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THE PROPORTION OF ANIMAL PROTEIN CONSUMPTION WITH A PREVALENCE OF STUNTING, WASTING, AND UNDERWEIGHT IN TODDLERS IN INDONESIA

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ABSTRACT

Background: *Stunting, wasting, and underweight are the main indicators of malnutrition that have a significant impact on children's growth and health. In Indonesia, the prevalence of these conditions is still high, especially in children under the age of two. One of the factors causing this nutritional problem is low consumption of animal protein. This study aims to analyze the relationship between the proportion of animal protein consumption and the prevalence of stunting, wasting, and underweight in children under the age of two in Indonesia using data from the 2023 Indonesian Health Survey (IHS).*
Method: *This study used a cross-sectional design with aggregate data from 38 provinces in Indonesia. Bivariate analysis used the Spearman correlation test.*
Result: *The results showed that the proportion of animal protein consumption was significantly associated with the prevalence of stunting (p-value 0.000), underweight (p-value 0.001), and wasting (p-value 0.003). The data showed that areas with higher animal protein consumption, such as Java and Bali, had a lower prevalence of nutritional problems compared to areas such as Nusa Tenggara and Papua.*
Conclusion: *This study concluded that there was a significant relationship between the proportion of animal protein consumption and the prevalence of stunting, wasting, and underweight in children under the age of two in Indonesia. Increasing access to animal protein consumption is an important step in reducing the prevalence of malnutrition among children. This study is expected to provide recommendations for more effective interventions in addressing nutritional problems in Indonesia.*
Keywords: *Animal Protein; Stunting; Wasting; Underweight*

INTRODUCTION

Stunting, wasting, and underweight are three main indicators of malnutrition that have a significant impact on children's growth and overall health. These three conditions often occur together and reflect the double burden of malnutrition, especially in developing countries. Stunting is characterized by a height that is lower than the standard for age due to chronic long-term malnutrition. Wasting refers to a body weight that is disproportionate to height, usually caused by short-term nutritional deficiencies or due to illness. Meanwhile, underweight describes a body weight that is not appropriate for a child's age, which can be an indication of chronic or acute malnutrition (Bahar et al., 2024).

According to UNICEF data in 2017, there were 92 million (13.5%) toddlers in the world who were underweight, 151 million (22%) toddlers experienced stunting, and 51 million (7.5%) toddlers experienced wasting. Most toddlers in the world who experienced underweight, stunting, and wasting came from the continents of Africa and Asia. In Indonesia, based on the 2023 Indonesian Health Survey (IHS), the prevalence of underweight was

10.4%, stunting 12.9%, and wasting 6.6% (BKPK, 2023). Underweight is seen based on weight per age (WAZ) which indicates acute and chronic malnutrition. Stunting is seen based on height per age (HAZ) which describes chronic malnutrition over a long period of time and occurs before the child is two years old. While wasting is seen based on weight per height (WHZ) which represents acute malnutrition (Badriyah, 2019).

This incident can be caused by a deficiency or low quality of protein containing essential amino acids. Bone growth begins with cartilage synthesis, which then goes through the ossification process. The process of cartilage synthesis requires a large amount of sulfur because one of its main components is sulfur. The body obtains most of its sulfur through amino acid catabolism, so adequate protein intake is very important to support child growth (Sudirman et al., 2023). Therefore, most of the protein that should be consumed by toddlers should come from high-quality sources, such as animal protein. This is because animal protein has better digestibility and more complete essential amino acid content compared to vegetable protein (Haryani et al., 2023).

Several studies have shown that animal protein intake has a fairly close relationship with the incidence of stunting in toddlers. Stunted toddlers tend to have lower animal protein intake when compared to toddlers who are not stunted (Iswara & Ahmad Syafiq, 2024). According to research Zulfiana et al., (2023) There is a significant relationship between protein intake and the prevalence of wasting in children. For this reason, sufficient energy is needed with complete nutritional data based on age to recognize. According to research Listyawardhani & Yunianto, (2024) There is a relationship between the level of protein and fat adequacy and the incidence of underweight.

Various previous studies have discussed the prevalence of stunting in Indonesia, but most of them only focus on certain or specific areas. However, this study examines the prevalence of stunting, wasting, and underweight in toddlers based on provinces in Indonesia using IHS 2023 data. This study will provide a comprehensive analysis of the prevalence of stunting, wasting, and underweight based on provinces in Indonesia. Therefore, researchers are interested in conducting research to analyze the relationship between animal protein intake and the incidence of stunting, wasting, and underweight in Indonesia.

There has been no study on national prevalence using aggregate data comparing the results of IHS data, so researchers want to describe and see how nutritional events in Indonesia by comparing data on the proportion of animal protein consumption with the incidence of nutritional problems in toddlers in Indonesia from IHS 2023 data, and research on the relationship between the proportion of animal protein consumption with the prevalence of stunting, wasting, and underweight in toddlers in Indonesia is still limited. The novelty of this study lies in the use of IHS 2023 national aggregate data to compare the proportion of animal protein consumption with the prevalence of stunting, wasting, and underweight throughout Indonesia, as well as the differences between 7 regions of Indonesia. This study is expected to provide a more comprehensive picture of nutritional problems in Indonesia and provide recommendations for more effective policies. The purpose of the study was to explain the description of the proportion of animal protein consumption, a description of the prevalence of stunting, wasting, and underweight in toddlers in 7 regions of Indonesia, and the relationship between the proportion of animal protein consumption with the prevalence of stunting, wasting, and underweight in toddlers in Indonesia. The results of this study are expected to provide deeper insight into the relationship between animal protein consumption and nutritional status in toddlers in Indonesia, as well as provide a basis for more appropriate

interventions in addressing nutritional problems in Indonesia.

METHODS

This study uses secondary data obtained from data aggregate in the 2023 Indonesian Health Survey (IHS) report with a Cross-sectional Study research design. IHS 2023 was conducted in the period from August to October 2023, covering all provinces in Indonesia. The population in this study were all toddlers (under two years old) who experienced stunting, wasting, and underweight in 34 provinces in Indonesia, which were grouped into seven regions, namely Sumatra, Java-Bali, NTB-NTT, Kalimantan, Sulawesi, Maluku, and Papua. The sample of this study consisted of the total population in all provinces covered by IHS 2023.

The variables analyzed in this study consisted of independent and dependent variables. The independent variable used was the proportion of animal protein consumption (meat/fish/eggs), which was calculated based on the number of children who consumed animal protein (meat/fish/eggs) in the previous 24 hours divided by the total number of toddlers. The dependent variables analyzed included the prevalence of stunting, wasting, and underweight in toddlers. The prevalence of stunting, wasting and underweight is calculated based on the number of children experiencing each condition divided by the total number of toddlers, then multiplied by 100%. Stunting is determined based on the anthropometric index of height for age (HAZ) <-2 SD, wasting based on weight for height (WHZ) <-2 SD, and underweight based on weight for age (WAZ) <-2 SD.

Weight data is obtained using a baby scale (accuracy level of 0.1 kg), while height data is measured using a length board (accuracy level of 1 mm). Data collection is carried out by enumerators with technical supervision by the technical person in charge of the Regency/City and administrative supervision by the person in charge of the Regency/City operations. In data collection, 1 team is responsible for 10 to 12 census blocks. 1 census block consists of 10 ordinary households with an additional ± 7 toddler households to obtain toddler nutritional status figures. After the data was collected, the data was processed and analyzed statistically using the SPSS version 22 program. Univariate analysis was conducted to describe the characteristics of each variable, using the middle and variance measures (mean, standard deviation, minimum value, and maximum value). To analyze the relationship between animal protein consumption variables and the prevalence of stunting, underweight, and wasting, bivariate analysis was conducted using the Spearman correlation test because the normality assumption was not met. The implementation of the Indonesian Health Survey has received approval and an ethical clearance letter from the National Health Research and Development Ethics Commission (KEPPKN) with the number HK.01.07/MENKES/156/2023.

RESULTS AND DISCUSSION

Table 1 shows that the highest proportion of animal protein consumption is in the Java and Bali regional areas, namely in the province of D.I Yogyakarta (88.3%) and the lowest proportion of animal protein consumption is in the Papua regional area, namely the province of Papua Pegunungan (40.0%). Nationally, the proportion of animal protein consumption in Indonesia averages 76%.

The results of this study indicate that there are significant differences in the proportion of animal protein consumption and the prevalence of nutritional problems (stunting, wasting, and underweight) between regions in Indonesia. In general, the proportion of animal protein consumption in Indonesia is still low, with a national average of 76%. This

figure illustrates the low animal protein consumption, which has an impact on children's nutritional status. The highest proportion of animal protein consumption is found in Java and Bali, while the lowest is found in Papua. This shows that there is inequality in access and consumption of animal protein between regions. The indirect causes are income factors and economic disparities, food systems, health systems, urbanization, and others (Purnamasari & Febry, 2023).

Table 1. Distribution of the Proportion of Animal Protein Consumption by Region of Indonesia in 2023

Region	Minimum	Maximum	$\underline{X}$ ± SD
Sumatera	74.1	85.4	81.4 ± 3.2
Jawa dan Bali	76.9	88.3	81.1 ± 4.3
Nusa Tenggara	70.0	80.3	75.1 ± 7.3
Kalimantan	73.1	80.7	77.4 ± 2,8
Sulawesi	64.1	77.6	71.7 ± 4.4
Maluku	72.5	72.9	72.7 ± 0.3
Papua	40.0	77.9	65.3 ± 15.7
Indonesia	**40.0**	**88.3**	**76.0 ± 8.8**

From Table 1, it is found that the proportion of animal protein consumption by province in Indonesia is lowest in the Papua Pegunungan province at 40% and the highest is in the D.I Yogyakarta province at 88.3%. Animal protein is an important component for the growth and cognitive development of children. Consumption of high-quality animal protein in children reduces the risk of nutritional problems such as underweight, stunting, and wasting. Animal protein has advantages such as having more complete essential amino acids than vegetable protein (Rawani et al., 2024).

Protein plays an important role in children's growth. Protein is a nutrient for children's physical growth because it is needed for bone and muscle growth. According to WHO recommendations, children under 1 year old should get 1.5 grams of protein/kg/day. Based on the Regulation of the Minister of Health (PMK) no. 28 of 2019, children's daily protein intake requirements are adjusted to the age of the child, namely 6-11 months as much as 15 grams/day, 1-3 years as much as 20 grams/day, 4-6 years as much as 25 grams/day and 7-9 years as much as 40 grams/day (Nursani et al., 2023). The amount of protein is adequate if it contains all types of essential amino acids in sufficient quantities and is easily digested and absorbed by the body. Amino acids needed by toddlers are lysine, leucine, isoleucine, valine, threonine, phenylalanine, tyrosine, methionine, cysteine, tryptophan, histidine, and arginine, the majority of which are essential amino acids. Therefore, most of the protein consumed by toddlers must be of high quality such as animal protein because it has better digestibility and a more complete essential amino acid content than vegetable protein (Haryani et al., 2023).

Table 2. Distribution of Nutritional Status by Region of Indonesia in 2023

Region	Stunting			Underweight			Wasting		
	Min	Max	$\underline{X}$ ± SD	Min	Max	$\underline{X}$ ± SD	Min	Max	$\underline{X}$ ± SD
Sumatera	8.8	17.2	11.9 ± 2.7	6.1	13.7	9.4 ± 2.7	5.0	9.9	6.8 ± 1.5
Jawa dan Bali	5.0	13.6	11.6 ± 3.0	3.7	12.0	9.1 ± 2.7	3.2	8.3	5.8 ± 1.6
Nusa Tenggara	15.1	21.0	18.0 ± 4.2	12.7	18.5	15.6 ± 4.1	6.0	9.9	7.9 ± 2.8
Kalimantan	10.8	16.2	13.7 ± 1.9	10.1	13.8	12.5 ± 1.5	6.7	9.3	7.9 ± 1.2
Sulawesi	14.6	17.2	15.8 ± 0.8	11.1	14.9	13.6 ± 1.5	7.5	9.5	8.4 ± 0.7
Maluku	13.7	14.2	13.9 ± 0.4	14.6	15.8	15.2 ± 0.8	10.8	12.3	11.5 ± 1.1
Papua	13.3	18.2	15.8 ± 1.7	5.4	15.5	13.1 ± 3.8	6.8	14.2	9.8 ± 2.7
Indonesia	**5.0**	**21.0**	**13.7 ± 2.9**	**3.7**	**18.5**	**11.6 ± 3.3**	**3.2**	**14.2**	**7.8 ± 2.2**

Table 2 shows that the highest prevalence of stunting occurred in the Nusa Tenggara region (21.0%) and the lowest prevalence of stunting occurred in the Java and Bali regions (5.0%). The highest prevalence of underweight occurred in the Nusa Tenggara region (18.5%) and the lowest prevalence of underweight occurred in the Java and Bali regions (3.7%). Meanwhile, the highest prevalence of wasting occurred in the Papua region (14.2%) and the lowest prevalence of wasting occurred in the Java and Bali regions (3.2%). National figures show a stunting prevalence of 13.7%, an underweight prevalence of 11.6%, and a wasting prevalence of 7.8%.

Table 3. Relationship between the Proportion of Animal Protein Consumption and the Prevalence of Nutritional Problems in Toddlers in Indonesia in 2023

Animal Protein Consumption Proportion	Prevalence of Stunting	Prevalence of Underweight	Prevalence of Wasting
Betta	-0.428	-0.168	-0.265
Constant	93.754	81.230	84.252
Correlation	-0.551	-0.947	-0.464
Coefficient (r)	0.000	0.001	0.003
p-value			

Table 3 shows the results of the analysis that the proportion of animal protein consumption is related to the prevalence of stunting (p-value 0.000), the prevalence of underweight (p-value 0.001), and the prevalence of wasting (p-value 0.003). Based on the beta coefficient value, it shows that the higher the proportion of animal protein, the lower the incidence of stunting, underweight, and wasting. The high proportion of animal protein consumption is very strongly related to the prevalence of underweight (r = 0.947), and moderately related to the prevalence of stunting and wasting (r = 0.551 and r = 0.464).

3.1 Proportion of Animal Protein Consumption with Stunting Prevalence

Stunting is a condition of failure to grow in the body and brain due to long-term malnutrition so that children are shorter than normal children of the same age and have delays in thinking (Anjani et al., 2024). According to WHO, 2022, the stunting rate in the world is 148.1 million toddlers, or 22.3%. Indonesia ranks 27th out of 154 countries with stunting data, making Indonesia ranked 5th in Asia and the second highest in Southeast Asia.

Based on IHS, 2023, the highest stunting prevalence occurs in Nusa Tenggara (21%%), which shows that geographical factors and access to nutritious food play a major role in the high stunting rate in the area. Meanwhile, the prevalence of stunting in Java and Bali is relatively lower (5.0%), which may be related to easy access to more diverse food resources and better health facilities in this region. According to research Nirmalasari (2020), stunting can be caused by many factors such as socioeconomic conditions, maternal nutrition during pregnancy, illness in infants, and lack of nutritional intake in infants. Generally, these causes last for a long time (chronic).

The results of the study (Sholikhah & Dewi, 2022), that food ingredients sourced from animal protein can accelerate growth rates and prevent stunting. Research (Afiah et al., 2020) also states that consumption of animal protein is protective against stunting, toddlers who do not finish their food at every meal are 3 times more at risk of stunting and households that provide vegetables less than 3 days a week are 10 times more at risk of stunting. Research (Sudirman et al., 2023) is also in line with previous research, it was found that protein intake is one of the triggers for stunting in toddlers.

The problem of stunting in toddlers is caused by direct and indirect causes. Food intake and infectious diseases are direct causes. Parenting habits and food security are indirect causes. Food intake caused by calorie-rich foods and a lack of animal products, fruits, and vegetables results in stunting. Food intake is used in the form of energy and protein which functions to support all body activities. Stunting children who lack protein are more likely to

lose muscle mass, experience fractures, and get infectious diseases in addition to the risk of growth and development failure. Protein is very important for the development of the structure, function, and regulation of living cells. Some foods that contain protein, such as meat, fish, eggs, almonds, and milk. Growth is greatly influenced by protein consumption. Stunting can occur due to a lack of protein consumption because in general protein is needed for the development, synthesis of structural components, and antibody production (Juliyusman et al., 2023). This is because toddlers need more protein for muscle and antibody formation. However, the 2014 Individual Food Consumption Survey Data reported that toddlers' animal protein intake tended to be lacking, namely <5% in children aged 6 months and over (H. P. Sari et al., 2022).

Factors that can cause stunting in toddlers include internal and external factors. Internal factors include the baby's health condition, such as heredity, metabolism, and infection. Examples of internal factors that can cause stunting in babies include disorders of the digestive system, hormonal disorders, and disorders of the nervous system. External factors include the baby's environment and socio-economic conditions, such as the availability of clean water, poor sanitation, parenting and nutrition patterns, and the level of parental knowledge. Examples of external factors that influence the occurrence of stunting in babies include exclusive breastfeeding, providing additional intake other than breast milk, the availability of food with poor nutrition, poor access to sanitation, access to clean water, and the mother's minimal knowledge in caring for and providing nutrition to babies. In addition to the factors that can cause stunting above, researchers are examining other factors to find innovations in research, namely economic factors where family income can also influence the incidence of stunting in toddlers (Febriani et al., 2024).

3.2 Proportion of Animal Protein Consumption with Underweight Prevalence

Underweight or lack of body weight is caused by a lack of energy intake compared to energy expenditure. Lack of energy intake or inadequate consumption of essential nutrients needed by the body will usually cause a decrease in activities carried out (E. Kartika Sari et al., 2019). The United Nations International Children's Emergency Fund (UNICEF) in 2020 stated that 167 million toddlers worldwide are underweight. Most toddlers in South Asia are underweight at 52%, followed by West Asia with 15%, and Southeast Asia with 17%.

Regarding the prevalence of underweight, SKI 2023 data shows that the Nusa Tenggara region has the highest figure (18.5%) and the lowest prevalence of underweight incidents occurs in the Java and Bali regions (3.7%). Children with low body weight can cause growth and development disorders. This nutritional problem affects the development of the child's brain which will later hinder academic and non-academic development in the next period of life. The period of children requires optimal nutrients to support very rapid growth and development (Putri et al., 2024). The decrease in the prevalence of underweight was also found to be very strong along with the increase in animal protein consumption ($r = 0.94$), which shows the importance of animal protein in improving children's nutritional status. This study is in line with research conducted that animal protein consumption is significantly related to the incidence of underweight (Ilmi et al., 2021).

Factors causing underweight are the mother's education and knowledge, parenting patterns, and history of breastfeeding. The education received and the things that mothers of toddlers know about nutrition affect the provision of exclusive breastfeeding for their babies. There is a relationship between exclusive breastfeeding and the nutritional

status of toddlers because, in the process of consuming foods containing nutrients, exclusive breastfeeding is important. After all, breast milk has the most complete source of nutrients according to the child's age which must be given to help the process of growth and development (Esti, 2024). Other supporters of underweight toddlers are deteriorating family conditions, namely low socio-economic status (poverty), poor household hygiene and sanitation, and low dietary diversity, as well as a lack of agricultural products resulting in a lack of food availability in the household. Minimal household access to health facilities will worsen the nutritional status of toddlers (Selvianita & Sudiarti, 2021). The weight parameter based on age (BB/A) is a parameter commonly used to assess the nutritional status of toddlers. This index can be used to assess children with underweight (underweight - 3 SD to <- 2 SD) or very underweight (severely underweight <-3 SD) (Putri et al., 2024).

3.3 Proportion of Animal Protein Consumption with Wasting Prevalence

Wasting is one of the nutritional problems in Indonesia, a combination of wasted and very wasted based on the Body Weight Index according to Body Length or Height (WHZ) with a threshold (Z-score) <-2 SD (Octari & Dwiyana, 2021). According to data from the World Health Organization (WHO), there were 32.5 million people in the world who experienced wasting in 2019, and the Asia and Pacific region had the highest number of wasting cases with 8.7% of cases coming from Southeast Asia. After Timor Leste, Indonesia is the country with the second highest wasting cases in Southeast Asia and is ranked sixth out of 30 countries. Based on SKI, 2023, the highest prevalence of wasting incidents occurred in the Papua region (14.2%) and the lowest prevalence of wasting incidents occurred in the Java and Bali regions (3.2%).

Table 3 shows the results of the prevalence of wasting in toddlers with the proportion of animal protein consumption obtained a p-value of 0.003, there is a significant relationship between the proportion of animal protein consumption and the prevalence of wasting in toddlers in Indonesia. This is greatly related to the intake of nutrients, especially essential animal protein to prevent wasting (Abdullah et al., 2023). This study is in line with the study (Zulfiana et al., 2023), that there is a significant relationship between protein intake and the prevalence of wasting in children. The study (Veronica et al., 2023) is also in line with previous studies, that there is an influence between giving high-protein nuggets on the weight of wasting toddlers in the work area of the Palembang City Reading Park Health Center.

This growth disorder occurs due to several factors including socio-economic factors, consumption factors, and maternal nutritional status factors. One of the parameters to determine the nutritional status of pregnant women is the Upper Arm Circumference (UAC) anthropometric indicator in mothers, where insufficient energy and protein intake in pregnant women can cause Chronic Energy Deficiency (CED). Pregnant women with CED during pregnancy are at risk of wasting in toddlers. Pregnant women with low nutritional intake and experiencing infectious diseases will give birth to babies with Low Birth Weight (LBW). A child's life from in the womb to the age of two years (1,000 The First Day of Life) is a critical period in supporting optimal child growth and development (Saleh et al., 2022). The impact of Wasting is that it makes a person less social, less cheerful, and apathetic and reduces concern for the environment. The long-term impacts of wasting are behavioral problems, decreased achievement in learning, cognitive disorders, and even a high possibility of death (Sadik et al., 2025).

Based on the results of this study, increasing the proportion of animal protein consumption is an important step in reducing the prevalence of stunting, wasting, and

underweight. The Indonesian government needs to focus on programs to increase access to high-protein foods throughout the region, especially in areas that still have difficulty in meeting basic nutritional needs. Nutrition education programs for mothers and families. More integrated policies between the health and education sectors are essential in addressing the problem of malnutrition in children in Indonesia.

CONCLUSION

The conclusion of this study shows that there is a significant relationship between the proportion of animal protein consumption and the prevalence of stunting, wasting, and underweight in toddlers in Indonesia. The results of the analysis show that the higher the proportion of animal protein consumption, the lower the prevalence of stunting (p-value 0.000), underweight (p-value 0.001), and wasting (p-value 0.003). The data indicate that areas with better access to animal protein sources, such as Java and Bali, show a lower prevalence of nutritional problems compared to areas with less access, such as Nusa Tenggara and Papua. This study also found that consumption of high-quality animal protein is very important to support children's growth and development, as well as prevent long-term nutritional problems. Therefore, increasing access to and consumption of animal protein should be a primary focus of nutrition policy in Indonesia.

Recommendations for further research include longitudinal studies to evaluate the impact of animal protein consumption in more depth and analysis of other factors that influence children's nutritional status, such as maternal education and socio-economic conditions. This study is expected to provide more comprehensive insights for policymakers in designing effective interventions to address nutritional problems in children in Indonesia.

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CONFLICT OF INTEREST

The authors have no conflicts of interest related to the material presented in this research.

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