

ORIGINAL RESEARCH

Effect of an Educational Module on Parenting Patterns Regarding Knowledge, Parental Behavior, and Nutritional Status of Undernourished Children: A Quasi-Experimental Study

El efecto de un módulo educativo sobre patrones de crianza relacionados con conocimientos, comportamiento parental y cambios de estado entre infancias desnutridas: un estudio cuasi experimental

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Abstract

Objective. This study was to analyze the influence of a parental fostering pattern module on parental knowledge and behavior, and its impact on the nutritional status of undernourished toddlers. **Study Design, Place and Duration of the Study.** This study used a quasi-experimental method with a two-group pretest-posttest design. It was conducted from January to May 2025 at the Community Health Center Moswaren and Inanwatan in South Sorong Regency. **Methodology.** The study used purposive sampling. The sample size was 35 people in each group (intervention and control). The intervention group used a parenting pattern module, while the control group used a maternal and child health (KIA) book. The instruments used were the parenting module, knowledge questionnaire, and food recall forms. Statistical analysis was performed using chi-square, Wilcoxon, and Mann-Whitney tests. **Results.** The intervention resulted in a significant increase in knowledge scores, particularly in sessions 1 and 4, with a significant increase of 30 points, compared to a control group that showed only small changes. The percentage of good behavior was higher in the intervention group (70.0%) than in the control group (30.0%). The chi-square test showed a significant difference in behavior between the groups ($p = 0.004$). The significance value (p -value) for nutritional status was 0.024, which indicates a significant difference between the intervention and control groups. **Conclusions.** The module pattern of foster parents significantly impacts their child's knowledge, behavior, and nutritional status. It is recommended to regularly implement this intervention and periodically monitor the nutritional status of toddlers.

Keywords: Educational Module On Parenting, Parental Knowledge, Parental Behavior, Child Nutritional Status

Resumen

Objetivo. Este estudio analiza la influencia de un módulo sobre patrones de crianza parental en los conocimientos y comportamientos de las y los progenitores y sus efectos en el estado fisiológico de infancias pequeñas desnutridas. **Diseño, lugar y duración del estudio.** Se utilizó un método cuasi experimental con un diseño de prueba previa y posterior para dos grupos. Se llevó a cabo de enero a mayo de 2025 en el Centro de Salud Comunitaria Moswaren e Inanwatan en la Municipalidad de Sorong del Sur, Indonesia. **Metodología.** Se utilizó un muestreo intencional. El tamaño de la muestra fue de 35 personas en cada grupo (intervención y control). Al grupo de intervención se le impartió un módulo sobre patrones de crianza, mientras que el grupo de control tuvo acceso a un libro de salud materna e infantil (KIA). Los instrumentos utilizados fueron el módulo de crianza, el cuestionario de conocimientos y los formularios de registro de alimentos. El análisis estadístico se realizó utilizando pruebas de chi cuadrada, Wilcoxon y Mann-Whitney. **Resultados.** La intervención produjo un aumento significativo en las evaluaciones de conocimientos, especialmente tras las sesiones 1 y 4, con un aumento también significativo de 30 puntos, en comparación con el grupo de control que mostró sólo pequeños cambios. El porcentaje de comportamientos readecuados fue mayor en el grupo de intervención (70.0%) que en el grupo de control (30.0%). La prueba de chi cuadrada mostró una diferencia significativa entre el comportamiento de los grupos ($p = 0.004$). El valor de significación (valor- p) para el estado nutricional fue 0.024, lo que indica una diferencia significativa entre los dos grupos. **Conclusiones:** La participación en el módulo de patrones de crianza por parte de las y los progenitores adoptivos afecta significativamente su nivel de conocimientos, su comportamiento y el estado nutricional de su progeñe. Se recomienda implementar regularmente esta intervención y monitorear periódicamente el estado nutricional de las y los pequeños.

Palabras clave: Módulo educativo sobre la crianza, conocimiento parental, comportamiento parental, estado nutricional del niño



Introduction

The nutritional status of toddlers remains an urgent issue and serves as a primary benchmark for measuring health development success; therefore, toddler nutrition must receive close attention.^(1, 2) Malnutrition is a significant nutritional problem, driven primarily by insufficient dietary intake or infectious diseases.⁽³⁾ The impact of these nutritional problems can cause a child's growth and development to become suboptimal, and in the long term, the quality of human resources will decline.⁽⁴⁾

The Indonesian Nutritional Status Survey (SSGI) provides an overview of nutritional status in toddlers, covering stunting, wasting, underweight, and overweight.⁽⁵⁾ National stunting data show that the prevalence in East Nusa Tenggara Province is 35.3%, followed by West Sulawesi at 35.0%, Papua at 34.6%, West Nusa Tenggara at 32.7%, and Aceh at 31.2%. Meanwhile, Southwest Papua ranks fifth at 30.0%. The number of cases lacking sufficient nutritional intake in infants in Southwest Papua Province (PBD) up to 2023 remains around 30 percent, and the prevalence is highest in Sorong City.⁽⁶⁾ The Moswaren Community Health Center is a designated stunting locus, and the nutritional deficit coverage at the Moswaren Health Center in 2023 was still at 30%.

One of the impacts of malnutrition is stunting,⁽⁷⁾ which affects children's intelligence, causes cognitive delays, and reduces productivity.⁽⁸⁾ According to the Global Nutrition Report, millions of children experience a lack of nutrition every year, which has a negative impact on the economy. One of the most severe health problems in the world due to a lack of nutrition is the mortality of children under five years (toddlers).⁽⁹⁾

A lack of knowledge and poor practices in child parenting cause insufficient nutrition.⁽¹⁰⁾ In addition, the condition of not having enough nutrition is usually due to poverty, insufficient food supplies, and families with low economic status, who must prioritize immediate needs like the cost of food and housing. Consequently, the food consumed also tends to be unbalanced with regard to nutritional guidelines and diet.⁽¹¹⁾

According to Riskesdas data in 2018, the proportion of insufficient nutritional status in Indonesia shifted from 17.7% to 19.6% (12). Although a change occurred, the recorded decline was still not considered significant (12). The World Health Organization (WHO) has determined that the prevalence threshold is 20% for insufficient nutrition.⁽⁸⁾

Women as mothers and the environment play a very important role in the growth and development of children.⁽²⁾ One of the factors that can affect the nutritional status of children is the care given by parents to children.⁽¹³⁾ Previous studies have shown that parenting skills in executing caregiving functions are still low.⁽¹⁴⁾ Nutritional deficiencies, including malnutrition, can be driven by poor parenting practices, ranging from food preparation and the selection of food ingredients, to determining the daily menu.⁽⁸⁾

The theory that a predisposing factor influences behavioral health is a known fact.⁽¹⁵⁾ Mothers, who play a vital role in stimulating the development of children, often face obstacles in providing effective stimulation, especially because of limited access to resources and information.⁽¹⁶⁾ There are various types of educational media that can be used to educate mothers and increase their knowledge, including flipcharts, educational modules, and integrated health flashcards.⁽¹⁷⁾

To overcome this challenge, intervention-based education is an effective solution. One potential approach is the development of a parental education module, to increase the knowledge and skills of parents, especially mothers, in raising children. Mothers of toddlers are educated about caregiving patterns and appropriate nutrition, so that they can understand proper care and the importance of nutrition in supporting the growth of children. The material provided covers parenting styles, balanced nutrition concepts with menu variations, eating frequencies and patterns, the importance of breastfeeding, and other useful knowledge to prevent the occurrence of stunting.⁽¹⁸⁾ This module functions as a practical guide that includes information about children's nutritional needs, feeding techniques, the importance of early stimulation, and

developmental steps to prevent stunting and other growth deficits.

With this parenting education module, caregiving material can be delivered in a flexible and practical way, utilizing illustrations, tables, or photographs to make concepts easier to understand, especially for mothers who may not be accustomed to reading long texts. The module is more easily accessible to all groups, including underserved populations with limited access to technology. This approach is in line with previous research titled *Socialization Stunting Prevention with Proper Parenting & Dietary Patterns*. Therefore, this research presents clear novelty in developing health education through a specialized parenting education module.

Referring to the importance of positive parenting styles in child growth and development, this development module is highly relevant for increasing parental awareness and capabilities. Therefore, maternal education classes utilizing modified modules must be developed. Providing this information is expected to modify maternal behavior and enhance maternal knowledge to prevent stunting. This objective aligns closely with the targets of the Sustainable Development Goals (SDGs), particularly Goal 3 regarding good health and well-being, as well as Goal 4 regarding quality education.⁽¹⁹⁾

Methodologies

This study employed a quasi-experimental design with a two-group pretest–posttest approach, conducted from January to May 2025 at Moswaren Community Health Center (control) and Inanwatan Community Health Center (intervention) in South Sorong Regency, Southwest Papua. The study flow is illustrated in Figure 1.

A total of 70 mothers with children aged 12–60 months presenting with undernutrition were

recruited, equally divided into intervention and control groups. Purposive sampling was applied.

The sample size was determined as follows:

$$n1 = n2 = 2 \left(\frac{(Z_{\alpha} + Z_{\beta})S}{X_1 - X_2} \right)^2$$

n1 : Minimum sample size for group intervention .

n2 : Minimum sample size for group control .

Z α : error type I (set at 1.96)

Z β : error type II (set at 0.842)

X1–X2 : clinical judgment, difference clinically established (1.25)

S : deviation frozen second group (1.30)

$$n1 = n2 = 2 \left(\frac{(Z_{\alpha} + Z_{\beta})S}{X_1 - X_2} \right)^2$$

$$n1 = n2 = 2 \left(\frac{(1.96 + 0.842)1.30}{3.98 - 5.63} \right)^2$$

$$n1 = n2 = 30.77 = 31$$

Inclusion criteria were children aged 12–60 months with undernutrition, mothers who provided informed consent to participate in the intervention, and the ability to communicate effectively. Exclusion criteria included a history of chronic disease or active infection in the child, or low birth weight (LBW). The sample size was calculated using the formula for large samples, with a 10% addition to anticipate dropouts.

Primary variables included maternal knowledge and behavior regarding parenting and child nutrition, and the nutritional status of children. Maternal knowledge and behavior were assessed using standardized questionnaires and 24-hour food recall. Child nutritional status was measured anthropometrically (weight and length) according to the WHO Child Growth Standards (2006). Weight was measured with a digital infant scale (± 10 g), and length with an infantometer (± 0.1 cm), each measured twice by trained enumerators, and the average was recorded.

The intervention group received a 4-week parenting education module, which included weekly sessions on parenting styles, nutritious feeding, positive communication, and practical anthropometry. The control group utilized the standard maternal and child health (KIA) book for 4 weeks. Each educational session lasted 60–90 minutes and included lectures, discussions, and practical activities.

Statistical analysis was performed using SPSS. Pre- and post-intervention comparisons within groups were analyzed using the Wilcoxon signed-rank test, and comparisons between groups were analyzed using the Mann–Whitney U test or the Chi-square test for proportions. Toddler nutritional status was treated as a categorical variable (undernourished vs. normal).

Figure 1. Flow Diagram of the Effect of the Maternal and Child Health Book (KIA Book) and Parenting Education Module Interventions on the Knowledge and Nutritional Status of Mothers with Toddlers.

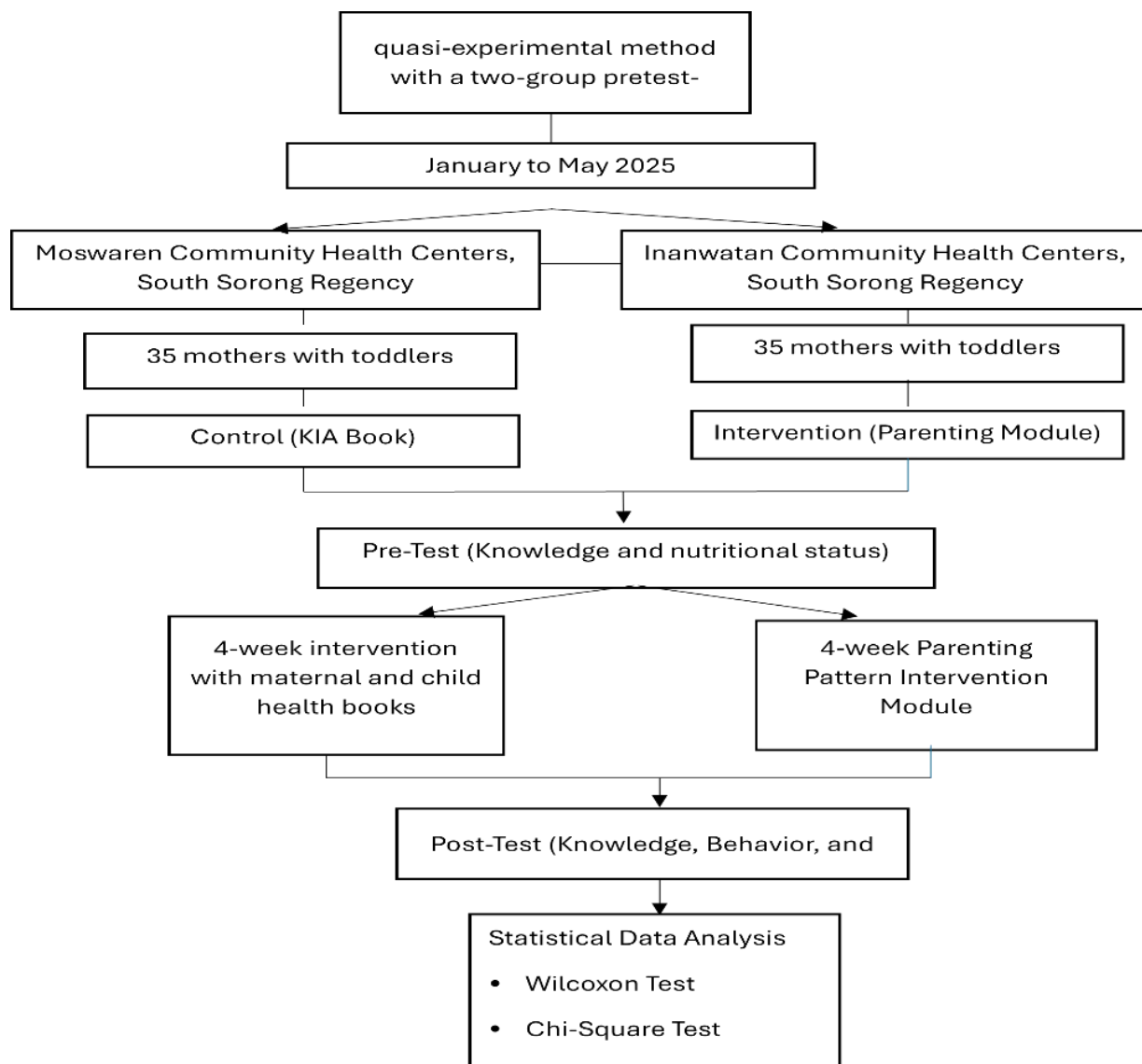


Table 1. Educational Sessions Curriculum

Session	Material	Time	Participant
Week 1	1. Definition and types of parenting styles (authoritarian, permissive, democratic). 2. Explanation of undernutrition: signs, symptoms, causes, and impacts. 3. Relationship between parenting styles and toddlers' nutritional status.	45 minutes	Mothers of undernourished toddlers
Week 2	1. Guidance on providing nutritious foods (carbohydrates, proteins, fats, vitamins, minerals). 2. Introduction to appropriate supplementary feeding (PMT) for undernourished toddlers. 3. Strategies to manage picky eating in toddlers.	45 minutes	Mothers of undernourished toddlers
Week 3	1. Positive communication techniques between parents and toddlers. 2. Play-based approaches to teach healthy eating habits. 3. Building independent eating habits in toddlers.	45 minutes	Mothers of undernourished toddlers
Week 4	1. Recap of previous sessions' material. 2. Tools for evaluating toddlers' nutritional status (simple anthropometric measurements). 3. Advanced tips and strategies to maintain toddlers' nutritional status.	45 minutes	Mothers of undernourished toddlers

Table 1 describes the content of the four-week parenting education sessions delivered to mothers of undernourished toddlers in the intervention group. The table outlines the weekly topics, learning materials, duration, and target participants. This table was included to provide a detailed overview of the educational intervention and to clarify the objectives of each session. The main objective of these sessions was to improve maternal knowledge, attitudes, and practices related to parenting and child nutrition. Specifically, the sessions were designed to:

1. Increase mothers' understanding of parenting styles and their relationship to child nutrition (Week 1);
2. Improve mothers' knowledge and skills in providing nutritious meals and appropriate supplementary feeding (Week 2);

3. Strengthen positive communication and establish healthy eating habits in toddlers (Week 3); and
4. Reinforce learning through review, practical anthropometric evaluation, and strategies to maintain optimal nutritional status (Week 4).

Results

There were 35 respondents in each group. Recorded respondent characteristics include mother's age, mother's highest education, mother's occupation, toddler's age, toddler's gender, economic status, number of children, and exposure to educational information, with the following characteristics:

Table 2. Distribution of Respondents Based on Respondent Characteristics in the Group Interventions and Groups Control

Variables	Group				Total	
	Intervention		Control			
	n	%	n	%	n	%
Maternal Age						
< 20 years	11	31.4	3	8.6	14	20.0
20–35 years	22	62.9	30	85.7	52	74.3
>35 years	2	5.7	2	5.7	4	5.7
Maternal Education						
Elementary School	4	11.4	5	14.3	9	12.9
Junior High School	17	48.6	16	45.7	33	47.1
Senior High School	14	40.0	14	40.0	28	40.0
Maternal Occupation						
Stay-at-home Mother	13	37.1	14	40.0	27	38.6
Farmer	22	62.9	21	60.0	43	61.4
Toddler's Age						
1-3 Years	16	45.7	32	91.4	48	68.6
3-5 Years	19	54.3	3	8.6	22	31.4
Toddler's Gender						
Male	21	60.0	19	54.3	40	57.1
Female	14	40.0	16	45.7	30	42.9
Socioeconomic Status						
<Regional Minimum Wage	35	100.0	35	100.0	70	100.0
Number of children						
One	24	68.6	17	48.6	41	58.6
More than One	11	31.4	18	51.4	29	41.4
Exposure to Educational Information						
Exposed	21	60.0	22	62.9	43	61.4
Not Exposed	14	40.0	13	37.1	27	38.6

Table 2 shows the baseline characteristics of the respondents. Distribution based on maternal age showed that the majority of mothers were 20–35 years old in both the intervention (62.9%) and control (85.7%) groups. Regarding maternal education level, most respondents had completed junior high school, accounting for 48.6% in the intervention group and 45.7% in the control group. In terms of occupation, the majority were farmers in both the intervention (62.9%) and control (60.0%) groups. Distribution based on child age showed that the majority of children in the intervention group were aged 3–5 years (54.3%), while the majority in the control group were aged 1–3 years (91.4%). Regarding the distribution of child sex, males were more common in both the control group (60.0%) and the intervention group

(54.3%). For socioeconomic status, 100.0% of respondents in both the intervention and control groups fell below the regional minimum wage. Based on the number of children, the majority were primiparous in the intervention group (68.6%) and multiparous in the control group (51.4%). Finally, regarding prior information exposure, the majority were classified as exposed in both the intervention (60.0%) and control (62.9%) groups.

Table 3 displays maternal knowledge scores before and after the intervention, measured weekly over a four-week period. The intervention group demonstrated a consistent increase in median scores across all weeks, with the most pronounced improvements observed in weeks 1 and 4 (+30

points). Conversely, the control group demonstrated only marginal fluctuations or no change at all, particularly during weeks 2 and 4.

The Wilcoxon signed-rank test was performed to evaluate the effectiveness of the educational intervention in shifting respondents' knowledge. Within the intervention group, a significant improvement occurred in the median posttest scores during week 2 ($p = 0.003$), and significant statistical differences were also observed in weeks 1 and 4 ($p = 0.005$). The results also revealed a significant value of $p = 0.037$ ($p < 0.05$) in week 3. Collectively, these findings indicate that education positively impacts the improvement of participants' knowledge.

On the other hand, no significant difference was found within the control group between the pretest and posttest scores across the four weeks of education (all $p > 0.05$), indicating no meaningful knowledge change occurred without the targeted educational intervention.

In the intervention group, utilizing the parenting education module successfully triggered active participant engagement rather than passive reading alone. Whereas in the control group, mothers utilizing the KMS health card tended to engage in superficial reading, merely skimming or completely overlooking the provided information.

Table 3. Parental Knowledge Scores Before and After Educational Sessions in the Intervention and Control Groups.

Week	Group	Pretest Median (Min–Max)	Posttest Median (Min–Max)	<i>p</i> -value*
1	Intervention	30.0 (10–90)	60.0 (10–90)	0.005
	Control	40.0 (10–80)	50.0 (10–80)	0.460
2	Intervention	40.0 (10–90)	60.0 (10–90)	0.003
	Control	40.0 (10–80)	40.0 (10–70)	0.710
3	Intervention	50.0 (10–90)	60.0 (10–90)	0.037
	Control	40.0 (10–70)	50.0 (10–70)	0.410
4	Intervention	40.0 (10–90)	70.0 (10–90)	0.005
	Control	40.0 (10–70)	40.0 (10–70)	0.700

*Wilcoxon Signed-Rank

Table 4. Effect of the Parenting Education Module and KIA Book Interventions on Parental Behavior

Behavior							
Group	Adequate		Inadequate		Total		<i>p</i> -value
	n	%	n	%	n	%	
Intervention	21	60.0	14	40.0	35	100.0	0.004*
Control	9	25.7	26	74.3	35	100.0	
Total	30	42.9	40	57.1	70	100.0	

*Chi Square

Table 5. Comparison of Toddler Nutritional Status Between the Intervention and Control Groups Post-Intervention

Group	Mean Rank	Sum of Rank	<i>p</i> value
Intervention Group	37.90	1326.50	0.024*
Control Group	33.10	1158.50	

*Mann Whitney

Table 6. Linear Regression Analysis of Factors Influencing Toddler Nutritional Status

Variables	<i>B</i> (Unstandardized)	Beta (Standardized)	95% CI (Lower – Upper)	<i>t</i>	<i>p</i> -value
Constant	-2.989	–	-3.877 – -2.101	-6.733	0.000
Maternal Age	0.081	0.128	-0.110 – 0.272	2.08	0.042
Maternal Education	-0.042	-0.092	-0.165 – 0.080	-0.13	0.892
Maternal Occupation	0.014	0.021	-0.152 – 0.179	0.25	0.807
Toddler's Age	0.084	0.127	-0.112 – 0.281	3.50	0.000
Toddler's Gender	-0.002	-0.003	-0.159 – 0.155	-0.48	0.632
Socioeconomic Status	0.000	0.000	-0.050 – 0.050	0.00	1.000
Number of Children	-0.003	-0.004	-0.172 – 0.167	-1.70	0.092
Exposure to Educational Information	0.083	0.130	-0.099 – 0.264	0.25	0.807

Table 4 shows maternal behavior related to toddler nutrition in the intervention and control groups. In the intervention group, 60.0% of mothers demonstrated adequate nutritional behavior, compared to 25.7% in the control group. Conversely, 40.0% of mothers in the intervention group and 74.3% of mothers in the control group showed inadequate behavior. These results indicate that the educational intervention significantly improved maternal practices ($p = 0.004$).

Table 5 shows the statistical analysis comparing toddler nutritional status between the intervention and control groups. The test results demonstrated that the intervention group had a higher mean rank of 37.90, compared to a mean rank of 33.10 for the control group. The sum of ranks for the intervention group was 1326.50, while the sum of ranks for the control group was 1158.50.

The significance value (p -value) obtained was 0.024, which is lower than the standard significance threshold of 0.05. This confirms that there is a statistically significant difference in nutritional status between the intervention and control groups. This finding indicates that the implementation of the parenting education module significantly influenced positive changes in the toddlers' nutritional status over the study period.

A multiple linear regression (Table 6) was conducted to examine factors influencing children's nutritional status after the educational module. Independent variables included Nutritional knowledge refers to a mother's ability to understand all relevant information regarding

intervention group, maternal age, education, maternal occupation, toddler age, child sex, socioeconomic status, number of children, and prior information exposure. The analysis showed that toddler age ($B = 0.084$, $p < 0.001$) and maternal age ($B = 0.081$, $p = 0.042$) were significantly associated with post-intervention nutritional status, indicating that older toddlers and mothers were slightly more likely to have better nutritional outcomes. Other variables, including intervention group, maternal education and occupation, child sex, socioeconomic status, number of children, and prior information exposure, were not statistically significant ($p > 0.05$). Standardized coefficients were small, and most 95% confidence intervals included zero, suggesting limited independent impact of these factors on nutritional outcomes. These results imply that while demographic characteristics have minor effects, the parenting education module likely played a central role in improving toddler nutrition, independent of other covariates.

The role of parents, especially mothers, is vital in fulfilling the nutritional needs of children.⁽²⁰⁾ The interactions between parents and their children form distinct caregiving patterns.⁽²¹⁾ These parenting practices naturally vary across households, yet every child fundamentally requires supportive parenting to thrive. Indeed, Putri⁽²²⁾ demonstrated that nutritional deficiencies in children are often directly linked to maternal caregiving patterns, as daily food intake is primarily managed by the mother foods that contain essential nutrients for toddlers.⁽²³⁾ Dietary behaviors and feeding practices are

deeply influenced by this baseline nutritional knowledge (20). Knowledge plays a foundational role in shaping an individual's actions, as behavior rooted in solid knowledge tends to be more stable over time (24). Conversely, limitations in a mother's internal capacity can restrict her food choices, directly impacting the type and availability of nutritious foods within the family (25). Ultimately, parental nutritional knowledge strongly dictates children's food choices and remains closely linked to maternal attitudes, problem-solving skills, and overall family organization (26).

To facilitate the reception of community health messages, health education is often supported by structured media (24). The parenting education module effectively improves parents' knowledge and behavior regarding toddler nutrition and is valued for its flexible, accessible use (27). Providing information through targeted media enhances awareness and motivates mothers, with convenient, tailored formats accelerating knowledge acquisition (14). The educational module significantly improved mothers' knowledge and behavior, supporting existing evidence that structured education fosters lasting behavior change based on true comprehension (28,29).

Modules are structured teaching materials designed to provide comprehensive and systematic learning experiences, including clearly defined content, methods, and evaluations (30,31). Previous studies show that parenting education modules effectively increase mothers' knowledge and understanding (1,25), with up to 82.5% of participants demonstrating improved knowledge in interventions such as stunting prevention for pregnant mothers.

Toddler nutritional status improved after the intervention, resulting in fewer cases of undernutrition. Even modest gains in weight-for-age or height-for-age can reduce infection risk, support linear growth, and enhance cognitive development (32). Despite a highly statistically significant improvement ($p = 0.000$), the overall clinical relevance must always be carefully considered. Ongoing monitoring and community support remain vital to sustain these long-term health benefits.

These results are consistent with international evidence that parental education improves child nutrition, such as maternal counseling programs in India, which successfully enhanced children's dietary intake and nutritional practices (33). Similarly, a United States home-visiting program for low-SES families showed that structured parent education significantly improved parental knowledge of child nutrition (34). Nutritional improvements in the current study were slightly lower than in longer-term international interventions, likely due to a shorter study duration, localized cultural factors, and baseline socioeconomic conditions, highlighting the critical need to adapt public health programs to local contexts with adequate duration and reinforcement.

The four-week intervention significantly improved maternal knowledge and behavior, but its short duration may limit long-term nutritional gains. Longer interventions, such as integrative nutrition programs in Yogyakarta that combined education, home visits, and targeted feeding support, demonstrated more sustained improvements in child weight and height over time (35). Differences in program duration, cultural context, and socioeconomic conditions likely explain the disparity in these outcomes. This highlights the need to adapt programs locally and ensure a sufficient intervention duration with structured follow-up, as combined education and hands-on support are more effective in achieving lasting nutritional improvements. Continued reinforcement may be necessary to sustain these positive behavioral changes.

Toddler nutritional status differed significantly between the intervention and control groups ($p = 0.024$). The parenting education module helped parents, especially mothers, consistently apply proper feeding practices, increasing the proportion of toddlers with normal nutritional status and reducing undernutrition. Ultimately, long-term knowledge retention and behavior improvement should be supported by a favorable caregiving environment and supportive economic conditions (36).

Linear regression analysis findings suggest that while age-related factors play a minor role, the parenting education module itself likely

contributed the most to the overall improvement in toddler nutrition, independent of other demographic variables. Structured and systematic educational modules help mothers rapidly acquire health literacy, apply proper feeding practices, and sustain positive behavioral changes over time (25,26). The observed improvement in nutritional status, even if modest, is clinically meaningful, as it can actively enhance child growth trajectories, reduce infection risk, and support foundational cognitive development. International studies strongly support these results, confirming that parental education and structured, home-based interventions systematically improve children's dietary intake and long-term nutritional outcomes (32,33). Future interventions should consider a longer program duration, repeated follow-ups, and structural integration with broader community health support networks to maximize sustained improvements in child nutrition.

The study emphasizes mothers' key role in toddler nutrition and demonstrates that targeted educational modules effectively improve both maternal knowledge and caregiving behavior. Future public health interventions should include longer study timelines, repeated follow-ups, and seamless integration with community health programs. Finally, policymakers should actively support combined efforts that merge parental education with enhanced food access, direct economic support, and accessible primary health services to sustain lasting improvements in child nutrition.

Limitations of the Study

This quasi-experimental study may be subject to certain confounding variables. While maternal age and toddler age significantly differed between the groups, other key demographic factors—including education, maternal occupation, child sex, socioeconomic status, and prior information exposure—did not demonstrate significant baseline differences. Additionally, because the study was conducted in the South Sorong Regency with a small, purposive sample, the findings may have limited generalizability to broader populations. Finally, the routine use of the standard KIA book within the control group could have independently

influenced maternal outcomes over the study period.

Conclusion

The parenting education module significantly improved parents' knowledge, caregiving behavior, and the nutritional status of undernourished toddlers. Overall, the intervention group achieved higher knowledge scores and demonstrated better feeding behaviors compared to the control group. The practical design of the module, supplemented with illustrations and structured tables, effectively helped mothers understand and consistently implement proper nutrition practices.

A notable limitation of this study is potential selection bias, as highly motivated or naturally more knowledgeable mothers may have demonstrated greater improvements, which could potentially overestimate the intervention's overall effectiveness. Future research should utilize more representative, larger sample sizes, incorporate longer follow-up periods (6–12 months), and thoroughly examine the socioeconomic and cultural factors that influence the field implementation of nutrition education. Ultimately, regular utilization of the module paired with periodic community monitoring is strongly recommended to sustain long-term improvements in child nutrition.

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Author Contributions

AAK: Contributed to the study design and data acquisition, drafted and critically reviewed the manuscript for important intellectual content, and gave final approval of the version to be published.

J: Contributed to data acquisition, assisted with manuscript drafting and critical review for important intellectual content, and gave final approval of the version to be published. **HHI:** Contributed to data analysis and interpretation, performed a critical review of the manuscript, and gave final approval of the version to be published. **D:** Contributed to the study concept and design, performed a critical review of the manuscript, and gave final approval of the version to be published. **SB:** Contributed to the study concept and design, performed a critical review of the manuscript, and gave final approval of the version to be published.

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Conflict of Interest

There is no conflict of interest in this research.

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