



CORRELATION BETWEEN PROTEIN INTAKE IN CHILDREN AGED 6-12 MONTHS AND PREVALENCE OF STUNTING: A LITERATURE REVIEW

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Article info	ABSTRACT
<p>Corresponding Author:</p> <p>Fatatul Anafah fatatulanafah@gmail.com Faculty of Public Health, University of Kediri</p>	<p>Stunting is a significant public health issue characterized by chronic malnutrition, particularly during the first 1,000 days of life. This literature review investigates the correlation between protein intake in children aged 6–12 months and the prevalence of stunting. Utilizing a systematic review method following the PRISMA protocol, eight relevant articles published between 2020 and 2025 were analyzed. Findings consistently show that stunted children have lower overall protein and essential amino acid intake, particularly from animal sources, compared to their non-stunted peers. Inadequate dietary diversity, low family income, maternal education, and poor breastfeeding and complementary feeding practices emerged as key contributing factors to stunting. Despite abundant protein resources in some regions, cultural practices and limited nutritional knowledge often hinder adequate protein consumption. This review highlights the critical role of protein, especially animal-based protein, in preventing stunting and underscores the need for integrated strategies to improve dietary intake and socioeconomic conditions among vulnerable populations.</p> <p>Keywords: <i>protein intake, stunting, children 6–12 months, dietary diversity, essential amino acids</i></p>
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INTRODUCTION

Stunting is a chronic nutritional problem caused by the lack of nutritional intake over a long period of time and the provision of food with inadequate nutrition. (1) Indonesia is one of the countries with a high burden of malnutrition, including stunting. Child health outcomes are poor, even though the Indonesian economy is the largest in Southeast Asia and the 17th largest in the world (2). Stunting describes chronic nutritional deficiency that occurs during critical periods of life, from pregnancy to the first two years of a child's life. This condition can cause permanent physical and cognitive developmental disorders and has the potential to increase the risk of metabolic diseases such as insulin resistance and cardiovascular disease in adulthood. (3)

The first 1,000 days of life, or the period from conception to a child's second birthday, represents a critical window for optimal growth and development. During this

time, rapid physical, psychomotor, mental, and social development occurs, necessitating balanced and adequate nutritional intake. Failure to meet nutritional needs during this period can lead to various nutritional problems, including growth retardation. (4)

According to the 2024 Indonesian Nutritional Status Survey, the prevalence of stunting in Indonesia is still at 19.8% (3), although this figure has decreased from the results of the Indonesian Health Survey where the prevalence of stunting reached 21.5%. (5) According to Anthropometric Standards for Assessing Children's Nutritional Status, the definition of short (stunting) and very short (severely stunted) is nutritional status based on the index of Body Length for Age (BL/A) or Height for Age (H/U) and then compared with the result, when compared with the WHO-MGRS standard (Multicenter Growth Reference Study) in 2005, is at z-score value less than -2SD and is categorized as very short if the z score is less than -3SD (6)

There are several studies that have examined factors associated with child stunting including intake of protein. However, there is a need for studies that further investigate how the protein affects stunting. This study aims to determine the extent of the relationship between protein intake in children aged 6-12 months and the prevalence of stunting.

METHOD

Study Design and Search:

This study used a Systematic Literature Study design from several selected materials using the PRISMA protocol method. The 13 study materials taken were obtained publications from PubMed, Google Scholar and Science Direct which were searched from January 1, 2020, to Januari 1, 2025. The keywords used to search for articles were 'stunting, protein intake and children 6-12 months'.

Selection Criteria:

The selected articles were only those written in English and available in full text from 2020 to 2025. There were no restrictions on the choice of study design. Excluded from the selection were articles in the form of a thesis, guidelines, multiple articles and inappropriate keywords.

Data Collection Techniques:

The standard protocol used to select articles uses PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyses). 9.271 articles were identified and further screened for appropriate Titles and Abstracts. The next step was to establish the relevance of the article and whether the article was full text. This process resulted in 274 articles that were excluded from the screening process. The final screening process by reading the articles left 8 suitable articles.

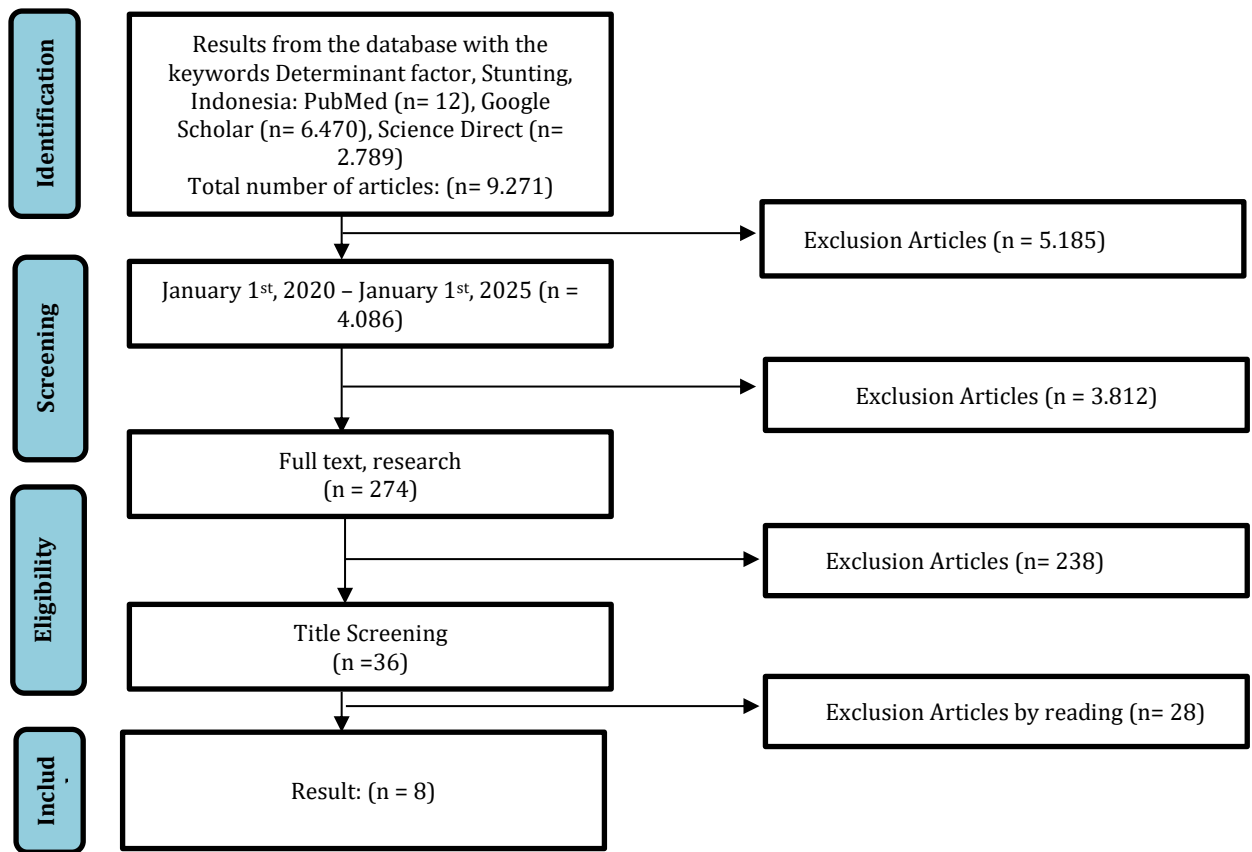


Figure 1. Data Extraction with PRISMA Protocol

RESULT AND DISCUSSION

Finding

No	Title	Methods Used	Population Sample	Conclusions	Results
1	Protein Intake, Dietary Diversity, and Length-for-Age Nutritional Status Among Children Aged 6-23 Months A Comprehensive Overview Study	<ul style="list-style-type: none"> - Descriptive quantitative study with cross-sectional design. - Involved 171 children aged 6-23 months. - Nutrient intake assessed via 24-hour food recall questionnaire. - Dietary diversity evaluated using Minimum Dietary Diversity for Children questionnaire. 	<ul style="list-style-type: none"> - The study population consisted of 1,027 children aged 6-23 months. - A total sample of 171 children was selected. - Multistage simple random sampling technique was used for selection. 	<ul style="list-style-type: none"> - The study describes protein intake and dietary diversity among children aged 6-23 months. - Stunted children have lower animal protein intake than non-stunted children. - Dietary diversity levels are lower among stunted children. 	<ul style="list-style-type: none"> - Majority of mothers are housewives living below minimum wage. - Most toddlers are aged 12-23 months with normal birth weight. - Daily animal protein intake is lower in stunted children. - Dietary diversity levels are lower among stunted children.

No	Title	Methods Used	Population Sample	Conclusions	Results
2	Low intake of essential amino acids and other risk factors of stunting among under-five children in Malang City, East Java, Indonesia (7)	<ul style="list-style-type: none"> - A descriptive, case-control study was performed. - Subjects were children aged 24–59 months. - Analyzed using multiple logistic regression. 	<ul style="list-style-type: none"> - The study involved a case-control design at a Health Center in Malang. - The sample size 80 children - A structured questionnaire was administered to mothers or primary caretakers. 	<ul style="list-style-type: none"> - Stunted children had a lower intake of nine essential amino acids than non-stunted children. - Risk factors for stunting include low family income and inadequate breast feeding. - Inadequate dietary diversity predicts stunting in children. 	<ul style="list-style-type: none"> - Stunted children had a lower intake of nine essential amino acids (EAAs). - Significant differences in histidine, isoleucine, and methionine were observed. - Low family income and underweight were risk factors for stunting. - High protein intake was noted despite low energy and carbohydrate intake.
3	Nutritional Intake Differences of Children Aged 6-23 Months in Coastal and Non-Coastal Stunting Areas.pdf	<ul style="list-style-type: none"> - Subjects aged 6-23 months were selected for dietary analysis. - Nutritional intake was assessed using a 24-hour dietary recall method. - Food diversity was analyzed based on various food categories. - A quantitative cross-sectional study design was employed. 	<ul style="list-style-type: none"> - The sample size included 65 coastal and 66 non-coastal toddlers. - Subjects were aged 6-23 months and physically healthy. - The study used a quantitative cross-sectional design. 	<ul style="list-style-type: none"> - Most children aged 6-23 months had sufficient nutrient intake in both areas. - Significant differences in energy and carbohydrate intake were observed between regions. - Future research should analyze nutrient intake causality and nutritional problems. - Stunting remains a health concern in developing countries. 	<ul style="list-style-type: none"> - Most children aged 6-23 months had sufficient nutrient intake in both regions. - Malnutrition prevalence was 7.6% in non-coastal and 26.2% in coastal areas. - Stunting prevalence was 21.2% in non-coastal areas and 18.4% in coastal areas. - Future research will analyze nutrient intake causality and nutritional problems.

No	Title	Methods Used	Population Sample	Conclusions	Results
4	Dietary intake and stunting in children aged 6-23 months in rural Sumba, Indonesia (8)	<ul style="list-style-type: none"> - A case-control study was conducted in Southwest Sumba, Indonesia. - 370 children and mothers were interviewed from February to August 2019. - Dietary intake was compared using length-for-age z-scores. - Nutritional intake was assessed using 24-hour food recall method. - Logistic regression analyzed nutrient intake sufficient and stunting associations. 	<ul style="list-style-type: none"> - The sample size was 370 children and their biological mothers. - Participants were selected from a nutrition clinic and health service posts. - A case-control study design was utilized for sampling. 	<ul style="list-style-type: none"> - Most children aged 6-23 months lacked sufficient nutrient intake. - Stunted children had significantly lower protein intake than non-stunted children. - Sufficient nutrient intake is essential for childhood growth and health. - Further studies are needed to assess nutrient intake effects on growth. 	<ul style="list-style-type: none"> - The study included 200 children, split into stunted and non-stunted groups. - Stunted children had lower protein intake compared to non-stunted children. - Only 6% of stunted children had adequate food diversity. - Maternal education and income were lower in the stunted group. - Breastmilk significantly increased total energy and nutrient intake.
5	Gambaran Keragaman Makanan Dan Sumbangannya Terhadap Konsumsi Energi Protein Pada Anak Balita Pendek (Stunting) Di Indonesia.(9)	<ul style="list-style-type: none"> - The study used descriptive analytical design with secondary data from Riskesdas 2010. - Data collection involved a 24-hour food recall method. - Chi-square tests and ANOVA were employed for data analysis. - Food diversity and nutrient contribution were assessed among children under five. 	<ul style="list-style-type: none"> - The sample size is 6,796 children aged 24-59 months. - Data collected from Riskesdas 2010 using a 24-hour recall method. - The analysis included children with complete nutritional status and consumption data. 	<ul style="list-style-type: none"> - Stunting prevalence among children aged 24-59 months is 21.0%. - Food diversity impacts energy and protein intake in stunted children. - Older children show lower stunting rates compared to younger ones. - The study utilized Riskesdas 2010 data for analysis. 	<ul style="list-style-type: none"> - 21.0% of children aged 24-59 months are stunted or very short. - Shortest children are primarily in the 24-35-month age group. - Food consumption diversity is higher in normal toddlers than stunted ones. - The study used data from the 2010 Riskesdas survey.

No	Title	Methods Used	Population Sample	Conclusions	Results
6	Daily Protein Intake among Stunted Toddlers in Cimahi, Indonesia.(1)	<ul style="list-style-type: none"> - A cross-sectional design was employed for the research. - The population included 172 stunted toddlers aged 12-59 months. - Data collection occurred from March to April 22019. - Dietary intake was assessed using a two-day 24-hour food recall and FFQ. - The total subjects were determined to be 64 stunted toddlers . 	<ul style="list-style-type: none"> - The population sample size was 172 stunted toddlers aged 12-59 months. - The sampling method used was cross-sectional design . - A total of 64 stunted toddlers were assessed for dietary intake . 	<ul style="list-style-type: none"> - Stunted children aged 1-3 years had a protein intake of 18.9 g/day. - Children aged 4-5 years had a protein intake of 20.0 g/day. - Both groups did not meet recommended protein intake levels. - Eggs were the most frequently consumed animal protein source. 	<ul style="list-style-type: none"> - Stunted children aged 1-3 years had a protein intake of 18.9 g/day. - Stunted children aged 4-5 years had a protein intake of 20.0 g/day. - Most stunted children were boys (69%) asource.3 years (72%). - Protein intake was primarily from animal sources for both age groups. - The prevalence of stunting in Cimahi Village was 25.8% .
7	Correlation Between Diet History and Nutritional Status of Children Aged 24–59 Months in Tarumajaya, Bekasi in 2019.(10)	<ul style="list-style-type: none"> - Height measured using Microtoise Stature Meter with standardized techniques. - Data collected through questionnaires on breastfeeding and dietary practices. - Minimum Dietary Diversity assessed with 7 standard food groups. - Sample size determined using Lemeshow formulation, totaling 96 children. - Data analyzed using Fisher's exact test. 	<ul style="list-style-type: none"> - The sample size was 96 children aged 24-59 months. - Cluster sampling technique was used in four villages. - Inclusion criteria included children without disorders and willing guardians. 	<ul style="list-style-type: none"> - Five out of six children lack a minimum acceptable diet. - Dietary diversity significantly affects stunting in children. - Nutrition is not the sole factor affecting child growth. - The study has limitations due to reliance on respondents' memory. 	<ul style="list-style-type: none"> - 16.7% of children were found to be stunted. - 83.3% received exclusive breast feeding. - 53.1% met the minimum meal frequency. - 81.3% achieved minimum dietary diversity. - 30.2% had a minimum acceptable diet. - Dietary diversity significantly affected stunting ($p < 0.001$).

No	Title	Methods Used	Population Sample	Conclusions	Results
8	Energy and Protein Intake-Related Risks Affected the Occurrence of Stunting Among Young Children.(11)	<ul style="list-style-type: none"> - The study employed a quantitative cross-sectional design with 96 mothers as subjects. - Purposive sampling technique was used for selecting participants. - Inclusion criteria included mothers with toddlers aged 6-59 months. - Data collection occurred in the Sungai Alang Health Center area. - Stunting was categorized based on WHO anthropometric standards. 	<ul style="list-style-type: none"> - The population size is 96 mothers with toddlers. - The sampling method used is purposive sampling. - The initial number of mothers considered was 127. - Inclusion criteria included mothers living in the riverbank area. 	<ul style="list-style-type: none"> - Energy intake significantly influences stunted toddlers' risk levels. - Further research is needed on complementary feeding and maternal knowledge. - Retrospective examination of maternal nutrition during pregnancy is essential. - Stunting persists despite high fish production in the area. 	<ul style="list-style-type: none"> - High prevalence of stunting among toddlers despite protein-rich diets. - Energy intake below adequacy increases stunting risk by 9.133 times. - Low birth weight and lack of exclusive breastfeeding are significant factors. - Family income and education levels correlate with stunting incidence. - Majority of stunted toddlers had poor protein intake.

Discussion

From the results of research by Hermina et al, Food consumption was normal toddlers (24-59 months) is more diverse than short toddlers. The diversity of these foods is approached with the hope of food pattern score (PPH), which is normal toddlers' PPH score at 96.6, while among short toddlers at 88,4. Significantly shorter toddlers who suffered a deficit of energy and protein compared with normal toddlers ($P = 0.000$). (9) The protein intake of stunted children aged 1–3 years was 18.9 g/day, and that of children aged 4–5 years was 20.0 g/day. The findings show that the two groups did not achieve the recommended levels of daily protein intake. Adequate protein is mostly met from animal protein sources. Eggs were the source of animal protein that the two groups most frequently consume. (1)

Some reviewed literatures indicate that EAA plays a crucial role in multiple growth pathways. Several studies have demonstrated notable distinctions between the EAA profiles of typically developing children and those who are stunted. EAA can be obtained from both plants (in lower bioavailability compared to animal proteins) and animal proteins, such as milk, eggs, and fish. Although both plant and animal proteins have the potential to reduce stunting in developing countries, however, in this review, we will focus exclusively on animal proteins. (12)

Stunted children had a lower intake of nine essential amino acids than non-stunted children. Risk factors for stunting include low family income and inadequate breastfeeding and inadequate dietary diversity predicts stunting in children. (7)

CONCLUSION

Protein Intake and Stunting: Stunted children generally have lower protein intake compared to non-stunted children. Animal protein, which contains essential amino acids, is particularly important for growth, and its deficiency is linked to higher stunting rates (4,7,13). **Dietary Diversity:** Inadequate dietary diversity is a strong predictor of stunting. Children with a more varied diet, including animal source foods, are less likely to be stunted (1,8,10). **Socioeconomic Factors:** Low family income and educational levels are significant risk factors for stunting. Families with higher incomes and better education levels tend to provide more adequate nutrition, reducing stunting risk (8,11). **Breastfeeding and Complementary Feeding:** Exclusive breastfeeding for less than six months and inadequate complementary feeding practices are associated with increased stunting risk. Proper breastfeeding and age-appropriate complementary feeding are crucial for preventing stunting(8,11). **Geographical and Cultural Influences:** Regions with abundant fish resources, like coastal areas, should theoretically have lower stunting rates due to protein availability. However, cultural practices and food preferences can affect actual consumption patterns, impacting stunting prevalence (1,11). **Nutritional Knowledge and Practices:** Parental nutritional knowledge and practices significantly influence children's dietary intake and stunting outcomes. Educating parents on nutrition can help mitigate stunting (11). These findings highlight the multifaceted nature of stunting, involving nutritional, socioeconomic, and cultural factors. Addressing stunting requires comprehensive strategies that improve dietary diversity, protein intake, and socioeconomic conditions.

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