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HISTORY OF PROTEIN INTAKE AS RISK FACTOR FOR STUNTING AMONG TODDLERS IN THE SERVICE AREA OF THE KEANG COMMUNITY HEALTH CENTER

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ABSTRACT

Stunting is a critical global issue. Stunting increases vulnerability to disease and death, impairs brain development, and slows motor and mental development. One of the causes of stunting is inadequate protein intake, as protein plays a role in the production of Insulin-like Growth Factor (IGF)-1, which is essential for bone development and enhances children's growth rates. This study aims to determine the history of protein intake as a risk factor for stunting in toddlers aged 24–59 months in the service area of the Keang Community Health Center. This is a quantitative case-control study with a population of 246 toddlers. The sample consisted of 64 toddlers, comprising 32 toddlers with stunting as the case group and 32 toddlers with normal nutritional status as the control group. The instruments used to collect data included a microtoise, a questionnaire, and the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). Nutritional status data were grouped into two categories: stunting, defined as a z-score between -3 SD and < -2 SD; and normal, defined as a z-score between -2 SD and +3 SD. Meanwhile, protein intake history was categorized as adequate if intake was ≥40% of the RDA and inadequate if intake was <40% of the RDA. The data were analyzed using the chi-square test and odds ratio. The study results showed a p-value of 0.001 < 0.05 and a crude OR (95% CI) of 11.88 (3.535–39.925), indicating that toddlers with a history of inadequate protein intake are at a higher risk of stunting. The crude OR value of 11.88 indicates that toddlers with inadequate protein intake have significantly higher odds of experiencing stunting compared to toddlers with adequate intake. It is therefore concluded that a history of inadequate protein intake is a risk factor for stunting among toddlers aged 24–59 months in the service area of the Keang Community Health Center.

Kata Kunci:
Asupan;
Protein;
Stunting

ABSTRAK

Stunting menjadi masalah yang sangat penting di tingkat global. Stunting meningkatkan kerentanan terhadap penyakit dan kematian, mengganggu perkembangan otak, memperlambat perkembangan motorik, dan mental. Stunting salah satunya dapat disebabkan oleh asupan protein yang kurang karena protein berperan dalam produksi Insulin-like Growth Factor (IGF)-1, yang esensial untuk perkembangan tulang, dan meningkatkan laju pertumbuhan anak. Penelitian ini bertujuan mengetahui riwayat asupan protein sebagai faktor risiko stunting pada balita usia 24-59 bulan di wilayah kerja Puskesmas Keang. Jenis penelitian kuantitatif dengan desain case control dengan populasi 246 balita. Sampel sebanyak 64 balita, terdiri dari 32 balita berstatus gizi stunting sebagai kelompok kasus dan 32 balita normal sebagai kelompok kontrol. Instrumen yang digunakan dalam mengumpulkan data yaitu microtoice, kuesioner dan form Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). Data status gizi dikelompokkan 2 kategori yaitu stunting jika z skor -3SD sd <-2SD dan normal jika z skor -2SD sd +3SD. Sedangkan riwayat asupan protein dikategorikan cukup jika asupan ≥40% dari AKG dan kurang jika asupan <40% dari AKG. Data dianalisis menggunakan uji chi-square dan odds ratio. Hasil penelitian menunjukkan nilai p-value 0.001< 0.05 dan crude OR (95% CI) sebesar 11,88 (3,535 – 39,925), hal ini berarti bahwa balita dengan riwayat asupan protein yang kurang merupakan faktor risiko terhadap kejadian stunting. Nilai crude OR 11.88 mengindikasikan bahwa balita dengan asupan protein yang kurang memiliki odds yang secara signifikan lebih tinggi untuk mengalami stunting dibandingkan balita yang memiliki asupan yang cukup. Sehingga disimpulkan bahwa riwayat asupan protein merupakan faktor risiko stunting pada balita usia 24-59 bulan di wilayah kerja Puskesmas Keang.

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INTRODUCTION

Adequate nutrition is key to improving the quality of human resources. Adequate nutrition is fundamental to human capital development because it supports optimal brain development, cognitive function, educational achievement, and future workforce productivity (Behrman et al., 2020; Ottolini et al., 2020). Although significant progress has been made over the past few decades, one of the most serious nutrition-related problems facing Indonesia is child stunting (UNICEF Indonesia, 2024). Stunting is a serious health concern that increases the likelihood of developing various diseases, impairs both brain and motor skill development, and reduces overall intellectual capacity. This condition presents a significant challenge worldwide, prompting international efforts to address it through various initiatives. The Sustainable Development Goals (SDGs) and the Global Nutrition Goals have prioritized the reduction of stunting, with ambitious targets such as eliminating malnutrition by 2030 and decreasing the number of children under five who are stunted by 40% by 2025. These efforts are essential to improving long-term health and development outcomes for vulnerable populations (Sekretariat Wakil Presiden Republik Indonesia, 2019).

The World Health Organization (2021) reported that in 2020, global stunting rates impacted approximately 22% of children worldwide. Based on the Indonesian Health Survey (Kemenkes Republik Indonesia, 2023b), 21.5% of children under five experience stunting, with 5.7% suffering from severe stunting and 15.8% from moderate stunting, highlighting significant child health concerns in the country. Meanwhile, in West Sulawesi in 2023, the prevalence of stunting was recorded at 30.4%. Data obtained from the Dinas Kesehatan Kabupaten Mamuju (2024) indicate that the prevalence of stunting in Mamuju Regency reached 30.9% of the total target population of 22,586 toddlers. This rate remains high when compared to the WHO's guideline for stunting prevalence, which is set at below 20%.

Among the factors influencing the incidence of stunting in toddlers is nutritional intake (Nurdiansyah et al., 2024). Therefore, the food consumed by toddlers requires special attention, particularly protein intake, which supports height growth as well as brain development and intelligence. Protein deficiency can hinder a child's growth, preventing toddlers from reaching their maximum height potential (Septinova et al., 2023). A lack of protein intake can reduce IGF-1 production, which may hinder bone growth and development, potentially leading to delayed growth and weaker skeletal development (Sari et al., 2016). Achieving optimal growth depends on consuming complete, easily digestible proteins that contain all essential amino acids necessary for proper development and health (Hardinsyah & Supariasa, 2017).

A study conducted by Fikawati et al., (2021) indicates that toddlers experiencing stunting in Jember have considerably lower protein consumption than their non-stunted counterparts, highlighting the importance of adequate nutrition for healthy growth and development. Puentes et al., (2016) reported that consuming adequate amounts of protein plays a crucial role in supporting height growth among children aged 6 to 24 months in Guatemala and the Philippines, highlighting the importance of proper nutrition during this vital developmental stage. A study by Maulidiana & Sutjiati (2021) showed that insufficient consumption of essential amino acids and poor protein quality contribute to stunting among children under five in Malang City. These stunted children tend to have lower amino acid intake, which hampers their growth and development. However, a different study conducted in Bantul revealed that overall protein intake did not significantly influence the risk of stunting in children aged 6 to 23 months. This suggests that factors such as amino acid quality and specific nutrient deficiencies may play a more crucial role in early childhood growth than total protein consumption alone (Rahmaniah et al., 2014).

A preliminary investigation conducted at Keang Community Health Center has revealed a notably high prevalence of stunting among young children in the area. This issue continues to be a significant concern, prompting the need for focused interventions to address the underlying causes. During the study, it was observed that many toddlers are not receiving adequate amounts of protein in their diets, which could be a contributing factor to their growth deficiencies. Despite this, research exploring the direct connection between protein intake and stunting remains limited, highlighting a gap in current knowledge. The primary objective of this study is to analyze the role of protein consumption as a potential risk factor for stunting in children aged 24 to 59 months. The findings aim to inform more effective, targeted strategies to combat stunting within this vulnerable age group.

METHOD

Type of Research

This research employed a quantitative, observational, case-control methodology to investigate the association between protein intake and the nutritional status of toddlers. The study involved two distinct groups: children diagnosed with stunting and those exhibiting normal growth patterns, as determined by the World Health Organization's height-for-age criteria. The primary independent variable was the toddlers' protein consumption history over the previous three months, which was classified into two categories: adequate intake and inadequate intake. The dependent variable was the nutritional status of the children, categorized as either stunted or normal, based on their z-scores. The main objective of the study was to explore potential correlations between the level of protein consumption and the occurrence of stunting among young children. By comparing the two groups, the research aimed to determine whether insufficient protein intake is significantly associated with growth retardation, thereby providing insights into the role of dietary protein in early childhood development and nutritional well-being.

Place and Time of Research

This study was conducted in the service area of the Keang Community Health Center, Mamuju Regency, from January to May 2026.

Population and Sample

The research study encompassed a total of 246 young children aged between 24 and 59 months who were recruited from the Keang Community Health Center. The sample size of 64 participants was calculated using Lemeshow's formula, which is suitable for comparing two proportions. The participants were evenly divided into two groups: 32 toddlers with stunted growth, serving as the cases, and 32 toddlers with normal nutritional status, serving as the controls. Selection was carried out through cluster sampling based on village location to ensure representativeness. Keang Village, which had a total of 198 toddlers, contributed 52 children to the study, while Uhaimate Village, with a total of 48 toddlers, contributed 12 children. Within each village, cases were identified—specifically, 26 in Keang and 6 in Uhaimate—based on their nutritional assessments. Controls were then selected from children residing near the identified cases to minimize environmental and dietary confounding factors. Additionally, a retrospective review of the participants' dietary histories was conducted, focusing particularly on their protein intake. This review aimed to analyze the potential relationship between protein consumption and stunting, providing insights into nutritional influences on growth among toddlers in these rural communities. The study design ensured a balanced comparison between stunted and normally nourished children, facilitating a comprehensive understanding of the nutritional factors involved.

Data Collection

Primary research data, including respondent characteristics, toddler characteristics, and data on the history of protein intake and the nutritional status of toddlers, were collected using questionnaires and semi-quantitative food frequency questionnaires through interviews. Meanwhile, secondary data, consisting of information obtained from the Keang Community Health Center regarding the number of toddlers and the nutritional status of toddlers aged 24–59 months, were obtained from existing nutritional reports at the Community Health Center. Nutritional status data were obtained by measuring height using a microtoise; measurements were taken repeatedly and then averaged to determine the toddlers' height. Variables related to the toddlers' age, as well as characteristics of the toddlers and respondents, were obtained through interviews using a questionnaire. Meanwhile, data on protein intake history were collected using the SQ-FFQ form covering the past 3 months. The foods asked about included food types, consumption amounts (household measures and grams), and frequency of consumption. The food types covered staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits, as well as beverages/snacks and supplements.

Data Analysis and Processing

Data analysis was divided into two categories: univariate analysis and bivariate analysis. Univariate analysis aimed to provide an overview of toddler characteristics such as gender, age, birth weight, birth

length, protein intake, and characteristics of the mothers of toddlers, including age and the highest level of education.

Bivariate analysis is a statistical method used to explore the association between two variables, typically one independent and one dependent. When both variables are categorical, the chi-square test is commonly employed to assess whether a significant relationship exists. In cases where the data are organized in a 2×2 contingency table, particular attention is given to the expected cell counts; if any cell has an expected frequency less than 5, Fisher's exact test is used to provide a more accurate result. Otherwise, a continuity correction may be applied to the chi-square test to improve its accuracy. The significance of the findings is determined by comparing the p-value to a predetermined threshold, often set at 0.05; if the p-value falls below this level, the association is considered statistically significant. Additionally, the odds ratio is calculated to measure the strength and direction of the relationship, indicating the level of risk associated with the independent variable. Ethical approval for the study was granted by the Indonesian Association of Public Health Professionals, and informed consent was obtained from all participants to ensure ethical standards were maintained.

RESULT

Univariate Analysis: Characteristics of Toddlers

The study sample consisted of 64 toddlers, divided into 32 toddlers in the case group (stunting) and 32 toddlers in the control group (normal nutritional status). The characteristics of the toddlers, including age, sex, birth weight, and birth length, are as follows:

Table 1 Frequency Distribution of Toddler Characteristics (n=64)

Characteristics Toddlers	Nutritional Status (Height for Age)			
	Stunting		Normal	
	n	%	n	%
Age				
24-47 Months	20	62.5	22	68.7
48-59 Months	12	37.5	10	31.3
Gender				
Female	16	50.0	19	59.4
Male	16	50.0	13	40.6
Birth Weight				
Low	2	6.2	1	3.1
Normal	30	93.8	31	96.9
Birth Length				
Low	0	0.0	1	3.1
Normal	32	100	31	96.9

Based on Table 1, the case group (stunting) was found to consist mostly of toddlers aged 24–47 months (62.5%); the gender distribution in the case group was balanced, with 50.0% female and 50.0% male; birth weight was mostly normal (93.8%); and birth length was normal for all toddlers. Meanwhile, in the control group (normal), the majority of toddlers were aged 24–47 months, totaling 22 toddlers (68.7%), and the majority were female, accounting for 59.4%. Birth weight in the control group was mostly normal (96.9%), as was birth length (96.9%).

Univariate Analysis: Respondent Characteristics

The group identified with stunting mainly consisted of mothers aged between 30 and 39 years who generally had lower levels of education and were primarily homemakers. In contrast, the normal group was predominantly made up of younger mothers aged 20 to 29 years, most of whom possessed secondary education and were also mainly homemakers. These differences suggest that age and educational background may play a role in the nutritional status of the children. Understanding these demographic variations can help tailor intervention programs more effectively.

Table 2 Frequency Distribution of Respondent Characteristics (n=64)

Characteristics	Nutritional Status (Height for Age)			
	Stunting		Normal	
	n	%	n	%
Mother's Age				
20-29 years	13	40.6	20	62.5
30-39 years	16	50.0	11	34.4
40-49 years	3	9.4	1	3.1
Mother's Highest Level of Education				
No Schooling	1	3.1	0	0
Elementary	19	59.4	12	37.5
Secondary	11	34.4	14	43.8
High	1	3.1	6	18.7
Mother's Occupation				
Housewife	31	96.9	26	81.3
Contract Worker	1	3.1	5	15.6
Civil Servant	0	0.0	1	3.1

Protein Intake Distribution

Table 3 Frequency Distribution of Protein Intake Among Toddlers Aged 24–59 Months by Type, Frequency, and Amount (grams/day) (n=64)

Food Type	Nutritional Status (Height for Age)			
	Stunting		Normal	
	Average Frequency (Per Day)	Average Daily Weight (grams)	Average Frequency (Per Day)	Average Daily Weight (grams)
Animal Protein				
Chicken eggs	0.47	22.23	0.47	25.20
Saltwater Fish	0.40	9.60	0.44	14.32
Freshwater Fish	0.33	6.86	0.30	10.41
Shrimp	0.05	1.85	0.075	2.2
Squid	0.05	0.81	0.05	1.90
Duck Eggs	0,09	4.73	0.03	1.57
Chicken	0.09	3.75	0.08	3.73
Goat Meat	0.0	0.0	0.015	0.375
Beef	0.01	0.03	0.01	0.29
Plant Based Protein				
Tofu	0.37	9.37	0.50	10.90
Tempeh	0.29	9.75	0.48	14.27
Peanuts	0.05	0.59	0.14	4.0
Green Beans	0.01	0.16	0.03	0.5

Table 3 shows that toddlers consumed a variety of foods derived from both animal and plant-based proteins.

Bivariate Analysis

A history of protein intake is associated with the risk of stunting in toddlers aged 24 to 59 months. Table 4 shows that 68.8% of toddlers in the stunting group had insufficient protein intake, compared to 15.6% in the normal group. Statistical analysis using the chi-square test revealed that protein intake was significantly associated with stunting, with a p-value of 0.001. Additionally, the odds ratio of 11.88 suggests that children with inadequate protein consumption had nearly twelve times higher odds of experiencing stunting than those receiving sufficient protein. This highlights the critical importance of adequate nutrition for proper growth and development

Table 4 History of Protein Intake as a Risk Factor for Stunting in Toddlers Aged 24–59 Months (n=64)

Protein Intake	Nutritional Status (Height for Age)				OR (95% CI)	P value
	Stunting		Normal			
	n	%	n	%		
Insufficient	22	68.8	5	15.6	11.88	0.001
Adequate	10	31.2	27	84.4	(3.535 – 39.925)	
Total	32	100	32	100		

DISCUSSION

Bivariate analysis demonstrated a significant association between protein consumption and the occurrence of stunting in children aged 24 to 59 months attending Keang Community Health Center, with a p-value of 0.001. The crude odds ratio was calculated at 11.88, with a 95% confidence interval ranging from 3.535 to 39.925. This finding suggests that children with insufficient protein intake had approximately 12 times higher odds of experiencing stunting compared to those with adequate protein consumption. Nonetheless, the broad confidence interval indicates a degree of uncertainty in the estimate, likely attributable to the limited sample size, particularly among the subgroup of toddlers who had inadequate protein intake but maintained normal nutritional status. To obtain more precise and reliable data, larger-scale studies are necessary. Such research would help clarify the strength of the association between protein intake and stunting, providing a stronger basis for public health interventions aimed at improving nutritional outcomes among young children.

These findings are supported by Puentes et al. (2016), who studied the impact of protein intake on height development in children aged 6-24 months in Guatemala and the Philippines and found that adequate protein intake played an important role in supporting height growth during this critical developmental period. Findings from Fikawati et al. (2021) in Jember revealed that toddlers with stunted growth consumed notably less protein compared to their non-stunted peers, highlighting a potential link between protein deficiency and growth impairment. The results of a study by Kundarwati et al. (2022) showed that children between the ages of 1 and 3 who did not get enough protein were five times more likely to suffer from stunted growth compared to their peers with adequate protein intake. Proper nutrition during this critical period is essential for healthy development and preventing long-term developmental issues. However, these results are inconsistent with the findings of Rahmaniah et al. (2014), whose research in Sedayu Bantul and coastal regions showed that insufficient protein consumption was not linked to stunting among children aged 6–23 months and 2–5 years. The study found no significant association between low protein intake and growth delays in these age groups, suggesting that other factors may play a more critical role in stunting within these communities (Leo et al., 2018). Findings by Insani (2026) also concluded that there is no association between protein intake and the incidence of stunting among toddlers aged 24–59 months in Bekanong Village. Based on the Kemenkes, children who receive adequate protein intake, particularly from animal protein sources, are effectively protected against stunting (Kemenkes Republik Indonesia, 2023a).

Low protein intake in toddlers may be linked to maternal education levels, as the data show that the majority of stunted children come from mothers who only completed elementary school. This is further supported by Pakpahan (2021), who notes that a mother's low level of education can impact child-rearing practices, including the selection and preparation of food provided to toddlers. Mothers with low educational attainment tend to have difficulty understanding nutritional information, resulting in suboptimal meal planning for toddlers and thereby increasing the risk of stunting.

Protein intake plays a crucial role in the growth process of toddlers. An overview of protein consumption patterns (animal and plant-based proteins) is shown in Table 3, which indicates that toddlers with stunting and those without stunting exhibit differences in protein consumption, both in terms of frequency and average daily intake. In the stunted group, the most frequently consumed type of animal protein was chicken eggs (0.47 times/day with an average of 22.23 grams/day), followed by saltwater fish (0.40 times/day; 9.60 grams/day) and freshwater fish (0.33 times/day; 6.86 grams/day). Consumption of meat (chicken, beef, goat) and other seafood (shrimp, squid) was relatively less frequent and in smaller amounts. Meanwhile, among toddlers with normal nutritional status, the pattern of animal protein consumption was also dominated by chicken eggs (0.47 times/day; 25.20 grams/day), saltwater fish (0.44 times/day; 14.32 grams/day), and freshwater fish (0.30 times/day; 10.41 grams/day).

It is known that toddlers in the group with normal nutritional status consumed higher amounts of saltwater fish, freshwater fish, and chicken eggs compared to the stunting group. Among plant-based protein sources, the stunting group consumed the most tofu (0.37 times/day; 9.37 grams/day) and tempeh (0.29 times/day; 9.75 grams/day). Among toddlers with normal nutritional status, the frequency of tofu consumption was higher (0.50 times/day; 10.90 grams/day) than that of tempeh (0.48 times/day; 14.27 grams/day). However, when looking at the average daily intake, tempeh intake was higher than that of tofu. Legume consumption in both groups was relatively low.

Toddlers experiencing normal growth tend to consume higher amounts of both animal and plant-based proteins compared to their stunted peers. This difference underscores the critical role of adequate protein intake in supporting healthy development and preventing growth deficiencies. Ensuring proper nutrition, especially sufficient protein, is vital for optimal childhood growth and development. The results of this study are also consistent with those of Haryani et al. (2023), who found that eggs, chicken, and catfish are the primary animal proteins consumed by toddlers. Research shows that children experiencing stunting tend to have lower average protein intake compared to well-nourished children, highlighting the importance of adequate protein consumption for healthy growth and development during early childhood.

Based on the interview results, several respondents also mentioned that their toddlers were picky eaters and preferred certain foods; for example, they did not like to eat fish, eggs, tempeh, tofu, or vegetables. The children were also rarely given meat because their families did not have enough money to buy it. Based on Nurhidayah (2022), toddlers who receive adequate protein intake typically consume eggs, chicken, and fish. Meanwhile, toddlers with poor nutritional status tend to consume foods such as tofu, tempeh, and vegetables, resulting in their protein needs not being met. Table 4 also shows that 31.2% of toddlers have adequate protein intake but still experience stunting; the researchers assume this may be influenced by other factors not examined in this study. A child's adequate protein intake can be influenced by many factors, one of which is the mother's role; if a child who is a picky eater is left unchecked, they may experience inadequate nutrient intake, which can hinder growth. Therefore, to prevent this, parents, especially mothers, need to be creative by serving a variety of foods and diversifying their children's diets, or by introducing new menu items to toddlers. However, it is possible that other factors not examined in this study also play a role as risk factors for stunting in toddlers.

CONCLUSION AND SUGGESTION

A history of inadequate protein intake is a risk factor for stunting in toddlers. Therefore, efforts to educate families about balanced nutrition are needed so that respondents provide food that meets their children's nutritional needs. Interview results indicate that families' financial constraints also pose a barrier to providing animal-based protein sources, such as meat. Consequently, efforts to prevent stunting require not only educating families about balanced nutrition but also considering their ability to afford and access nutritious protein sources. In this study, protein intake history was collected using the SQ-FFQ, so respondent recall bias may have occurred. Data analysis was also limited to bivariate tests; thus, the observed association may have been influenced by unmeasured or uncontrolled confounding factors. The researchers recommend that future studies increase the sample size and conduct multivariate analyses of variables suspected of acting as confounders.

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