected to provide empirical evidence on the effectiveness of digital media as an integrated intervention strategy in stunting prevention programs, as well as offer practical recommendations for implementation at the community level and in public health policy.

Methods

Study Design

This study used a quasi-experimental design with a one-group pretest-posttest approach to evaluate the effect of digital media-based nutrition education on parents' behavior in providing animal-source foods (ASF) to toddlers(Sahputra & Kurniawan, 2024).

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The research was conducted in Sukadana Village, Ciamis District, West Java Province, Indonesia, which had a stunting prevalence of 20.2% in 2022. Data collection was carried out from March to May 2024.

Participants

The target population was all parents with toddlers in the Sukadana Village area. The research sample was selected using stratified purposive sampling, covering three hamlets, namely Sukamaju, Ciilat, and Kedung. Inclusion criteria included: (1) parents (father or mother) with children under 5 years of age, (2) access to digital media (smartphone), (3) willingness to participate in the entire intervention series, and (4) written informed consent. Exclusion criteria were respondents who did not complete the pre-test or post-test questionnaire in full. The sample size was set at 150 respondents, based on the minimum sample size calculation for a paired t-test with a 95% confidence level and 80% power.

Instruments

The instrument used was a questionnaire on ASF feeding behavior, which was developed by the researchers based on literature and nutritional guidelines from the Indonesian Ministry of Health. The questionnaire consisted of 20 items with a 3-point Likert scale (1 = poor, 2 = fair, 3 = good). Content validity was tested by three nutrition and public health experts, while reliability testing yielded a Cronbach's alpha value of 0.82, indicating high reliability.

Intervention

The intervention, which was nutrition education, was delivered through a ±10-minute smartphone-based educational video containing material on the importance of ASF for toddler growth, sources of ASF, safe serving methods, and tips for increasing ASF consumption at home. The video content was validated by nutrition experts and adapted to the local context. The intervention was administered once, after which respondents were given one week to study the material independently before taking the post-test.

Data Collection

Data collection was conducted by the research team, assisted by two trained enumerators. The pre-test questionnaire was completed before the intervention, while the post-test was completed one week after the intervention. All data were collected offline using printed forms.

Data Analysis

Data were analyzed using SPSS software version 26. Descriptive analysis was used to describe the characteristics of respondents in the form of frequency distributions and percentages. Bivariate analysis was performed using a paired sample t-test to compare behavior scores before and after the intervention. A p-value < 0.05 was considered statistically significant. Effect sizes were calculated using Cohen's d, accompanied by a 95% confidence interval (CI).

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Galuh University (No. 021/KEPK-FIKES/UNIGAL/III/2024). All respondents were provided with an explanation of the purpose, procedures, benefits, and risks of the study, and then signed a written consent form before participating.

Results

Table 1 shows that the characteristics of the respondents in this study are based

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on several individual aspects (age, occupation, education, number of biological children, and family income). A total of 150 respondents participated in the intervention and completed the behavioural assessment related to ASF intake. Most of the respondents are between 25 and 35 years old (33.3%) and have a senior high school education (50.0%). Respondents are spread across a range of economic statuses, with the majority working as housewives and having lower family income (48.7%).

Table 1. Demographic Characteristics of Respondents

Characteristics	n	%
Gender		
Male	18	12.0
Female	132	88.0
Age (years)		
18–25	44	29.3
26–35	50	33.3
36–45	38	25.3
46–55	14	9.3
>55	4	2.7
Educational Level		
Primary school	12	8.0
Junior high school	40	26.7
Senior high school	75	50.0
Diploma	13	8.7
Bachelor's degree	10	6.6
Marital Status		
Married	147	98.0
Widowed/Divorced	3	2.0
Occupation		
Unemployed	12	8.0
Housewife	73	48.7
Government/Private	28	18.7
Entrepreneur	25	16.6
Others	12	8.0

Table 2. Paired T Test Results

Behaviour Category	Pre-test n (%)	Post-test n (%)	Mean ± SD	p-value	Effect Size (95% CI)
Good	42 (28.0)	126 (84.0)	1.94 ± 0.88	<0.001	0.91 (0.69–1.12)
Fair	65 (43.3)	19 (12.7)			
Poor	43 (28.7)	5 (3.3)	1.23 ± 0.57		

Based on **Table 2**, there was a significant increase in the category of parental behavior related to animal-based food provision (ASF) after the digital media-based nutrition education intervention. The proportion of respondents with good behavior increased from 28.0% in the pre-test to 84.0% in the post-test, while the fair behavior category decreased from 43.3% to 12.7%, and the poor behavior category decreased from 28.7% to 3.3%. The average behavior score increased from 1.23 ± 0.57 before the intervention to 1.94 ± 0.88 after the intervention, with this difference being statistically significant ($p < 0.001$) and having a large effect size (Cohen's $d = 0.91$; 95% CI: 0.69–1.12), indicating a strong practical impact of the intervention on behavioral change.

Discussion

Poor feeding practices, low dietary diversity, and low intake of animal source foods (ASF) have been reported as key determinants contributing to child stunting and a barrier to stunting prevention programs (Beal et al., 2018; Haryani et al., 2023; Sukamto et al., 2021). Parental knowledge and awareness on child feeding play an important role in supporting good feeding practice (De Rosso et al., 2022). According to a previous study, improving parent health literacy through structured health education programs is related to healthier eating habits and affects the overall nutritional status of children (Velardo & Drummond, 2013). However, a study conducted by (Ainy et al., 2021)

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highlighted that mothers faced challenges due to limited access to information about healthy feeding practices. The use of digital media in delivering nutritional education is a promising solution due to its ability to widely deliver information in a creative way (Morales-Cahuancama et al., 2024). Given the limited research on the use of digital media in nutritional education related to ASF intake, this study aims to investigate the effect of nutritional education through digital media on parent behavior regarding ASF intake in children under five.

This study shows that nutritional education through digital media has been proven as an effective strategy to improve parents' knowledge and behavior on ASF feeding. This is in line with previous research showing that digital media can be a powerful tool to increase mothers' knowledge regarding nutritional practices for their infants (Seyyedi et al., 2021). According to the Health Belief Model, which emphasizes the role of perceived susceptibility and severity in motivating behavioral changes, mothers are more likely to adopt healthier feeding practices when they understand the risks associated with inadequate nutrition (Mulualem et al., 2016). Supported by another study, structured health education may lead mothers to have significant improvement in knowledge and behaviors related to nutrition, as evidenced by increased consumption of diverse and healthy foods for their children (Pierre & Dzinamarira, 2019). Moreover, the better the parental knowledge, the greater the quantity and quality of food provided to toddlers, ensuring that children nutritional intake is adequately met (Noviana et al., 2024). However, short-term interventions are not sufficient to improve the nutritional status of children experiencing stunting (Bidira et al., 2022). Continuing health promotion by providing nutrition training and support is needed to create sustainable framework in reducing stunting rates (Shekar et al., 2017). In this context, the use of digital media is very important to facilitate health promotion and education programs.

Compared to conventional health education which has the advantage of fostering personal relationships and direct support, the use of digital media may offer greater accessibility, interactivity, and personalization in a cost-effective manner (Stellefson et al., 2020). These advantages may help to overcome the issues related to resource constraints that limit the availability of educational materials and trained personnel, which are common in low- and middle-income countries (LMIC) (Pierre & Dzinamarira, 2019). Integrating digital media into health education programs may significantly increase the reach and effectiveness of promoting healthy behaviours among diverse populations. Digital media can be an effective tool to engage communities in the planning and implementation of health promotion and education, which can also support the sustainability of these programs (Sultan & Amir, 2023). According to several study that discusses the application of digital media in nutritional education programs, the use of digital media can be effective in improving nutrition-related outcomes both for parents and their children (Au et al., 2016; Zarnowiecki et al., 2020). Therefore, digital media can be an alternative solution that can be used to increase the scope of information delivery and overcome problems related to distance and resource constraints.

Although digital media offers a promising solution in optimizing health education and promotion programs to reduce stunting, there are several aspects are need to be considered. A study conducted by Labrique et al. (2018) emphasizes several critical factors to consider in implementing digital media for

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health education programs, including community engagement, user interface design, integration into existing health systems, ongoing training and support, and robust monitoring and evaluation (Labrique et al., 2018). In this case, it is important to ensure that recipients of health education also have adequate digital literacy skills to receive health information properly. Effective information retention through intuitive interface design can boost user engagement, which is vital for the sustainability of community-based health education programs (Sultan & Amir, 2023). Consequently, digital media should not be viewed as a standalone solution to existing problems; rather, it should be utilized to enhance the effectiveness of health promotion and education initiatives. Additionally, public health policies should integrate digital media strategies into existing nutrition programs targeting parents (Barker et al., 2018). This is also include creating user-friendly mobile applications that provide personalized nutrition information, utilizing social media for community engagement and peer support, and establishing regular monitoring and feedback systems to evaluate the effectiveness of these interventions (Dallagiacoma et al., 2023).

This study has several limitations, including: First, the use of a quasi-experimental design without a control group limits the ability to draw definitive conclusions about cause-and-effect relationships. Second, stratified purposive sampling techniques can introduce selection bias and reduce the generalizability of results to a broader population. Third, behavior measurement relies solely on self-reported data, which may be influenced by social bias and the desire to provide answers perceived as correct. Fourth, the evaluation was conducted over a short timeframe, making it impossible to confirm the sustainability of behavioral changes.

Considering these limitations, the research results should not be generalized broadly without further testing in different populations and contexts. Future research is recommended to use an experimental design with a control group, a longer follow-up period, and more objective behavior measurements. In addition, integrating digital nutrition education with community programs and support from health workers can increase the sustainability of the intervention's impact.

Implications and limitations

The findings of this study imply that digital media–based nutrition education is a practical and effective strategy to enhance parental behavior by providing animal-source foods (ASF) to toddlers, thereby supporting stunting prevention efforts in community and primary healthcare settings. This approach can be scaled up due to its cost-effectiveness, accessibility, and adaptability to various socio-economic contexts. However, several limitations must be acknowledged. The quasi-experimental design without a control group restricts the ability to establish causality, and the purposive sampling technique limits generalizability to a broader population. Additionally, the reliance on self-reported behavior data introduces the potential for response bias, and the short duration of the study prevents assessment of long-term behavior change. Future research should employ randomized controlled trials with larger and more diverse populations, longer follow-up periods, and objective behavioral assessments to validate and strengthen the evidence for digital nutrition education interventions.

Relevance to For Practice

The results of this study are relevant to clinical practice, particularly in efforts to

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prevent stunting and improve the nutritional status of young children. Health workers, including midwives, nurses, and nutritionists in primary care, can utilize digital media as an effective educational tool to improve animal-based food consumption behaviors in households. The use of smartphone-based educational materials enables healthcare workers to reach a wider population, provide repeated education, and facilitate monitoring of parental behavior without limitations of distance or time. Integrating this approach into routine posyandu programs or home visits is expected to strengthen the success of nutrition interventions and provide an adaptive alternative strategy for health promotion in line with technological advancements and community needs.

Conclusion

This study shows that digital media-based nutrition education has the potential to be an effective strategy for improving parents' behavior in providing animal-based foods to toddlers. This approach is relevant for integration into primary health care services, integrated health service posts, and community interventions because it can reach a wider audience, is flexible, and can be adapted to the local context.

To maximize its impact, the implementation of digital nutrition education should be combined with direct guidance from health workers and a sustainable monitoring mechanism. Future research needs to test its effectiveness on a more diverse population, with a stronger design and long-term evaluation, so that it can produce more solid evidence to support stunting prevention policies at the national and regional levels.

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CrediT Authorship Contributions Statement

Daniel Akbar Wibowo: Conceptualization, Methodology, Formal Analysis, Supervision, Writing – Original Draft, Writing – Review & Editing.

Dini Nurbaeti Zen: Investigation, Data Curation, Validation, Resources, Writing – Review & Editing, Project Administration.

Conflicts Of Interest

There is no conflict of interest.

Acknowledgments

This study has several limitations in its research methodology. As a result, the generalizability of the findings is limited due to its single-center design, inadequate sample size, and use of a purposive sampling technique. In this study, randomization of participants was not performed, and the intervention was not assigned to two different groups, such as intervention and a control groups. Thus, it is difficult to establish causality between the intervention and the observed effects with certainty due to the presence of confounding factors that are not adequately measured. Moreover, our evaluation was limited to the cognitive aspects of respondents through pre- and post-tests.

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