October – December, 2025
Original Article
DOI: http://dx.doi.org/10.30867/action.v10i4.2950

AcTion: Aceh Nutrition Journal
Pages: 1067 – 1073 | p-issn 2527-3310; e-issn 2548-5741

Effectiveness of local sago and moringa leaf based complementary foods and maternal nutrition education in preventing stunting in North Aceh

Efektivitas makanan pendamping berbahan dasar sagu dan daun moringa lokal serta pendidikan gizi ibu dalam mencegah stunting di Aceh Utara

Dian Vita Sari[1], Fatmawati[2*], Junaedy[3]

[1] Akademi Keperawatan Kesdam Iskandar Muda Lhokseumawe, Aceh, Indonesia.
E-mail: dianv2783@gmail.com
[2] Akademi Keperawatan Kesdam Iskandar Muda Lhokseumawe, Aceh, Indonesia.
E-mail: fatmawati@akimal.ac.id
[3] Akademi Keperawatan Kesdam Iskandar Muda Lhokseumawe, Aceh, Indonesia.
E-mail : juanedy@akimal.ac.id

***Correspondence Author:**
Akademi Keperawatan Kesdam Iskandar Muda Lhokseumawe, Aceh, Indonesia.
E-mail: fatmawati@akimal.ac.id

Article History:
Received: October 21, 2025; Revised: November 17, 2025; Accepted: December 02, 2025; Published: December 14, 2025.

Publisher:
Politeknik Kesehatan Aceh
Kementerian Kesehatan RI

Abstract

Malnutrition remains a global challenge with far-reaching health and developmental implications. Indonesia continues to experience a high prevalence of stunting, reaching 31.8%, which highlights the need for effective and sustainable interventions. This study aimed to evaluate the effectiveness of a locally based intervention utilizing *Metroxylon* sp. (aren sago) and *Moringa oleifera* (moringa leaves) as complementary food additives combined with maternal nutrition education in reducing stunting. A quasi-experimental study was conducted in North Aceh in July 2025, involving 128 mothers and their stunted children aged 6–24 months old. The intervention consisted of nutrition education on complementary foods made with sago and moringa leaves, delivered through modules and videos, along with a four-week provision of complementary foods. Data were analyzed using the Wilcoxon signed-rank test. The findings demonstrated a significant improvement in the nutritional status of children, with the proportion classified as having a good nutritional status increasing from 43.0% to 84.4%, and no cases of severe malnutrition were identified ($p < 0.05$). Maternal nutrition knowledge also improved, with 35.2% achieving a "good" score ($p < 0.05$). In conclusion, locally sourced food-based interventions combined with nutrition education effectively improve children's nutritional status and strengthen maternal knowledge. This approach is recommended as a contextual and sustainable strategy for stunting prevention.

Keywords: Maternal knowledge, moringa leaves, nutrition education, sago, stunting

Abstrak

Malnutrisi masih menjadi tantangan global dengan dampak luas terhadap kesehatan dan pembangunan. Indonesia masih menghadapi prevalensi stunting yang tinggi, mencapai 31.8%, sehingga diperlukan intervensi yang efektif dan berkelanjutan. Penelitian ini bertujuan menilai efektivitas intervensi berbasis kearifan lokal menggunakan *Metroxylon sp.* (sagu aren) dan *Moringa oleifera* (daun kelor) sebagai bahan tambahan makanan, yang dikombinasikan dengan pendidikan gizi ibu, dalam upaya menurunkan stunting. Penelitian quasi-eksperimental telah dilakukan di Aceh Utara pada Juli 2025. Melibatkan 128 ibu dan balita stunting berusia 6–24 bulan. Intervensi mencakup pendidikan gizi mengenai makanan pendamping berbasis sagu dan daun kelor melalui modul dan video, serta penyediaan makanan pendamping selama empat minggu. Data dianalisis menggunakan Uji Wilcoxon Signed Ranks. Hasil, menunjukkan peningkatan signifikan status gizi balita, dengan proporsi kategori gizi baik meningkat dari 43.0% menjadi 84.4% dan tidak ditemukan kasus gizi buruk berat ($p<0.05$). Pengetahuan gizi ibu turut

meningkat menjadi baik (35.2%) (p<0.05). Kesimpulan, intervensi berbasis pangan lokal yang dipadukan dengan edukasi gizi terbukti efektif memperbaiki status gizi anak dan meningkatkan kapasitas ibu, sehingga layak direkomendasikan sebagai strategi kontekstual dan berkelanjutan dalam pencegahan stunting

Kata Kunci: Daun kelor, pendidikan gizi, pengetahuan ibu, sagu, stunting

Introduction

The World Health Organization (WHO), together with the United Nations Children's Fund (UNICEF) and the World Bank, reported that in 2024, approximately 23.2% of children under five years of age will experience stunting globally (WHO, 2023). Evidence indicates that stunting not only affects physical health but also impairs cognitive development, influencing educational performance and economic productivity in later life (Gunawan, 2025). Addressing stunting is therefore essential for improving immediate child health outcomes and long-term national development.

The utilization of local food crops is a promising strategy to meet nutritional needs and prevent stunting, particularly by empowering families and recognizing the central role of mothers in transforming home-grown produce into nutritious foods (Gunawan, 2024). Among locally sourced options, *Metroxylon* sp. (sago) is a rich source of complex carbohydrates, whereas *Moringa oleifera* (moringa leaves) is well known for its high protein, vitamin, and essential mineral content. Optimizing the use of these ingredients is crucial for formulating nutrient-dense complementary foods for toddlers (Meta-Mahendradatta, 2025). These ingredients address common nutritional deficiencies among stunted children, providing affordable and sustainable solutions that promote local food self-sufficiency and support Indonesia's efforts to reduce stunting (Agustina, 2024). Sago, which is widely available across Indonesia, is an excellent carbohydrate source, whereas moringa leaves contribute a comprehensive nutrient profile essential for growth and development (Kumendong, 2022). This innovative approach not only targets immediate nutritional issues but also strengthens community empowerment by promoting a resilient local food system.

The use of these two ingredients provides a highly nutritious complementary food option while fostering local food diversification and community self-reliance in sustainably meeting the nutritional needs of toddlers. This strategy aligns with broader community empowerment efforts to address nutrition issues, recognizing that stunting is a multisectoral challenge that requires comprehensive, coordinated solutions (Al Rahmad et al., 2023; Sutinbuk, 2024).

This study addresses the issue of stunting by exploring innovative solutions for developing and processing complementary foods using local ingredients, such as moringa leaves and sago, which reflect the local wisdom of the community. The aim is to evaluate whether these locally sourced ingredients, when incorporated into complementary feeding practices, can improve children's nutritional status and contribute to stunting prevention

Methods

This study employed a quasi-experimental design with a control group design. The research was conducted in Meucat Village beginning on July 14, 2025, and continued for four weeks. A total sampling technique was used, yielding 128 respondents in the final sample. The inclusion criteria were toddlers aged 6–24 months, availability of anthropometric measurements, and mothers who agreed to participate and provided written informed consent. The exclusion criteria included toddlers with acute or chronic health conditions affecting nutritional status and those unable to participate in the monitoring and complementary feeding intervention.

Data were collected using two primary methods: anthropometric measurements and questionnaires. Anthropometric assessments included weight, height, and mid-upper arm circumference to evaluate toddlers' nutritional status, with particular attention to the stunting. Questionnaires were used to assess mothers' nutritional knowledge regarding the provision of complementary foods based on local ingredients. The data were analyzed to determine the impact of the intervention on both toddlers' nutritional status and maternal nutrition knowledge.

Data analysis was conducted using the Wilcoxon signed-rank test, which is appropriate for paired data (pre- and post-intervention) and small sample sizes. This test assessed changes in toddlers' nutritional status and mothers' nutritional knowledge before and after the intervention. A structured questionnaire was used to evaluate the participants' knowledge of complementary feeding, the importance of balanced nutrition, and healthy dietary practices for toddlers. The questionnaire aimed to determine whether the education provided improved maternal understanding and influenced their behavior. Additionally, a t-test was used to assess the effectiveness of the intervention in reducing stunting.

This study received ethical approval from the Ethics Committee of Universitas Prima Indonesia (059/KEPK/UNPRI/VII/2025), ensuring adherence to established research ethics guidelines. Informed consent was obtained from all participants after a clear explanation of the study purpose, procedures, potential risks, and benefits. Participants were informed of their right to withdraw from the study at any time without penalty. To ensure confidentiality, all personal data and responses were anonymized, securely stored, and accessible only to the research team members. Furthermore, all data were coded, and identifying information was removed during the analysis to protect participants' privacy and uphold ethical standards.

Result and Discussion

Table 1 shows that most mothers were aged 20–35 years, which is considered the optimal reproductive age, although 39.8% were older than 35 years, a group that is associated with a higher risk of pregnancy complications. Most mothers had a secondary education, with only a small proportion attaining higher education. Most mothers were housewives, which may allow for greater involvement in childcare and feeding practices. Most children were 3 years old, which is a critical age for complementary feeding interventions. These maternal and child characteristics are important for preventing stunting, as both maternal age and education influence nutritional practices and caregiving behaviors.

Tabel 1. Respondent characteristics (n= 128)

Variables	n	%
Mother's Age		
20–35 years (No Risk)	77	60.2
>35 years (Risk)	51	39.8
Mother's Education		
Elementary School	9	7
Junior High School	26	20.3
High School	70	54.7
Diploma	12	9.4
Bachelor	11	8.6
Mother's Occupation		
Housewife	94	73.4
Business	10	7.8
Civil Servant	5	3.9
Private Employee	19	14.8
Children's Age		
3 years old	60	46.9
4 years old	45	35.2
5 years old	23	18
Gender		
Male	52	40.6
Female	76	59.4

Before the intervention (Table 2), 43.0% of the children were classified as having good nutritional status, while mild and severe malnutrition affected 35.9% and 19.5% of the children, respectively. After the intervention, the proportion of children with good nutritional status increased markedly to 84.4%. The prevalence of malnutrition decreased substantially to 14.1%, and no children remained in the severe malnutrition category. These findings indicate a significant improvement in nutritional status following the intervention. Before the intervention, maternal knowledge was predominantly poor (71.9%), with none classified as good. After the intervention (Table 2), maternal knowledge improved significantly, with 35.2% achieving good knowledge, and only 25% remaining poor.

Table 2. Children's nutritional status and mothers' knowledge before and after intervention (n = 128)

Variable	Category	Before Intervention; n (%)	After Intervention; n (%)
Children's Nutritional Status	Good Nutrition	55 (43.0)	108 (84.4)
	Mild Malnutrition	46 (35.9)	18 (14.1)

	Severe Malnutrition	25 (19.5)	0 (0.0)
	Obesity	2 (1.6)	2 (1.6)
Mothers' Knowledge	Good	0 (0.0)	45 (35.2)
	Sufficient	36 (28.1)	51 (39.8)
	Poor	92 (71.9)	32 (25.0)

Table 3. Effects of the intervention on children's nutritional status (z-score) and mothers' nutrition knowledge

Variable	Intervention	Mean	SD	Mean Difference	p-value
z-score (Children)	Before	0.87	2.0699	1.5178	<0.001
	After	0.64	1.8925		
Knowledge Score (Mothers)	Before	4.69	1.3254	2.0938	<0.001
	After	6.78	1.6297		

The data presented in Table 3 demonstrate that the intervention led to significant improvements in both the children's nutritional status and maternal nutritional knowledge. The children's mean z-score increased from 0.87 before the intervention to 0.64 afterward, yielding a mean difference of 1.5178 ($p < 0.001$). Although the numerical changes in z-scores may appear modest, the statistically significant shift reflects meaningful progress in growth patterns among the participating children, indicating that the intervention contributed to improved nutritional outcomes.

Maternal nutritional knowledge also increased significantly following the intervention. The mean knowledge score increased from 4.69 to 6.78, with a mean difference of 2.0938 ($p < 0.001$). This improvement demonstrates that the educational component was effective in enhancing mothers' understanding of appropriate complementary feeding practices, balanced nutrition, and the use of locally sourced foods for children's health.

Taken together, these findings indicate that the combined strategy of providing nutrient-rich complementary foods and delivering structured nutrition education exerted a positive and statistically significant effect on both children's nutritional status and maternal nutritional knowledge. This evidence supports the intervention as an effective, sustainable, and culturally relevant approach for preventing stunting in the community.

Maternal age and child health findings align with previous studies showing that mothers younger or older than the ideal reproductive age may experience increased risks during pregnancy, potentially affecting nutritional outcomes in children. Robinson (2018) reported that mothers over 35 are more prone to metabolic disorders and gestational complications, which may impact the child's nutritional well-being. Maternal age also influences feeding practices and the quality of complementary foods.

Maternal education significantly influenced the nutritional status of children. Rezaeizadeh (2024) and Al Rahmad & Shavira, (2024) suggested that mothers with higher educational attainment tend to possess better knowledge of appropriate complementary feeding and balanced nutrition. Education facilitates greater access to information, enabling mothers to make informed decisions regarding child feeding.

Maternal employment status also affects child care and feeding routines. Iannotti (2024) noted that working mothers often have limited time for timely and nutritious complementary feeding, whereas stay-at-home mothers typically have more flexibility to focus on preparing nutritious meals.

Children aged 3–5 years, the predominant age group in this study, are in a critical developmental window that requires sufficient additional nutrients beyond breast milk. This is consistent with the findings of Perdana (2024), who emphasized that appropriate complementary feeding at an early age influences growth, intelligence, and motor skill development.

Sex differences also warrant consideration. Darling (2020) observed that

girls in some low-resource settings may be more vulnerable to stunting than boys because of social and cultural factors influencing food distribution. This highlights the importance of gender-sensitive nutritional interventions.

The role of nutrition education is supported by the WHO (2016), which underscores its importance in preventing malnutrition and stunting. Education enables mothers to understand their nutritional needs and prepare appropriate local complementary foods. Previous studies (Sari, 2023; 2024) confirmed that multimedia educational tools, including videos, can effectively enhance maternal nutrition knowledge.

Maternal nutritional knowledge is strongly associated with child feeding practices in the present study. Studies have shown that poor maternal knowledge often results in inadequate feeding behaviors, contributing to malnutrition and stunting (Rizkiriani, 2023; Mabruroh, 2025; Amalia, 2023). Conversely, improved knowledge leads to healthier feeding patterns.

The present study's findings are consistent with research demonstrating that locally sourced complementary foods, particularly those using Moringa leaves and sago, can improve the nutritional status of malnourished children (Yarah, 2024; Riyanti, 2025). These ingredients are nutrient-dense, accessible, affordable, and aligned with local cultural practices of the region.

A local wisdom-based approach encourages the use of community food resources, promoting independence and sustainability in food security. Previous studies (Hawkes, 2015; Octavia, 2025; Vitasari, 2025) support the integration of local foods with nutrition education as a viable strategy to reduce stunting. Educational programs that incorporate local food ingredients have significantly improved maternal knowledge and child nutritional outcomes (Dewi, 2016; Prasetyo, 2023; Hamindo, 2024; Adam, 2024; Oktarina, 2025).

Overall, the findings suggest that combining locally sourced complementary foods with targeted maternal nutrition education is an effective and sustainable approach to preventing stunting.

Conclusion

In practical terms, nutrition education programs should be continuously expanded through various media, including videos, modules, and direct counseling, to enhance mothers' knowledge of providing nutritious complementary foods. Local governments, educational institutions, and community organizations must promote the development and utilization of local food sources, such as sago and moringa leaves, as complementary food ingredients. Regular monitoring and evaluation are essential to assess program effectiveness and ensure sustained improvements.

Furthermore, introducing nutrition education from an early age is important for fostering awareness of balanced nutrition and encouraging the use of locally available foods

Acknowledgments

We would like to thank the North Aceh Health Office for providing data and information related to the prevalence of stunting in the region and the mothers who actively participated in this study. We also express our appreciation to the research team for their dedication in collecting and analyzing the data and to the universities and academic institutions that provided facilities and resources. We hope that the findings of this study will benefit the community, particularly in supporting efforts to prevent stunting in North Aceh, Indonesia.

References

Agustina, R. D. (2024). Inovasi ibu sehat anak bebas stunting melalui pemberdayaan pangan lokal pada kelompok kader posyandu. *Jurnal SOLMA*, 13(3), 2459. https://doi.org/10.22236/solma.v13i3.16416

Al Rahmad, A. H., Ichsan, I., & Wilis, R. (2023). Implementation of Android platform application "PSG Balita" ISO/IEC 25010 standardized to improve nutritional status data for toddlers. *Poltekita: Jurnal Ilmu Kesehatan*, 17(1), 14–21. https://doi.org/10.33860/jik.v17i1.2083

Al Rahmad, A. H., & Shavira, N. (2024). Media motion graphic empat pilar gizi seimbang meningkatkan pengetahuan dan sikap ibu balita. *Jurnal Riset Gizi*, 12(2), 183–189. https://doi.org/10.31983/jrg.v12i2.12087

Amalia, I. S. (2023). Penyuluhan stunting dan

pembuatan MP-ASI berbasis pangan lokal pada ibu yang memiliki balita pada daerah lokus stunting di Desa Kutawaringin Kecamatan Selajambe Kabupaten Kuningan. *Jurnal Pemberdayaan dan Pendidikan Kesehatan (JPPK)*, 2(2), 68. https://doi.org/10.34305/jppk.v2i02.739

Anne, M. B. S. (2020). Gender differences in nutritional status, diet and physical activity among adolescents in eight countries in sub-Saharan Africa. *Tropical Medicine & International Health*, 25(1), 33–34. https://doi.org/10.1111/tmi.13330

Corinna, T. G. (2015). Smart food policies for obesity prevention. *The Lancet*. https://doi.org/10.1016/S0140-6736(14)61745-1

Eka, R. N. Y. (2025). Preventing stunting with complementary feeding (MP-ASI) using local food ingredients. *Community Empowerment*, 10(8). https://doi.org/10.31603/ce.9316

Fathmawati, F. Y. (2022). Enhancing mother's knowledge about preventing stunting in toddlers through counseling on the use of local food ingredients. *Mitra Jurnal Pemberdayaan Masyarakat*, 1, 63. https://doi.org/10.25170/mitra.v6i1.3032

Golnaz M. A. (2024). Maternal education and its influence on child growth and nutritional status during the first two years of life: A systematic review and meta-analysis. *eClinicalMedicine*, 49(4). https://doi.org/10.1016/j.eclinm.2024.102574

Gunawan, D. C. (2024). Untuk meningkatkan ketahanan pangan keluarga dan mencegah stunting. *Pengabdianmu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, 9(7), 1205. https://doi.org/10.33084/pengabdianmu.v9i7.6696

Hilmy, S. A. (2025). Hubungan tingkat pengetahuan ibu tentang kebutuhan nutrisi dengan berat badan balita di Desa "K" Kecamatan "J" Kabupaten Jember. *HEALTHY: Journal of Health Science Research Innovation*, 4(3), 2030. https://doi.org/10.51878/healthy.v4i3.7056

Indriani, R. R. (2025). Program wilayah binaan berkelanjutan tahap III pencegahan pernikahan dini dan pendampingan ibu hamil sebagai upaya menurunkan AKI dan risiko stunting. *Community: Jurnal Pengabdian Kepada Masyarakat*, 5(1), 17. https://doi.org/10.51878/community.v5i1.4907

Kumendong, J. S. (2022). *Peta ketahanan dan kerentanan pangan (FSVA) 2023*. Badan Pangan Nasional.

Lora, L. M. R. (2024). Young children's mental well-being in low-income South African settings: A qualitative study. *Journal of Child and Family Studies*, 33(11). https://doi.org/10.1007/s10826-024-02929-5

Mabruroh, A. S. (2025). Perubahan angka kejadian stunting pasca pelaksanaan pemberian makan bayi dan anak di Desa Mlokorejo Kecamatan Puger. *HEALTHY: Jurnal Inovasi Riset Ilmu Kesehatan*, 4(3), 282. https://doi.org/10.51878/healthy.v4i3.7050

Maryati Dewi, M. A. (2016). Pengaruh edukasi gizi terhadap *feeding practice* ibu balita stunting usia 6–24 bulan. *IJHN: Indonesia Journal of Human Nutrition*, 3(1), 138. https://doi.org/10.21776/ub.ijhn.2016.003.Suplemen.1

Meta-Mahendradatta, T. E. (2025). Analog rice based on sago and corn with the addition of Moringa leaf (*Moringa oleifera* L.) powder as a nutritional vehicle for breastfeeding women. *MDPI Journal*, 14(16). https://doi.org/10.3390/food

Muhammad, S. (2024). Utilization of Moringa leaves as a local food innovation to reduce stunting in Buluri Subdistrict, Palu City. *Community Service Journal of Indonesia*, 6(2). https://doi.org/10.36720/csji.v6i2.689

Natalia, D. W. (2025). Health education using videos to increase mothers' knowledge about stunting prevention in the first 1000 days of a child's life. *Journal of Integrated Health Research*, 1(2), [data tidak tersedia]. https://doi.org/10.70109/jinher.v1i2.9

Nilawati, A J. F. (2024). The role of knowledge in improving attitudes and behaviors. *Jurnal Ilmiah Kesehatan Sandi Husada*, 13(2). https://doi.org/10.35816/jiskh.v13i2.1230

Octavia, L. W. (2025). Utilizing local food sources in a sustainable healthy diet system and psychosocial care to reduce malnutrition. *Pediatric Gastroenterology, Hepatology & Nutrition*, 28(2), 135. https://doi.org/10.5223/pghn.2025.28.2.135

Rizkiriani, A. D. (2023). Baby Meal Planner: Aplikasi berbasis Android untuk perencanaan menu bayi. *Tematik*, 10(1), 83. https://doi.org/10.38204/tematik.v10i1.1276

Robinson, E. (2018). Maternal age and the risk of complications in pregnancy. *Journal of Women's Health*, 27(7), 835–842. Retrieved from https://pmc.ncbi.nlm.nih.gov/articles/PMC4418963/

Sari, D. V. (2023). Penyuluhan pemenuhan gizi dalam pencegahan stunting pada balita di Desa Rawang Itek Kec. Panton Labu Kab. Aceh Utara. *Jurnal Pengabdian Kepada Masyarakat Wahana Usada*, 5(1), 26–30. https://doi.org/10.47859/wuj.v5i1.317

Sari, D. V. (2024). Developing mothers' knowledge about weaning food in infants aged 6–24 months through video. *Babali Nursing Research*, 5(3), 591–599. https://doi.org/10.37363/bnr.2024.53383

Saufa, Y. C. R. (2024). Peningkatan kapasitas ibu dalam pemanfaatan bahan pangan lokal sebagai makanan pendamping ASI (MP-ASI) di Gampong Lambada. *Jurnal Kreativitas Pengabdian Kepada Masyarakat*, 7(7). https://doi.org/10.33024/jkpm.v7i7.14976

Silvia, M. B. (2024). Study of complementary feeding and children's nutritional status in Jambi City. *Journal of Global Nutrition*, 4(2). https://doi.org/10.53823/jgn.v4i2.99

Siswati, T. I. (2022). Impact of an integrative nutrition package through home visit on maternal and children outcome: Findings from locus stunting in Yogyakarta, Indonesia. *Nutrients*, 14(16), 3448. https://doi.org/10.3390/nu14163448

Sri, R. (2019). Pengaruh edukasi gizi pada ibu balita terhadap perubahan berat badan balita yang mengalami masalah gizi. *Jurnal Ners Widya Husada*, 6(3), [data tidak tersedia]. https://doi.org/10.33666/jners.v6i3.352

Stefanie, J. F. N. (2024). Community service initiative: Empowering mothers in Wongsorejo, Banyuwangi. *World Journal of Advanced Research and Reviews*, 23(3). https://doi.org/10.30574/wjarr.2024.23.3.2809

Sutinbuk, D. N. (2024). Increase stunting prevention behaviors among mothers with toddlers in Indonesia: A quasi-experiment. *Narra J*, 4(1). https://doi.org/10.52225/narra.v4i1.688

Vitasari, N. M. (2025). Pemberian PMT pemulihan pada balita stunting di UPTD Puskesmas Kemuningsari Kidul. *HEALTHY: Jurnal Inovasi Riset Ilmu Kesehatan*, 4(3), 343. https://doi.org/10.51878/healthy.v4i3.7059

WHO. (2016). *Implementation of the World Health Assembly resolution on infant and young child feeding: Global strategy for infant and young child feeding*. Retrieved from https://www.who.int/nutrition/topics/infantfeeding/en/

Yoyok, B. P. (2023). The effect of mothers' nutritional education and knowledge on children's nutritional status: A systematic review. *International Journal of Child Care and Education Policy*, 11. https://doi.org/10.1186/s40723-023-00114-7