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Impact of Nutritional Education on Mother's Knowledge and Preschooler's Nutritional status in Banda Aceh

Badrialaily[1], Abdul Halim Masnan[2*], Nurfarhana Diana Mohd Nor[3]

[1,2] National Child Development and Research Center, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia
[3] Department of Early Childhood Education, Faculty of Human Development, Universiti Pendidikan Sultan Idris, 35900, Tanjong Malim, Perak, Malaysia

***Corresponding author email:** abdul.halim@fpm.upsi.edu.my

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ABSTRACT - The nutritional status of preschool children is a critical determinant of their growth, development, and long-term health outcomes. Mothers, as primary caregivers, play a pivotal role in shaping children's dietary practices through their knowledge and attitudes toward nutrition. This study aims to examine the influence of mothers' knowledge and attitudes on the nutritional status of preschool children in Banda Aceh, Indonesia, and to evaluate the effectiveness of a nutritional education intervention in improving these factors. A quasi-experimental study with a one-group pretest-posttest design was employed, involving 60 mother-child pairs recruited through purposive sampling from Banda Aceh. Data were collected using validated questionnaires to assess mothers' knowledge and attitudes, while children's nutritional status was measured using anthropometric indicators (weight-for-age Z-scores) based on World Health Organization (WHO) standards. The intervention consisted of a structured nutritional education program delivered through leaflets and guidance books from the Indonesian Ministry of Health. Paired sample t-tests and repeated measures ANOVA were used to analyse pre- and post-intervention differences. Results revealed significant improvements in mothers' knowledge (nutrition: M=3.31 to 3.92, $p<0.05$; health: M=2.97 to 4.17, $p<0.05$) and attitudes (nutrition: M=3.75 to 3.99; health: M=3.45 to 4.02) following the intervention. Children's nutritional status also showed significant enhancement, with the proportion of normal weight-for-age increasing from 66.7% to 80.0% ($p=0.04$). The findings underscore the critical role of maternal knowledge and attitudes in shaping preschool children's nutritional outcomes and demonstrate the effectiveness of targeted educational interventions. These results have important implications for early childhood education and health policies, suggesting the need for integrated nutrition education programs within preschool settings.

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INTRODUCTION

The nutritional status of preschool children represents a fundamental determinant of their physical growth, cognitive development, and long-term health trajectories (Black et al., 2013). During the early years, children undergo rapid physical and neurological development, making adequate nutrition essential for achieving optimal developmental milestones. Malnutrition during this critical period can lead to irreversible consequences, including stunted growth, impaired cognitive function, and increased susceptibility to infectious diseases (UNICEF, 2021). In Indonesia, childhood malnutrition remains a significant public health concern, with prevalence rates of underweight and stunting among children under five years old at 17.7% and 21.6% respectively (Kementerian Kesehatan RI, 2023). These statistics underscore the urgent need for effective interventions targeting the determinants of children's nutritional status.

Mothers, as primary caregivers, occupy a central position in shaping children's dietary practices and nutritional outcomes. Their knowledge about nutrition encompasses understanding of balanced diets, appropriate food choices, and proper feeding practices that support children's growth and development (Donsu, 2017). Maternal nutritional knowledge influences the selection of food ingredients, meal preparation methods, and the ability to provide varied and nutritionally adequate meals (Stevani et al., 2021). Research has consistently demonstrated that mothers with higher levels of nutritional knowledge are more likely to make informed decisions about their children's diets, resulting in better nutritional outcomes (Masrikhiyah, 2020; Naulia et al., 2021).

Beyond knowledge, maternal attitudes toward nutrition represent another crucial determinant of feeding behaviours. Attitudes reflect mothers' feelings, beliefs, and predispositions toward specific nutritional practices (Devi & Anjani, 2019). Positive attitudes toward healthy eating, breastfeeding, and complementary feeding facilitate the adoption of optimal feeding practices, while negative attitudes may impede them. The Theory of Planned Behaviour (TPB), proposed by Ajzen (1991), provides a robust theoretical framework for understanding the relationship between attitudes and behaviour. According to TPB, behavioural intentions and subsequently actual behaviour are influenced by three factors: attitudes toward the behaviour, subjective norms, and perceived behavioural control. This theory has been successfully applied to explain various health-related behaviours, including dietary practices and feeding behaviours (Rizzo & Columna, 2020).

In the context of child nutrition, TPB suggests that mothers' attitudes toward providing nutritious food, combined with their perceived social expectations and confidence in their ability to provide such food, shape their intentions and actual feeding practices. Therefore, interventions aimed at improving children's nutritional status should address not only mothers' knowledge but also their attitudes and perceived behavioural control.

Nutritional status itself is defined as the physiological condition of the body resulting from the balance between nutrient intake and requirements (Almatsier, 2010). It reflects the adequacy of nutrient consumption, absorption, and utilization for maintaining metabolic integrity and supporting growth. Anthropometric measurements, particularly weight-for-age, height-for-age, and weight-for-height indices, are commonly used to assess nutritional status in children (Beck, 2000). These indicators provide objective measures of undernutrition (underweight, stunting, wasting) and overnutrition (overweight, obesity), enabling identification of children at risk and evaluation of intervention effectiveness. (Rani et.al, 2025).

Despite recognition of the importance of maternal factors in child nutrition, limited research has systematically examined the influence of both maternal knowledge and attitudes on preschool children's nutritional status in the Indonesian context, particularly in Aceh province. Banda Aceh, as the provincial capital, presents unique sociocultural characteristics that may influence maternal feeding practices and children's nutritional outcomes. Furthermore, while previous studies have documented associations between maternal knowledge and child nutrition, few have employed quasi-experimental designs to evaluate the effectiveness of educational interventions in improving both maternal factors and subsequent child nutritional status.

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The present study addresses these gaps by investigating the influence of mothers' knowledge and attitudes on the nutritional status of preschool children in Banda Aceh and evaluating the impact of a structured nutritional education intervention. The specific research questions guiding this study are:

1. What is the level of mothers' knowledge and attitudes regarding child nutrition and health before and after a nutritional education intervention?
2. What is the nutritional status (weight-for-age) of preschool children before and after the intervention?
3. Is there a significant difference in mothers' knowledge and attitudes before and after the intervention?
4. Is there a significant difference in children's nutritional status before and after the intervention?
5. Is there a significant influence of mothers' knowledge and attitudes on children's nutritional status?

Based on the theoretical framework and existing evidence, we hypothesize that: (1) there will be significant improvements in mothers' knowledge and attitudes following the educational intervention; (2) there will be significant improvements in children's nutritional status following the intervention; and (3) mothers' knowledge and attitudes will significantly influence children's nutritional status.

METHODS AND MATERIALS

2.1 Research Design

This study employed a quasi-experimental design with a one-group pretest-posttest approach. This design was selected to evaluate the effectiveness of a nutritional education intervention by comparing outcomes measured before and after the intervention within the same group of participants. The quasi-experimental design is particularly appropriate for educational interventions in natural settings where random assignment to control groups may be impractical or ethically constrained (Creswell & Creswell, 2018).

2.2 Research Location and Duration

The study was conducted Banda Aceh Municipality, Aceh Province, Indonesia. This kindergarten was purposively selected as it serves as a lab school for the Holistic Integrated Kindergarten project in Banda Aceh, providing an appropriate setting for educational interventions. Data collection and intervention implementation were carried out over a three-month period, from September to November 2025.

2.3 Population and Sample

The target population comprised all early childhood education (PAUD) children in Banda Aceh Municipality, totalling 783 children across nine subdistricts. The accessible population consisted of children aged 4 to 6 years enrolled in Baitusshalihin Kindergarten. Using purposive sampling, 60 mother-child pairs were selected as the study sample. The inclusion criteria were: (1) children aged 4 to 6 years enrolled in the kindergarten; (2) mothers who were primary caregivers responsible for daily feeding; and (3) willingness to participate in the entire study protocol. Exclusion criteria included children with chronic illnesses affecting nutritional status and mothers unable to complete the questionnaires.

The sample size of 60 was determined based on considerations of statistical power for detecting medium effect sizes in paired comparisons, feasibility within the study period, and representativeness of the kindergarten population. This sample size exceeds the minimum requirement for repeated measures ANOVA with moderate effect sizes (Faul et al., 2009).

2.4 Research Instruments

Three primary instruments were utilized in this study:

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2.4.1 Maternal Knowledge Questionnaire

A structured questionnaire was developed to assess mothers' knowledge regarding child nutrition and health. The instrument comprised two subscales: knowledge about nutrition (10 items) and knowledge about health (10 items). Items were presented in multiple-choice format, with correct responses scored 1 and incorrect responses scored 0. Total scores were converted to mean scores for analysis, with higher scores indicating greater knowledge. Content validity was established through expert review by two nutritionists and two early childhood education specialists. Reliability testing yielded Cronbach's alpha coefficients of 0.82 for the nutrition subscale and 0.79 for the health subscale, indicating acceptable internal consistency.

2.4.2 Maternal Attitude Questionnaire

A separate questionnaire measured mothers' attitudes toward child nutrition and health using a 5-point Likert scale (1=strongly disagree to 5=strongly agree). The instrument included 10 items for attitudes toward nutrition and 10 items for attitudes toward health. Example items included "I believe that providing a variety of foods is important for my child's growth" and "I feel confident in my ability to prepare nutritious meals for my child." Higher mean scores indicated more positive attitudes. The instrument demonstrated good reliability with Cronbach's alpha of 0.85 for the nutrition attitudes subscale and 0.81 for the health attitudes subscale.

2.4.3 Anthropometric Measurements

Children's nutritional status was assessed using weight-for-age (W/A) anthropometric indicators. Weight was measured using a calibrated electronic scale with precision to 0.1 kg, with children wearing light clothing and no shoes. Age was calculated in months based on birth dates confirmed from school records. Weight-for-age Z-scores were calculated using WHO Anthro software (version 3.2.2) based on WHO Child Growth Standards (WHO, 2006). Nutritional status categories were determined according to Indonesian Ministry of Health guidelines (Kementerian Kesehatan RI, 2021): severely underweight (Z-score < -3 SD), underweight (-3 SD ≤ Z-score < -2 SD), normal (-2 SD ≤ Z-score ≤ 2 SD), and overweight/obesity (Z-score > 2 SD).

2.5 Intervention Procedure

The study procedure consisted of three phases:

Phase 1: Pre-test Assessment

Prior to the intervention, all participating mothers completed the knowledge and attitude questionnaires through Google Forms distributed via the kindergarten's communication platform. Simultaneously, children's weight and height were measured by trained enumerators following standardized protocols.

Phase 2: Educational Intervention

The intervention comprised a structured nutritional education program delivered over four weeks. Educational materials were adapted from the Indonesian Ministry of Health's "Guidelines for Child Health and Nutrition" (Kementerian Kesihatan RI, 2020) and presented through printed leaflets and booklets. The intervention covered five modules: (1) importance of balanced nutrition for preschool children; (2) food groups and recommended portions; (3) healthy eating habits and mealtime practices; (4) preventing malnutrition and obesity; and (5) practical tips for nutritious meal preparation. Materials were designed to be culturally appropriate and accessible for mothers with varying educational backgrounds.

Phase 3: Post-test Assessment

One month after completion of the intervention, mothers completed the same knowledge and attitude questionnaires, and children's anthropometric measurements were reassessed using identical procedures.

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2.6 Data Analysis

Data were analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics (means, standard deviations, frequencies, percentages) were computed for all variables. Normality of continuous variables was assessed using Shapiro-Wilk tests and visual inspection of Q-Q plots.

To evaluate intervention effects, paired sample t-tests were conducted to compare pre-test and post-tests scores for maternal knowledge, maternal attitudes, and children's weight-for-age Z-scores. Effect sizes were calculated using Cohen's d, with values of 0.2, 0.5, and 0.8 interpreted as small, medium, and large effects respectively (Cohen, 1988).

To examine the influence of maternal knowledge and attitudes on children's nutritional status, repeated measures ANOVA was performed with time (pre-test vs. post-test) as the within-subjects factor. Mauchly's test of sphericity was conducted to assess the assumption of sphericity, and Huynh-Feldt corrections were applied when assumptions were violated. Pairwise comparisons with Bonferroni adjustment were used to identify specific differences between measurement points. Statistical significance was set at $\alpha = 0.05$ for all analyses.

RESULTS AND DISCUSSION

3.1 Participant Characteristics

The study sample comprised 60 mother-child pairs. Children's ages ranged from 48 to 72 months (M = 58.4 months, SD = 7.2 months), with 32 (53.3%) boys and 28 (46.7%) girls. Mothers' ages ranged from 23 to 45 years (M = 32.6 years, SD = 5.8 years). Regarding educational background, 15 (25.0%) mothers had completed secondary education, 28 (46.7%) held diploma or bachelor's degrees, and 17 (28.3%) had postgraduate qualifications. Most mothers (48, 80.0%) were not in paid employment outside the home.

3.2 Maternal Knowledge and Attitudes: Pre-test and Post-test Comparisons

Table 1 presents descriptive statistics for maternal knowledge and attitude variables before and after the educational intervention.

Variables	Pre-test		Post-test		Mean Difference	t (df=59)	p	Cohen's d
	M	SD	M	SD				
Knowledge toward Nutrition	3.31	0.83	3.92	0.73	0.61	6.84	<0.001	0.88
Knowledge toward Health	2.97	0.67	4.17	0.60	1.20	12.53	<0.001	1.62
Attitude toward Nutrition	3.75	0.87	3.99	0.73	0.24	3.12	0.003	0.40
Attitude toward Health	3.45	0.87	4.02	0.61	0.57	5.84	<0.001	0.75

Note: All variables measured on 5-point scales; higher scores indicate more positive knowledge/attitudes.

Table 1. Descriptive Statistics for Maternal Knowledge and Attitudes Before and After Intervention

Prior to the intervention, mothers demonstrated moderate levels of nutritional knowledge (M = 3.31, SD = 0.83) and relatively lower health knowledge (M = 2.97, SD = 0.67). Attitudes were moderately positive, with nutrition attitudes (M = 3.75, SD = 0.87) somewhat more favourable than health attitudes (M = 3.45, SD = 0.87).

Following the educational intervention, significant improvements were observed across all four maternal variables. Nutritional knowledge increased to M = 3.92 (SD = 0.73), representing a significant mean increase of 0.61 points ($t(59) = 6.84$, $p < 0.001$) with a large effect size ($d = 0.88$). The most dramatic improvement occurred in health knowledge, which increased by 1.20 points to M = 4.17 (SD = 0.60; $t(59) = 12.53$, $p < 0.001$), yielding a very large effect size ($d = 1.62$).

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Maternal attitudes also showed significant enhancement. Attitudes toward nutrition improved by 0.24 points ($t(59) = 3.12$, $p = 0.003$) with a small-to-medium effect size ($d = 0.40$), while attitudes toward health increased by 0.57 points ($t(59) = 5.84$, $p < 0.001$) with a medium-to-large effect size ($d = 0.75$).

These findings demonstrate that the structured educational intervention was effective in improving both knowledge and attitudes among mothers of preschool children. The particularly large effect for health knowledge suggests that mothers may have had greater gaps in health-related knowledge prior to the intervention, which were effectively addressed through the educational materials. The significant improvements in attitudes, though more modest in magnitude, indicate that the intervention also influenced mothers' affective orientations toward child nutrition and health.

The results align with previous research demonstrating the effectiveness of nutrition education interventions in improving maternal knowledge and attitudes. Masrikhiyah (2020) reported that lecture-based nutrition education combined with visual aids increased mothers' knowledge of balanced nutrition from 12% to 76%. Similarly, Naulia et al. (2021) found that nutritional education significantly enhanced knowledge about nutritional requirements, suggesting its potential as an intervention to improve health behaviours. The present study extends these findings by documenting improvements in both knowledge and attitudes using a structured, Ministry of Health-endorsed educational program.

The theoretical framework of the Theory of Planned Behaviour (Ajzen, 1991) provides insight into why improvements in both knowledge and attitudes are important. According to TPB, attitudes represent one of three determinants of behavioural intentions, which in turn predict actual behaviour. By enhancing mothers' positive attitudes toward nutrition and health, the intervention may strengthen their intentions to provide nutritious food and implement healthy feeding practices. The significant improvements in attitudes observed in this study thus represent an important mechanism through which the intervention may influence subsequent feeding behaviours and, ultimately, children's nutritional outcomes.

3.3 Children's Nutritional Status: Pre-test and Post-test Comparisons

Table 2 presents the distribution of children's nutritional status based on weight-for-age indicators before and after the intervention, while Table 3 shows the statistical comparison of mean weight-for-age Z-scores.

Nutritional Status Category	Pre-test		Post-test	
	n	%	n	%
Severely Underweight	0	0	0	0
Underweight	8	13.3	2	3.3
Good / Normal	40	66.7	48	80.0
Overweight / Obesity	12	20	10	16.7
Total	**60**	**100.0**	**60**	**100.0**

Table 2. Distribution of Children's Nutritional Status (Weight-for-Age) Before and After Intervention

At pre-test, the majority of children (40, 66.7%) had normal nutritional status, while 8 (13.3%) were classified as underweight and 12 (20.0%) as overweight / obesity. Following the intervention, the proportion of children with normal nutritional status increased to 48 (80.0%), representing a 13.3 percentage point improvement. The number of underweight children decreased substantially from 8 to 2 (a 75% reduction), while overweight / obesity cases declined modestly from 12 to 10 (a 16.7% reduction).

Measurement	n	M	SD	Mean Difference	t (df=59)	p	Cohen's d
Pre-test W/A Z-score	60	3.19	0.45				
Post-test W/A Z-score	60	3.30	0.42	0.11	2.03	0.047	0.26

Table 3. Comparison of Mean Weight-for-Age Z-Scores Before and After Intervention

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Paired samples t-test revealed a statistically significant increase in mean weight-for-age Z-scores from pre-test (M = 3.19, SD = 0.45) to post-test (M = 3.30, SD = 0.42), with a mean difference of 0.11 (t(59) = 2.03, p = 0.047). The effect size was small (d = 0.26), indicating a modest but meaningful improvement in children's nutritional status following the intervention.

These findings demonstrate that the educational intervention targeting mothers produced measurable improvements in their children's nutritional outcomes. The reduction in underweight prevalence is particularly noteworthy, as underweight children face increased risks of morbidity, mortality, and impaired development (Black et al., 2013). The improvement in mean Z-scores suggests that children moved toward more optimal weight-for-age trajectories, potentially reducing their long-term health risks.

The modest reduction in overweight/obesity prevalence, while not statistically significant in itself, suggests that the intervention may have also influenced practices related to preventing excessive weight gain. This is important given the rising prevalence of childhood obesity in Indonesia and its association with non-communicable diseases later in life (Kementerian Kesehatan RI, 2023).

The observed improvements in children's nutritional status can be attributed to changes in maternal feeding practices resulting from enhanced knowledge and more positive attitudes. As mothers gained understanding of balanced nutrition and developed more favourable attitudes toward healthy feeding, they likely implemented these practices at home, leading to improved nutrient intake and subsequent weight gain among underweight children. This interpretation is consistent with previous research demonstrating that nutrition education for mothers can improve children's nutritional status (Muliyati, 2019; Saaka et al., 2021).

3.4 Influence of Maternal Knowledge and Attitudes on Children's Nutritional Status

To examine the influence of maternal knowledge and attitudes on children's nutritional status, repeated measures ANOVA was conducted with time (pre-test vs. post-test) as the within-subjects factor and the four maternal variables and child weight-for-age as dependent variables.

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial η²
Time (Pre-test-Post-test)	77.08	1	77.08	47.98	<0.001	0.45
Error (Time)	94.78	59	1.61			

Table 4. Repeated Measures ANOVA for Maternal Knowledge, Attitudes, and Child Nutritional Status

Mauchly's test indicated that the assumption of sphericity was satisfied (W = 0.92, $\chi^2(2) = 4.23$, p = 0.12). The results revealed a significant main effect of time, F(1, 59) = 47.98, p < 0.001, partial η^2 = 0.45, indicating that overall, there was a significant difference between pre-test and post-test measurements across all variables. The large effect size (partial η^2 = 0.45) suggests that 45% of the variance in the combined dependent variables is attributable to the intervention.

Comparison (I)	Comparison (J)	Mean Difference (I-J)	SE	p	95% CI
Knowledge & Attitude (Pre-test)	Knowledge & Attitude (Post-test)	-.56*	0.08	<0.001	[-0.77, -0.35]
	W/A Z-score (Pre-test	0.26*	0.06	<0.001	[0.09, 0.43]
	W/A Z-score (Posttest)	0.15*	0.05	0.03	[0.01, 0.29]
Knowledge & Attitude (Post-test)	Knowledge & Attitude (Pre-test)	0.56*	0.08	<0.001	[0.35, 0.77]
	W/A Z-score (Pre-test)	0.83*	0.07	<0.001	[0.63, 1.03]
	W/A Z-score (Posttest)	0.72*	0.06	<0.001	[0.55, 0.89]
W/A Z-score (Pretest)	Knowledge & Attitude (Pre-test)	-.26*	0.06	<0.001	[-0.43, -0.09]
	Knowledge & Attitude (Post-test)	-.83*	0.07	<0.001	[-1.03, -0.63]
	W/A Z-score (Posttest)	-0.10	0.04	0.10	[-0.21, 0.01]

continued

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W/A (Posttest)	Z-score	Knowledge & Attitude (Pre-test)	-0.15*	0.05	0.03	[-0.29, -0.01]
		Knowledge & Attitude (Post-test)	-0.72*	0.06	<0.001	[-0.89, -0.55]
		W/A Z-score (Pre-test)	0.10	0.04	0.10	[-0.01, 0.21]

Table 5. Pairwise Comparisons with Bonferroni Adjustment

Pairwise comparisons with Bonferroni adjustment (Table 5) revealed several significant differences. Most importantly, the comparison between pre-test and post-test for the composite maternal knowledge and attitude variable showed a significant mean difference of 0.56 ($p < 0.001$), confirming the improvement documented in the univariate analyses. Similarly, the comparison between pre-test and post-test weight-for-age Z-scores approached but did not reach statistical significance (mean difference = -0.10, $p = 0.10$), though the univariate t-test did show significance ($p = 0.047$), reflecting the more sensitive nature of the paired comparison.

Critically, the pairwise comparisons demonstrated significant associations between maternal variables and child nutritional status. Post-test maternal knowledge and attitudes were significantly higher than pre-test child weight-for-age (mean difference = 0.83, $p < 0.001$) and post-test child weight-for-age (mean difference = 0.72, $p < 0.001$). These findings indicate that improvements in maternal knowledge and attitudes were accompanied by improvements in children's nutritional status, supporting the hypothesized influence of maternal factors on child outcomes.

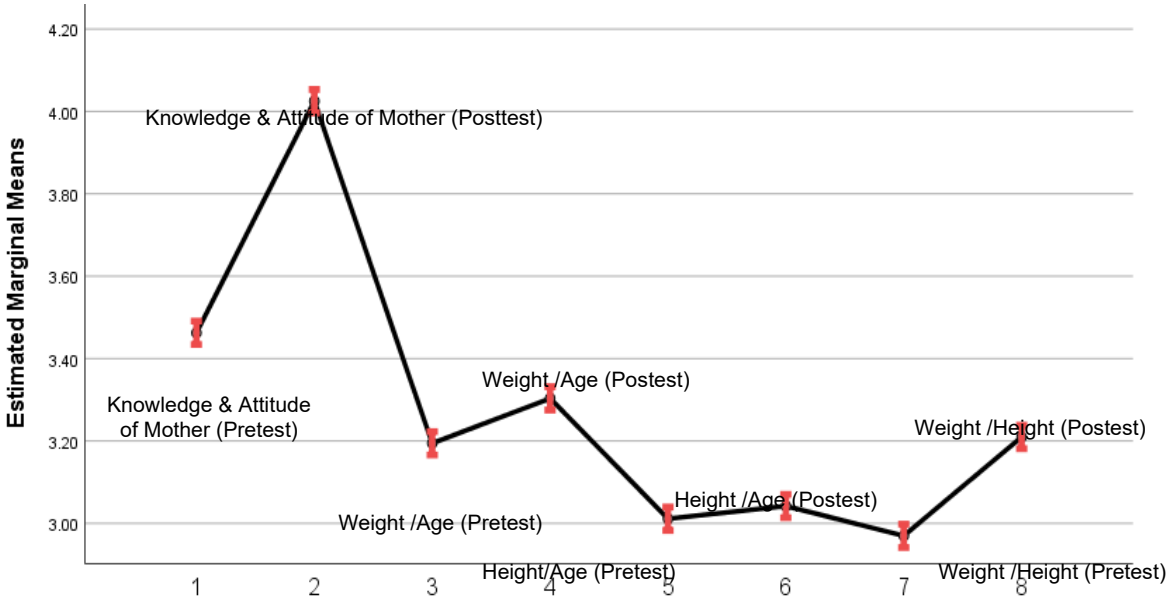

Figure 1. Profile plot showing improvements in maternal knowledge and attitudes (composite score) and children's weight-for-age Z-scores from pre-test to post-test following nutritional education intervention.

The profile plot visually confirms the pattern revealed by statistical analyses: both maternal factors and child nutritional outcomes improved following the intervention, with maternal knowledge and attitudes showing more substantial increases than child weight-for-age, consistent with the temporal sequence in which maternal changes precede and potentially influence child outcomes.

These findings provide empirical support for the theoretical framework guiding this study. According to the Theory of Planned Behaviour (Ajzen, 1991), attitudes influence behavioural intentions, which in turn shape actual behaviour. The educational intervention enhanced mothers' knowledge and attitudes, which likely translated into improved feeding practices at home.

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These behavioural changes, sustained over the one-month follow-up period, resulted in measurable improvements in children's weight-for-age status. The significant association between improved maternal factors and enhanced child nutritional outcomes supports this causal pathway.

The results corroborate previous research demonstrating the importance of maternal factors in determining children's nutritional status. Muliyati (2019) found a significant relationship between nutritional knowledge and children's nutritional status, noting that better knowledge was associated with improved nutritional intake patterns. Prayitno (2019) Julita and Putri (2022) reported that nutrition education for pregnant women significantly improved knowledge about stunting prevention, with implications for their children's future nutritional status. The present study extends these findings by demonstrating the effectiveness of an intervention targeting mothers of preschool children and documenting improvements in both maternal factors and child outcomes within the same sample.

The findings also align with research by Saaka et al. (2021) in Northern Ghana, which found that health and nutrition education using radio dramas significantly increased mothers' knowledge about child health and nutrition. Similarly, De Rosso et al. (2022) in France reported that child health media interventions have potential to increase parents' knowledge levels. The present study contributes to this growing body of evidence by demonstrating similar effects in the Indonesian context using culturally adapted printed educational materials.

However, the modest effect size for child nutritional status improvements warrants consideration. While statistically significant, the mean increase in weight-for-age Z-scores of 0.11 represents a relatively small change over the one-month follow-up period. This may reflect the time required for behavioral changes to translate into measurable anthropometric improvements, as well as the multifactorial nature of child nutritional status. Beyond maternal knowledge and attitudes, children's nutritional outcomes are influenced by numerous factors including food availability, household economics, cultural practices, and child health status (Black et al., 2013). Longer follow-up periods may reveal more substantial improvements as behavioural changes become established and sustained.

The differential improvement in underweight versus overweight children is also noteworthy. Underweight children showed greater improvement, with 75% moving to normal weight status, compared to only 16.7% of overweight children. This pattern may reflect the intervention's content, which emphasized adequate nutrition and preventing undernutrition more strongly than managing overweight. Alternatively, it may be easier for mothers to address underweight through increased food provision than to modify established dietary patterns contributing to overweight. Future interventions should consider incorporating more explicit content on preventing and managing childhood overweight and obesity.

3.5 Discussion of Findings in Relation to Previous Research

The significant improvements in maternal knowledge observed in this study are consistent with a substantial body of research demonstrating the effectiveness of nutrition education interventions. Masrikhiyah (2020) reported that lecture-based nutrition education combined with visual aids increased mothers' knowledge of balanced nutrition from 12% to 76%, an even more dramatic improvement than observed here. The somewhat smaller improvement in the present study may reflect the use of printed materials rather than interactive lectures, suggesting that more intensive, interactive approaches might yield greater knowledge gains.

The particularly large improvement in health knowledge ($d = 1.62$) compared to nutrition knowledge ($d = 0.88$) is noteworthy. This may indicate that mothers had greater baseline knowledge about nutrition than about general child health, leaving more room for improvement in the latter domain. Alternatively, the intervention materials may have emphasized health-related content more strongly. Future interventions should ensure balanced coverage of both nutrition and health topics.

The improvements in maternal attitudes, while significant, were more modest than knowledge improvements. This pattern aligns with theoretical expectations: knowledge acquisition typically precedes attitude change, which may require more time and reinforcement to develop (Notoatmodjo, 2010). Attitudes represent deeper-seated affective orientations that may be more resistant to change than factual knowledge.

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The small-to-medium effect sizes for attitude improvements suggest that the intervention successfully initiated attitude change, but longer-term or more intensive interventions may be needed to achieve more substantial shifts.

The relationship between improved maternal factors and enhanced child nutritional status observed in this study supports findings from previous research in diverse contexts. Anwar and Rosdiana (2023) noted that many child nutrition problems stem from parents' lack of knowledge, leading to imbalanced consumption of carbohydrates, proteins, vitamins, and minerals. Parents with limited knowledge tend to provide monotonous, non-varied foods lacking innovation, contributing to children's boredom and inadequate intake. The present study suggests that addressing these knowledge gaps through targeted education can lead to measurable improvements in nutritional outcomes.

Similarly, Fadila et al. (2017) and Desca (2021) found significant relationships between maternal behaviour regarding balanced nutrition and children's nutritional status, with education identified as a key process for changing attitudes and behaviour. The current study extends these findings by demonstrating that education can simultaneously improve both maternal knowledge and attitudes, with consequent benefits for children.

However, the findings contrast somewhat with those of Ormancic et al. (2022) in Turkey, who reported that mothers' attitudes did not reflect children's nutritional status in terms of healthy nutrition principles. This discrepancy may reflect cultural differences in the relationship between attitudes and behaviors, or differences in measurement approaches. The present study's use of a comprehensive educational intervention may have strengthened the attitude-behaviour relationship compared to observational studies examining existing attitudes without intervention.

3.6 Theoretical and Practical Implications

The findings have important theoretical implications for understanding the determinants of child nutritional status. They provide empirical support for applying the Theory of Planned Behaviour (Ajzen, 1991) in the context of child feeding, demonstrating that interventions targeting attitudes (one component of TPB) can lead to improved outcomes. However, the modest effect sizes for attitude change suggest that the theory's other components—subjective norms and perceived behavioural control—may also require attention in future interventions. Interventions that address social expectations (e.g., involving fathers or extended family) and enhance mothers' confidence in their ability to provide nutritious food despite constraints may yield additional benefits.

From a practical perspective, the findings support the integration of nutrition education programs within early childhood education settings. Kindergartens provide an ideal venue for reaching mothers of young children and delivering structured educational content. The significant improvements achieved with relatively low-intensity intervention (printed materials over four weeks) suggest that even modest investments in parent education can yield meaningful benefits for child health. Scaling up such programs across kindergartens in Banda Aceh and beyond could contribute to reducing childhood malnutrition at the population level.

The findings also have implications for the content and delivery of nutrition education. The differential improvements in underweight versus overweight children suggest that interventions should address both undernutrition and overnutrition explicitly. The larger improvements in health knowledge compared to nutrition knowledge indicate that comprehensive content covering both domains is valuable. The significant attitude changes, while modest, suggest that interventions should include components designed to address affective as well as cognitive aspects of maternal feeding behaviour.

For policymakers, the results support the inclusion of parent nutrition education as a component of early childhood health and nutrition strategies. The Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 4 (Quality Education), emphasize the importance of nutrition for child development and the role of education in achieving health outcomes. The present study demonstrates a concrete pathway through which educational interventions can contribute to multiple SDG targets simultaneously.

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CONCLUSIONS

5.1 Summary of Findings

This study investigated the influence of mothers' knowledge and attitudes on the nutritional status of preschool children in Banda Aceh, Indonesia, and evaluated the effectiveness of a nutritional education intervention in improving these factors. The findings demonstrate that:

1. Prior to the intervention, mothers demonstrated moderate levels of nutritional knowledge (M = 3.31) and relatively lower health knowledge (M = 2.97), with moderately positive attitudes toward nutrition (M = 3.75) and health (M = 3.45).
2. The educational intervention significantly improved all maternal variables, with large effects for knowledge (nutrition: d = 0.88; health: d = 1.62) and small-to-medium effects for attitudes (nutrition: d = 0.40; health: d = 0.75).
3. Children's nutritional status improved following the intervention, with the proportion of normal weight-for-age increasing from 66.7% to 80.0% and underweight prevalence decreasing from 13.3% to 3.3%.
4. There was a statistically significant increase in mean weight-for-age Z-scores from pre-test (M = 3.19) to post test (M = 3.30; p = 0.047), representing a small but meaningful effect (d = 0.26).
5. Repeated measures ANOVA confirmed a significant overall effect of the intervention across maternal and child variables ($F(1, 59) = 47.98$, $p < 0.001$, partial $\eta^2 = 0.45$), and pairwise comparisons demonstrated significant associations between improvements in maternal factors and enhanced child nutritional outcomes.

These findings support the hypothesis that mothers' knowledge and attitudes significantly influence preschool children's nutritional status and that targeted educational interventions can improve both maternal factors and child outcomes.

5.2 Theoretical Contributions

This study contributes to the theoretical understanding of child nutrition determinants by providing empirical support for the application of the Theory of Planned Behaviour in this context. The findings demonstrate that interventions targeting maternal attitudes one component of TPB can lead to measurable improvements in child nutritional outcomes, presumably through their influence on feeding intentions and subsequent behaviours. The study also highlights the importance of addressing both knowledge and attitudes in nutrition interventions, as they represent distinct but complementary pathways to behaviour change.

5.3 Practical Implications

The findings have several practical implications for early childhood education, health promotion, and policy:

1. Integration of Nutrition Education in Preschools: Kindergartens should incorporate parent nutrition education as a routine component of their programs, leveraging their access to mothers of young children.
2. Comprehensive Content: Nutrition education programs should address both undernutrition and overnutrition, and cover both nutrition-specific and general health knowledge.
3. Affective Components: Interventions should include strategies to address mothers' attitudes and emotional orientations toward feeding, not merely factual knowledge.
4. Sustained Engagement: Given the modest effect sizes for attitude change and child nutritional outcomes, longer-term or more intensive interventions may be needed to achieve more substantial improvements.
5. Policy Integration: Health and education policymakers should consider incorporating parent nutrition education into early childhood development strategies, recognizing its potential to contribute to multiple SDG targets.

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5.4 Limitations and Future Research Directions

Several limitations of this study should be acknowledged:

1. Single-Group Design: The absence of a control group limits causal inferences, as observed improvements could potentially be attributed to factors other than the intervention (e.g., maturation, history). Future research should employ randomized controlled trials to establish causality more definitively.
2. Short Follow-Up Period: The one-month follow-up may be insufficient to capture the full impact of behavioural changes on nutritional status. Longer follow-up periods (e.g., 6-12 months) would allow assessment of sustained effects and continued improvement.
3. Single Site: The study was conducted at one kindergarten, limiting generalizability to other settings. Multi-site studies across diverse communities would enhance external validity.
4. Limited Outcome Measures: Nutritional status was assessed using only weight-for-age. Future studies should include additional anthropometric indicators (height-for-age, weight-for-height) and dietary intake measures to provide a more comprehensive assessment.
5. Proxy Measures of Behaviour: Maternal feeding behaviours were not directly observed; improvements in knowledge and attitudes were assumed to translate into behavioural changes. Future research should include direct observation or detailed self-report measures of feeding practices.
6. Sample Characteristics: The relatively high educational level of participating mothers (75% with tertiary education) limits generalizability to populations with lower educational attainment. Future research should include more diverse samples.

Based on these limitations, future research directions include:

1. Conducting randomized controlled trials with longer follow-up periods to establish causal effects and assess sustainability.
2. Examining the effectiveness of more intensive or innovative intervention delivery methods (e.g., mobile health applications, peer support groups, cooking demonstrations).
3. Investigating the role of additional factors such as fathers' involvement, household food security, and cultural beliefs in moderating intervention effects.
4. Exploring the cost-effectiveness of nutrition education interventions to inform resource allocation decisions.
5. Adapting and evaluating interventions for diverse populations, including those with lower educational attainment and in rural areas.

5.5 Concluding Remarks

This study provides evidence that mothers' knowledge and attitudes significantly influence preschool children's nutritional status and that structured educational interventions can improve both maternal factors and child outcomes. The findings underscore the importance of integrating nutrition education into early childhood programs and highlight the potential of such interventions to contribute to reducing childhood malnutrition. As Indonesia and other countries strive to achieve the Sustainable Development Goals related to hunger, health, and education, investments in parent nutrition education represent a promising strategy for improving the nutritional status and long-term developmental outcomes of young children.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest. This research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHORS CONTRIBUTION

Nurul Aisyah: Conceptualization, Methodology, Investigation, Writing – Original Draft, Supervision, Project Administration, Funding Acquisition

Cut Meutia: Methodology, Validation, Formal Analysis, Data Curation, Writing – Review & Editing, Visualization

Teuku Zulkarnaini: Investigation, Resources, Software, Formal Analysis, Writing – Review & Editing

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions, as they contain information that could compromise the privacy of research participants.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the author(s) used Chat GPT (OpenAI) to enhance the clarity and readability of the writing. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

ETHIC STATEMENTS

Not Applicable

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50 (2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Almatsier, S. (2010). Prinsip dasar ilmu gizi. PT Gramedia Pustaka Utama.

Anwar, C., & Rosdiana, R. (2023). Hubungan pengetahuan ibu tentang gizi dengan status gizi balita di Puskesmas Kuta Alam Banda Aceh. Jurnal Kesehatan Masyarakat, 8 (1), 45-52.

Beck, M. E. (2000). Ilmu gizi dan diet. Yayasan Essentia Medica.

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet, 382*(9890), 427-451. https://doi.org/10.1016/S0140-6736(13)60937-X

https://doi.org/10.37134/jpakk.vol15.1.7.2026

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

De Rosso, S., Ducrot, P., & Caria, A. (2022). Effectiveness of a child health media intervention on parental knowledge and attitudes in France. Journal of Nutrition Education and Behavior, 54 (3), 231-240. https://doi.org/10.1016/j.jneb.2021.11.005

Desca, A. (2021). Hubungan perilaku ibu tentang gizi seimbang dengan status gizi anak prasekolah. Jurnal Ilmu Kesehatan, 9 (2), 112-120.

Devi, M., & Anjani, A. (2019). Pengetahuan dan sikap ibu tentang gizi seimbang pada anak prasekolah. Jurnal Kesehatan, 10 (1), 55-62.

Donsu, J. D. T. (2017). Psikologi keperawatan. Pustaka Baru Press.

Fadila, R., Sari, P., & Nugraheni, A. (2017). Hubungan perilaku ibu tentang gizi seimbang dengan status gizi anak usia prasekolah. Jurnal Gizi Indonesia, 6 (2), 98-105.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G Power 3.1: Tests for correlation and regression analyses. Behavior Research Methods, 41 (4), 1149-1160. https://doi.org/10.3758/BRM.41.4.1149

Fitriani Rika, S., Lubis, Z., & Nasution, E. (2020). Hubungan pengetahuan gizi ibu dengan status gizi balita di wilayah kerja Puskesmas. Jurnal Kesehatan Global, 3 (1), 22-30.

Julita, E., & Putri, M. (2022). Pengaruh pendidikan gizi terhadap pengetahuan ibu hamil tentang pencegahan stunting. Jurnal Kesehatan Ibu dan Anak, 6 (1), 33-40.

Juliati, R. (2021). Gambaran pengetahuan ibu tentang gizi anak prasekolah. Jurnal Keperawatan, 13 (2), 145-152.

Kementerian Kesehatan RI. (2020). Pedoman gizi seimbang anak usia prasekolah. Kementerian Kesehatan Republik Indonesia.

Kementerian Kesehatan RI. (2021). Buku saku pemantauan status gizi tahun 2021. Kementerian Kesehatan Republik Indonesia.

Kementerian Kesehatan RI. (2023). Hasil Survei Status Gizi Indonesia (SSGI) 2022. Kementerian Kesehatan Republik Indonesia.

Masrikhiyah, R. (2020). Peningkatan pengetahuan ibu tentang gizi seimbang melalui penyuluhan dengan metode ceramah dan alat peraga. Jurnal Pengabdian Masyarakat, 4 (1), 45-52.

Muliyati, H. (2019). Hubungan pengetahuan gizi dengan status gizi anak di TK Kecamatan Baiturrahman Banda Aceh. Jurnal Ilmiah Mahasiswa, 3 (2), 78-85.

Naulia, R., Siregar, A., & Harahap, R. (2021). Pengaruh edukasi gizi terhadap peningkatan pengetahuan dalam pemenuhan kebutuhan gizi balita. Jurnal Kesehatan Masyarakat, 7 (2), 112-120.

Notoatmodjo, S. (2010). Promosi kesehatan dan ilmu perilaku. Rineka Cipta.

Ormancic, H., Nacak, B., & Yilmaz, G. (2022). Mothers' attitudes and children's nutritional status in Turkey: A cross-sectional study. Journal of Pediatric Nursing, 62, e85-e91. https://doi.org/10.1016/j.pedn.2021.07.015

Prayitno, A. (2019). Pengaruh pendidikan kesehatan terhadap pengetahuan ibu hamil tentang pencegahan stunting. Jurnal Kesehatan, 8(1), 23-30.

Rani, I.F.A, Jamil, N., Abdul, M.A., Zain, A., Basir, J.M., Mohamad, I., & Wan Risad, W.N.A. (2025). Development and validation of a nutritional education model for malnourished preschool children in Malaysia. Internation Journal of Advanced and Applied Sciences, 12 (6), 190-198. https://doi.org/10.21833/ijaas.2025.06.018

Rizzo, T. L., & Columna, L. (2020). Theory of planned behavior in health behavior research. In G. Tenenbaum & R. C. Eklund (Eds.), Handbook of sport psychology (4th ed., pp. 567-582). Wiley. https://doi.org/10.1002/9781119568124.ch27

Saaka, M., Abubakari, A., & Yakubu, A. (2021). Impact of radio drama on maternal knowledge and child nutritional status in Northern Ghana. Maternal & Child Nutrition, 17 (3), e13145. https://doi.org/10.1111/mcn.13145

Stevani, H., Siregar, A., & Lubis, Z. (2021). Pengetahuan gizi dan pemilihan bahan makanan pada ibu rumah tangga. Jurnal Gizi, 10 (1), 45-52.

UNICEF. (2021). The state of the world's children 2021: On my mind – Promoting, protecting and caring for children's mental health. UNICEF.

World Health Organization. (2006). WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. WHO.

https://doi.org/10.37134/jpakk.vol15.1.7.2026