

MATERNAL KNOWLEDGE OF DIETARY PATTERNS AND CHILDHOOD STUNTING: A CROSS-SECTIONAL STUDY IN MEDAN MARELAN SUBDISTRICT, INDONESIA

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ABSTRACT

Stunting is chronic linear growth impairment in children resulting from malnutrition, recurrent infection, and inadequate psychosocial stimulation (UNICEF et al., 2023). Globally, an estimated 148.1 million children under five were stunted in 2022, and stunting remains a leading contributor to impaired cognitive development and long-term productivity loss (Soliman et al., 2021). In Medan, North Sumatra, Medan Marelan Subdistrict recorded the highest number of stunting cases in the city (34 children) as of January 2024, distributed across the Terjun and Rengas Pulau community health centres (Dinas Kesehatan Kota Medan, 2024). Objective: This study examined the relationship between maternal knowledge of dietary patterns and the incidence of stunting among children under five years in Medan Marelan Subdistrict. Methods: An analytical observational study with a cross-sectional design was conducted in December 2024. All 34 mothers of children under five identified with stunting in the Terjun and Rengas Pulau catchment areas were enrolled through total sampling, exceeding the minimum sample size ($n = 31$) calculated using a correlation-based sample size formula (Dahlan, 2010). Data were collected through interviewer-administered structured questionnaires. Univariate and bivariate analyses were performed using Spearman's rank-order correlation test ($\alpha = 0.05$). Results: Most children were aged 2–3 years (41.2%) and female (70.6%). Maternal education was dominated by senior high school graduates (47.1%). Maternal knowledge of dietary patterns was predominantly poor (52.9%), and severe stunting was more prevalent (61.8%) than moderate stunting (38.2%). The Spearman's rho test showed a statistically significant correlation between maternal knowledge of dietary patterns and stunting incidence ($r = 0.553$, $p = 0.001$), indicating a strong relationship. Conclusion: Maternal knowledge of dietary patterns is significantly and strongly associated with stunting incidence among children under five in Medan Marelan. Community-based nutrition education targeting mothers with limited dietary knowledge is recommended as a priority intervention.

Keywords: *Stunting, Maternal Knowledge, Dietary Patterns, Children Under Five, Cross-Sectional Study.*

Introduction

Stunting is a chronic form of linear growth impairment in children, defined as a height-for-age z-score below -2 standard deviations of the World Health Organization (WHO) growth reference, resulting from chronic malnutrition,

recurrent infection, and inadequate psychosocial stimulation (UNICEF et al., 2023). Globally, approximately 148.1 million children under five were affected by stunting in 2022, with Indonesia ranking fourth worldwide and among the five countries with the highest stunting burden

(United Nations Children's Fund (UNICEF), 2020). Recent data indicate that the national stunting prevalence in Indonesia stands at approximately 21.5%, based on the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia, SKI), with considerable disparity across regions (Arief et al., 2025; Setiyawati et al., 2024).

Medan City recorded approximately 208 stunted children as of January 2024, with Medan Marelan Subdistrict accounting for the highest number of cases in the city, namely 34 children distributed across the catchment areas of the Terjun (23 children) and Rengas Pulau (11 children) community health centres (Dinas Kesehatan Kota Medan, 2023; Jafar, 2024). Stunting that occurs during the first 1,000 days of life carries a high risk of irreversible long-term consequences, including impaired cognitive development, reduced academic performance, and diminished economic productivity in adulthood (Soliman et al., 2021).

A range of factors has been identified as contributing to childhood stunting, including household and caregiving characteristics (Yani et al., 2023), inadequate exclusive breastfeeding and complementary feeding practices (Kumala et al., 2022; Tahreem et al., 2025), household sanitation and access to clean water (Batoool et al., 2023), and maternal

education level (Laksono et al., 2022). Among these determinants, maternal knowledge of dietary patterns and child nutrition serves as an important proximal determinant that shapes the quality of daily feeding practices (Mporanyi et al., 2025; Venkatesh et al., 2026).

Evidence from multiple countries has consistently demonstrated this pattern: mothers with limited nutritional knowledge tend to have children with poorer nutritional status. In Rwanda, nearly half of mothers (46.4%) exhibited low knowledge regarding the causes of stunting, which was associated with inadequate infant and young child feeding practices (Mporanyi et al., 2025). Comparable findings have been reported in Namibia (Albanus & Ashipala, 2023), Pakistan (Tahreem et al., 2025), and India (Venkatesh et al., 2026), all of which consistently identified a positive correlation between maternal knowledge and/or feeding practices and children's anthropometric indicators. In the Indonesian context, a study by Fitri and Nursia, (2022) in Arongan Village concluded that a significant relationship exists between maternal nutrition knowledge and stunting incidence, even though maternal knowledge does not act as a direct causal factor but rather supports appropriate decision-making regarding feeding and child health. This finding is

corroborated by a study in Pandeglang Regency, which found a 12.9-fold higher risk of poor nutritional status among children under five whose mothers had inadequate knowledge of feeding practices (Irianti et al., 2023).

Although substantial evidence on the relationship between maternal knowledge and stunting exists at both national and international levels, subdistrict-specific data for areas with the highest stunting burden in Medan City, particularly Medan Marelan Subdistrict, remain limited. This study aims to address this gap by examining the relationship between maternal knowledge of dietary patterns and the incidence of stunting among children under five years in Medan Marelan Subdistrict, providing an evidence base for the design of more targeted nutrition education interventions in the area.

Method

Study Design and Setting

This study employed an analytical observational design with a cross-sectional approach. The study was conducted within the catchment areas of the Terjun and Rengas Pulau community health centres, Medan Marelan Subdistrict, Medan City, in December 2024. Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Muhammadiyah Sumatera

Utara, under approval number 1328/KEPK/FKUMSU/2024.

Population and Sample

The study population comprised all children under five years diagnosed with stunting in Medan Marelan Subdistrict according to Medan City Health Office data (Dinas Kesehatan Kota Medan, 2024), totalling 34 children (23 in the Terjun catchment area and 11 in the Rengas Pulau catchment area). Given the limited number of identified cases in the population, this study employed total sampling, enrolling all mothers of stunted children who met the inclusion criteria as respondents. The minimum required sample size was calculated using the correlation-based sample size formula described by Dahlan (2010):

$$n = \{(Z\alpha + Z\beta) / [0.5 \ln((1+r)/(1-r))]\}^2 + 3$$

where $Z\alpha = 1.64$ (one-sided significance level of 5%), $Z\beta = 1.28$ (statistical power of 90%), and $r = 0.5$ (the minimum correlation considered clinically meaningful), yielding a minimum sample size of $n = 31$. The 34 respondents ultimately enrolled in this study therefore exceeded the required minimum sample size.

Inclusion criteria: (1) mothers or primary caregivers of children under five diagnosed with stunting (height-for-age z-score < -2 SD according to WHO growth standards)

residing within the Terjun or Rengas Pulau catchment areas; (2) willingness to participate as a respondent and to sign an informed consent form.

Exclusion criteria: (1) mothers/caregivers who could not be interviewed due to a health condition; (2) incomplete child medical records; (3) respondents who withdrew before the interview was completed.

Variables and Research Instrument

The independent variable in this study was maternal knowledge of dietary patterns, categorised into three levels (good, moderate, and poor) based on scores from a structured questionnaire covering feeding schedules, food types, portion sizes, exclusive breastfeeding, and age-appropriate complementary feeding. The dependent variable was stunting status, categorised as stunting (height-for-age z-score from -3 SD to < -2 SD) or severe stunting (z-score < -3 SD) according to WHO anthropometric standards. The questionnaire was developed based on a review of the relevant literature and underwent content validity review by the research team prior to field administration. Subsequent researchers using this instrument are encouraged to explicitly report reliability coefficients (e.g., Cronbach's alpha) to meet the reporting

standards expected in international journals.

Data Analysis

Univariate analysis was conducted to describe the frequency distribution of children's and mothers' demographic characteristics, maternal knowledge levels, and stunting incidence. Bivariate analysis was performed to examine the relationship between maternal knowledge of dietary patterns (ordinal scale) and stunting incidence (ordinal scale) using Spearman's rank-order correlation test, which is appropriate for ordinal, non-normally distributed data. The strength of association was interpreted according to the following correlation coefficient ranges: 0.00–0.25 (very weak), 0.26–0.50 (weak), 0.51–0.75 (strong), 0.76–0.99 (very strong), and 1.00 (perfect) (Dahlan, 2010). Statistical significance was set at $p < 0.05$ with a 95% confidence level. All data were analysed using the Statistical Package for the Social Sciences (SPSS)

Results

This study involved 34 mothers of stunted children in Medan Marelan Subdistrict, selected based on the inclusion and exclusion criteria within the catchment areas of the Terjun and Rengas Pulau community health centres.

Child Demographic Characteristics
Table 1. Distribution of Sample
Characteristics by Child Demographic
Data

Characteristic	f	Percentage (%)
Child age		
1–2 years	7	20.6
2–3 years	14	41.2
3–5 years	13	38.2
Total	34	100
Sex		
Female	24	70.6
Male	10	29.4
Total	34	100

Table 1 shows that stunted children were predominantly aged 2–3 years (41.2%) and female (70.6%).

Maternal Demographic Characteristics
Table 2. Distribution of Sample
Characteristics by Maternal
Demographic Data (Maternal
Education)

Maternal Education	f	Percentage (%)
Primary school	6	17.6
Junior secondary school	10	29.4
Senior secondary/vocational school	16	47.1
Bachelor's degree	2	5.9
Total	34	100

Table 2 shows that maternal education was dominated by senior secondary/vocational school graduates (47.1%), followed by junior secondary school (29.4%), primary school (17.6%), and bachelor's degree holders (5.9%).

Univariate Analysis: Stunting Incidence and Maternal Knowledge Level

Table 3. Distribution of Stunting
Incidence among Children Under Five

Stunting Status	f	Percentage (%)
Stunting	13	38.2
Severe stunting	21	61.8
Total	34	100

Table 4. Distribution of Maternal
Knowledge of Dietary Patterns

Maternal Knowledge	f	Percentage (%)
Good	5	14.7
Moderate	11	32.4
Poor	18	52.9
Total	34	100

Severe stunting (61.8%) was more prevalent than moderate stunting (38.2%). Most mothers had poor knowledge of dietary patterns (52.9%), followed by moderate (32.4%) and good (14.7%) knowledge.

Bivariate Analysis: The Relationship between Maternal Knowledge and Stunting Incidence

Table 5. Results of Spearman's Rho
Correlation Test between Maternal
Knowledge of Dietary Patterns and
Stunting Incidence

Variable	p-value	Correlation coefficient (r)	Strength of association
Maternal knowledge level – Stunting incidence	0.001	0.553	Strong

The Spearman's rho test yielded a significance value of $p = 0.001$ ($p < 0.05$) with a correlation coefficient of 0.553, indicating a strong, positively directed relationship between maternal knowledge of dietary patterns and stunting incidence; the lower the maternal knowledge level, the greater the severity of stunting observed in children. The alternative hypothesis (H1) was therefore accepted, confirming a significant relationship between the two variables.

Discussion

Child Characteristics: Age and Sex

The predominance of stunting among children aged 2–3 years is consistent with the critical period of weaning and intensive environmental exploration, during which children become active consumers and are increasingly exposed to nutritionally poor food choices (Samaloisa, 2024). During this period, reduced appetite, inadequate nutrient intake, and heightened infection risk associated with poor sanitation practices contribute to delayed motor and linear growth (Batool et al., 2023; Samaloisa, 2024).

The predominance of female children among stunting cases in this study (70.6%) should be interpreted cautiously, as the study was not designed to statistically test the association between child sex and stunting. The literature presents mixed findings regarding the role of sex in stunting risk; several studies have found no significant difference in nutritional requirements between male and female children under five (Kurniawati & Yulianto, 2022), suggesting that the sex distribution observed in this study more likely reflects the composition of the case population in the study area rather than an underlying biological risk factor.

Maternal Education

The predominance of senior secondary/vocational education among

mothers (47.1%) suggests that formal educational attainment alone does not guarantee adequate nutritional knowledge. A national-scale study in Indonesia found that mothers with primary and secondary education retained a higher risk of having stunted children compared with those with tertiary education, although this relationship was graded (dose-response) rather than strictly linear (Laksono et al., 2022). This underscores the need for explicit and sustained nutrition education interventions, rather than reliance on formal maternal education alone (Alistina et al., 2021).

Maternal Knowledge of Dietary Patterns

The majority of mothers in this study demonstrated poor knowledge of dietary patterns (52.9%). This finding is consistent with multi-country evidence indicating that gaps in maternal knowledge regarding the causes and prevention of stunting remain a substantial challenge across developing countries. A nationally representative study in Rwanda reported that 46.4% of mothers had low knowledge of the causes of stunting, particularly regarding infection-related factors (Mporanyi et al., 2025), while a study in Namibia identified similar gaps between knowledge and feeding practices (Albanus & Ashipala, 2023). This pattern has also been observed in Pakistan, where low maternal nutritional literacy was associated with poor child growth outcomes

(Tahreem et al., 2025), and in India, where maternal knowledge-attitude-practice (KAP) scores were positively correlated with children's anthropometric indicators (Venkatesh et al., 2026).

Stunting Incidence

The predominance of severe stunting (61.8%) over moderate stunting (38.2%) in this study reflects a considerable degree of severity within the study area. Severe stunting is typically shaped by the interaction of multiple factors, including inadequate caregiving practices, limited access to health services, low dietary diversity, and poor environmental sanitation (Nurbaiti et al., 2024; Samosir et al., 2023). A stunting risk-detection application incorporating nutrition and sanitation indicators, developed in Bogor, West Java, similarly confirmed that the combination of nutritional and household sanitation factors accurately predicts stunting risk (sensitivity 88.3%, specificity 83.3%) (Permatasari et al., 2025), reinforcing the argument that knowledge-based intervention alone is insufficient without concurrent improvements in sanitation access and dietary quality.

The Relationship between Maternal Knowledge and Stunting Incidence

The Spearman's rho test in this study revealed a significant and strong relationship ($r = 0.553$; $p = 0.001$) between maternal knowledge of dietary patterns and

stunting incidence. This finding is consistent with the study by (Fitri & Nursia, 2022) in Arongan Village, which concluded that a significant relationship exists between maternal nutrition knowledge and stunting incidence. It is further corroborated by a study in Pandeglang Regency, which found a 12.9-fold higher risk of poor nutritional status among children under five whose mothers had inadequate knowledge of feeding practices (Irianti et al., 2023).

This finding also aligns with international evidence. A nationally representative study in Rwanda found that low maternal knowledge increased the odds of inadequate feeding practices by 2.43-fold (AOR = 2.43; 95% CI 1.81–3.27) (Mporanyi et al., 2025). A study in Pakistan confirmed that maternal nutritional literacy significantly contributes to growth outcomes among children aged 6–23 months (Tahreem et al., 2025), while a recent machine learning-based study demonstrated that socioeconomic status moderates the relationship between maternal nutrition knowledge and children's nutritional status (Alistina et al., 2021).

It should be emphasised that maternal knowledge is not a singular or direct risk factor, but rather functions as a proximal determinant shaping the quality of decisions related to feeding and child

healthcare (Fitri & Nursia, 2022). Several studies have similarly found that good knowledge does not automatically translate into optimal feeding practices unless accompanied by adequate economic resources, access to nutritious food, and adequate environmental sanitation (Batool et al., 2023; Mporanyi et al., 2025). Based on the researchers' field observations, maternal knowledge gaps in Medan Marelan Subdistrict were most pronounced with respect to feeding schedules, food types, and age-appropriate portion sizes, which are likely shaped by economic constraints, sociocultural background, and maternal education level (Ampow et al., 2025; Hardjito, 2024).

Practical Implications

These findings support the urgency of community-based nutrition education programmes targeting mothers with poor dietary knowledge in Medan Marelan Subdistrict, particularly within the Terjun and Rengas Pulau catchment areas. Such programmes should be integrated with interventions to improve access to nutritious food and environmental sanitation, given that stunting results from multifactorial interactions that cannot be addressed through knowledge enhancement alone (Permatasari et al., 2025; Yani et al., 2023).

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design can only establish an association, not a causal relationship, between maternal knowledge and stunting incidence. Second, the small sample size ($n = 34$), limited to a single subdistrict, restricts the generalisability of the findings to broader populations. Third, maternal knowledge was measured through self-reported questionnaire interviews, which may be subject to recall bias and social desirability bias. Fourth, the categorisation of knowledge levels (good/moderate/poor) was not accompanied by explicit reporting of construct validity and instrument reliability testing (e.g., Cronbach's alpha). Fifth, this study did not control for potential confounding variables such as household socioeconomic status, sanitation access, recurrent infection history, and caregiving patterns, all of which have been shown in the international literature to contribute to stunting incidence (Batool et al., 2023; Yani et al., 2023). Future research employing a longitudinal design, a larger and more representative sample, and multivariable analysis controlling for confounding variables is recommended to strengthen the evidence base for causal inference.

Conclusions

Based on the univariate and bivariate analyses, it is concluded that a significant and strong relationship exists between maternal knowledge of dietary patterns and stunting incidence among children under five in Medan Marelan Subdistrict ($r = 0.553$; $p = 0.001$). The lower the maternal knowledge of dietary patterns, the greater the severity of stunting experienced by the child.

It is recommended that the Medan City Health Office, together with the Terjun and Rengas Pulau community health centres, prioritise community-based nutrition education programmes targeting mothers with poor dietary knowledge, integrated with improvements in access to nutritious food and environmental sanitation. For future researchers, a longitudinal or case-control design, a larger and statistically representative sample size, and multivariable analysis controlling for confounding variables such as socioeconomic status and sanitation are recommended to strengthen causal evidence and the generalisability of findings.

Declarations

Ethics Approval: This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, under

approval

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