

## The Difference in Protein and Zinc Intake in Stunted and Non-Stunted Toddlers in Dawarblandong District, Mojokerto

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### ABSTRACT

Stunting is a health problem caused by several factors, one of which is a lack of nutrition in the long term. The nutrients that have been linked to influencing the incidence of stunting are protein and zinc. Protein is a macronutrient containing essential amino acids that are useful for growth, cell turnover, and maintenance of the body. Zinc is also useful for growth because zinc plays a role in the metabolism of Growth Hormone (GH). This study aims to determine differences in protein and zinc intake in stunted and non-stunted toddlers in Dawarblandong District, Mojokerto Regency. The type of research used is quantitative with an observational method and a case-control research design. The total sample was 54 toddlers consisting of 27 stunted toddlers and 27 non-stunted toddlers who were selected using a purposive sampling technique. Protein and zinc intake of toddlers were taken through 24-hour food recall interviews for three days and then the data were analyzed using the Wilcoxon Rank Sum Test. The results showed that there was a significant difference in protein intake (p value 0.014) and zinc intake (p value 0.020) between stunted and non-stunted toddlers. This difference in intake is thought to be influenced by differences in toddler eating patterns. Stunted toddlers consume more plant-sourced foodstuffs than animal-based ones, while non-stunted toddlers consume a combination of foods from plant and animal sources in a day's meal so that the nutrients they get are better. This difference in eating patterns is associated with differences in the parenting style of each toddler where mothers of non-stunted toddlers understand more about intakes that are rich in nutrients that are useful for children's bodies and are more patient in controlling children's eating patterns. Meanwhile, the parenting style of stunted toddler mothers frees the child to choose whatever food the child likes even though the food has less nutritional value.

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### 1. INTRODUCTION

Stunting is a serious nutritional problem that occurs in Indonesia. This nutritional problem can occur due to a lack of fulfillment of nutrition in a long period of time, namely from the time the fetus is still in the womb until the growth period is 2 years old, so this nutritional problem is called chronic malnutrition [1]. A child is said to be stunted if their height is more than two standard deviations below the average growth standard of the World Health Organization (WHO) for children based on age and sex [2]. There are several factors that can increase the risk of stunting in toddlers including a poor diet, especially a diet on nutrient intake which affects growth. Toddlers need to consume foods that contain good nutrients such as macro-nutrients (carbohydrates, proteins, fats) and micro-nutrients (vitamins and minerals) and a balance is needed in consuming both. The results of previous studies explained that the deficit protein consumption experienced by children will affect the risk of stunting. Lack of protein intake in children will increase the risk 10 times greater for stunting compared to children whose protein consumption is sufficient [3].

In addition, micronutrients also have a relationship with stunting, especially zinc. The less consumption of zinc, the greater the risk of stunting occurring 2.148 times [4]. Lack of zinc intake can

reduce growth hormone secretion from the pituitary and cause disturbances in growth hormone receptors and IGF-1 [5]. IGF-1 or Insulin-Like Growth Factor-1 is a hormone that links the effects of growth hormone (GH) and plays an important role in the regulation of somatic growth and organ development [6]. There are many consequences of zinc deficiency on health, so it is very important to pay attention to intake of food sources of zinc because zinc is the second most abundant micronutrient in the body and has a fairly important role, namely for physical growth [7]. This statement is in line with research conducted by Amalia [8] which stated that the activity of giving zinc supplements for three months to stunting toddlers showed a change in height of 4.76 cm, which exceeded the target for a change in height of 3.75 cm.

The impact of stunting is very influential on morbidity and mortality. According to previous research conducted by Khairani, the impact of stunting is a decrease in the level of intelligence during school and work productivity at a productive age which is caused by imperfect motor skills. The high stunting rate is a serious problem because it relates to the future of the nation where the success of a nation's national development is determined by the availability of quality human resources, namely human resources who are physically and mentally strong and in good health in addition to mastery of science and technology [9].

According to the 2022 Indonesian Nutrition Status Survey (SSGI), there are 27.4% of toddlers who are stunted in Mojokerto Regency. While the results of the activity report for June 2022 at the Dawarblandong Health Center, Mojokerto, there were 48 short toddlers and 18 very short toddlers who were in the stunting category out of a total of 2,985 toddlers in Dawarblandong District. Seeing the high number of stunting incidents based on the percentage of data above, stunting is a nutritional problem that is quite risky and requires full attention from the government and also the community so that this problem can be resolved properly. Based on this background, the authors are interested in analyzing "Differences in Protein and Zinc Intake in Stunting and Non-Stunting Toddlers in Dawarblandong District, Mojokerto" in order to find out whether there are significant differences in the consumption of food sources of protein and zinc in stunted and non-stunted toddlers which has a considerable influence on the growth of toddlers in Dawarblandong District, Mojokerto Regency.

## 2. METHOD

This type of research is quantitative using observational methods and the research design is a case-control approach. This research was done in ten villages of Dawarblandong Subdistricts, Mojokerto Regency. Data collection was carried out from 10<sup>th</sup> of September to 20<sup>th</sup> of October 2022. The number of samples in this study were selected through purposive sampling. Toddlers who become respondents are selected by mixing and matching the characteristics of the control group with the case group in order to obtain balanced data and increase research precision. Matching is determined by gender and the number of toddlers in each age category consisting of 25-36 months, 37-48 months and 49-59 months. Data of respondents were obtained through a direct interview process with the mother of the toddler and measuring the height of the toddler. Height measurement was carried out prior to the interview process to determine the nutritional status of toddlers based on indicators of height/age. The interview process begins with filling out the informed consent form by the mother of the toddler then followed by filling in the 24-hour food recall form to find out the consumption pattern of the toddler for 3x24 hours which includes 2x24 hours on weekdays and 1x24 hours on weekend.

## 3. RESULTS AND DISCUSSION

The number of respondents from this research were 27 stunted toddlers and 27 non-stunted toddlers. The age distribution of stunted and non-stunted toddlers in this study was the same because matching was carried out and the highest number of toddlers was in the age range of 37-48 months, namely 14 toddlers (51.85%). The sex distribution in this study was also matched between stunted and non-stunted toddlers and the most common sex was male, namely 14 toddlers (51.85%). The distribution of z-scores with indicators of height/age for stunting toddlers is mostly  $<-3$  SD, which is 59.26%. Whereas for non-stunted toddlers, the distribution of z-scores is all in the normal range. The most age distribution for stunted toddler mothers is in the 19-29 year age range, namely 16 people (59.26%), while the most non-stunted toddler mother age is in the 30-49 year range, namely 15 people

(55.55%). The most recent educational distribution of stunted and non-stunted toddler mothers was SMA, with 18 people (66.67%). According to BPS (2008), population income is divided into 4 groups, namely very high income groups if the average income is more than IDR 3,500,000 per month, high income groups if the average income is between IDR 2,500,000 – IDR 3,500,000 per month, the middle income group if the average income is between IDR 1,500,000 – IDR 2,500,000 per month and the low income group if the average income is less than IDR 1,500,000 per month. The most family income in stunted toddler families is in the low category, namely 55.56%, while the most non-stunting toddler family income is in the medium category, namely 48.15%. The authors can describe the results of the research in the exposure below:

Table 1. Respondents' Characteristics

Characteristics n=54	Stunted Toddler	Percentage (%)	Non Stunted Toddler	Percentage (%)
<b>Age</b>				
25-36 months	7	25,93	7	25,93
37-48 months	14	51,85	14	51,85
49-59 months	6	22,22	6	22,22
<b>Sex</b>				
Male	14	51,85	14	51,85
Female	13	48,15	13	48,15
<b>Nutritional Status (Height/Age)</b>				
Very Short (<-3 SD)	16	59,26	0	0
Short (-3 SD sd <-2SD)	11	40,74	0	0
Normal (-2 SD sd +3 SD)	0	0	27	100
<b>Mother's Age</b>				
19-29 years	16	59,26	12	44,44
30-49 years	11	40,74	15	55,55
<b>Mother's Education Level</b>				
Elementary School	0	0	0	0
Junior High School	7	25,93	5	18,52
Senior High School	18	66,67	18	66,67
Bachelor	2	7,4	4	14,81
<b>Family Income</b>				
Low (<Rp 1.500.000)	15	55,56	3	11,11
Middle (Rp 1.500.000 - Rp 2.500.000)	7	25,93	13	48,15
High (Rp 2.500.000 – Rp 3.500.000)	3	11,11	8	29,63
Very High (>Rp 3.500.000)	2	7,41	3	11,11

### Protein Intake for Stunting and Non-Stunting Toddlers

In this research, researchers interviewed and observed toddlers' eating patterns and found that non-stunted toddlers consume a variety of food sources of animal protein such as chicken, eggs and fish, as well as food sources of vegetable protein such as tofu, tempeh, nuts. They more often combine food sources of animal and vegetable protein in food portions. Meanwhile, stunted toddlers often consume food sources of vegetable protein such as tofu and tempeh compared to animal protein foods. The average protein intake of stunted and non-stunted toddlers obtained through a 3-day recall interview can be seen in the following table.

Table 2. Average Protein Intake of Stunting and Non-Stunting Toddlers for Three Days

Status Gizi	Mean	SD	Min	Max
Stunting	31,32	8,19	18,57	46,07
Non Stunting	45,19	7,77	33,5	75,3

Based on table , it can be seen that the average protein intake for stunting toddlers for three days is 31.32 grams and the standard deviation is 8.19 with the least protein intake being consumed at 18.57 grams and the most being consumed at 46.07 grams per day . The average protein intake for non-stunted toddlers for three days was 45.19 grams and the standard deviation was 7.77 with the least amount of protein consumed per day being 33.5 grams and the most consumed being 75.3 grams.

From these average results, protein intake for toddlers is then categorized into two categories, namely insufficient, if protein intake for toddlers aged 25-36 months <20 grams per day and for toddlers aged 37-59 months <25 grams per day and it is said to be sufficient if protein intake for toddlers aged 25-36 months  $\geq$ 20 grams per day and for toddlers aged 37-59 months  $\geq$ 25 grams per day (RDA, 2019). Based on this categorization, the number of toddlers whose protein intake is sufficient or insufficient can be seen in the following table.

Table 3. Results of Protein Intake of Stunting and Non-Stunting Toddlers

Intake of Protein	Category			
	Stunting Toddlers		Non Stunting Toddlers	
	<i>n</i>	%	<i>n</i>	%
<b>Sufficient</b>	21	77,78	27	100
<b>Insufficient</b>	6	22,22	0	0
<b>Total</b>	27	100	27	100

Based on table 3, it can be seen that the protein intake of stunted toddlers who is lacking based on the RDA is 6 toddlers (22.22%) and the number of stunted toddlers that is sufficient to fulfill protein intake is 21 toddlers (77.78%). While non-stunted toddlers are all in the sufficient category in fulfilling protein intake, which is 27 toddlers (100%).

### Analysis of Differences in Protein Intake of Stunting and Non-Stunting Toddlers

The protein intake of stunted and non-stunted toddlers that has been obtained is then tested using a non-parametric statistical test, namely the wilcoxon rank sum test to find out whether there is a difference between protein intake in stunted and non-stunted toddlers. From this test, the significance value is obtained which is presented in the following table.

Table 4. Wilcoxon Rank Sum Test Results of Protein Intake in Stunting and Non-Stunting Toddlers

	Z	Asymp. Sig. (2-tailed)
Average Protein Intake of Stunting and Non-Stunting Toddlers	-2,449	,014

Based on table 4. it can be seen that the average significance value of protein intake is 0.014 <0.05. This shows that there is a significant difference between protein intake in stunted and non-stunted toddlers. This research is in line with research conducted by Azmy [10] which states that there are differences in protein intake between stunted and non-stunted toddlers. The less protein consumption, the toddler will be 1.6 times more likely to be stunted. This significant difference is influenced by differences in toddler consumption patterns. Consumption patterns have quite an effect on the growth and development of toddlers, one of which is protein consumption where protein is a macro nutrient that plays an important role in the growth process. Non-stunted toddlers, in their daily life they consume a more diverse diet compared to stunted toddlers. In addition to food sources of vegetable protein, they also consume more and often food sources of animal protein such as meat, fish and eggs. By consuming food sources of animal protein, the protein intake received will be far better than only consuming food

sources of plant protein. This is in line with research from [11] which states that in general the protein content in animal-based foodstuffs tends to be superior both in terms of quantity and quality when compared to the protein content in plant-based foodstuffs. Meanwhile, stunted toddlers consume more vegetable protein sources such as tofu and tempeh than animal protein sources, so the quality of the protein they get is also of low value. Plant food ingredients tend to contain low amounts of protein and limited quality.

Low protein intake in stunting toddler research subjects can also be caused by a lack of ability or purchasing power of food sources of animal protein. This lack of purchasing power is caused by family income, in which most of the research subjects are in the low category, so that the budget for buying animal food is still not prioritized. The majority of the respondent's family (55.56%) of stunting toddlers earn IDR 500,000 to IDR 1,000,000 per month which is a low income category. Meanwhile, the income earned by non-stunting toddler parents in this category is 11.11%. This is in line with research conducted by Agustin [12] which states that family income greatly influences the nutritional status of toddlers, especially stunting toddlers. People who have low incomes will tend to buy more high-carb foodstuffs than high-protein foodstuffs because high-carb foodstuffs are relatively cheaper. At the time of the research it was found that stunting toddlers' eating patterns were irregular and they preferred to spend time playing and consuming more snacks or snacks rather than self-cooked food. To overcome this, mothers choose to obey their children's wishes about food, they provide snacks that their children like without giving restrictions because they are worried that their children will not want to eat at all. This mother's decision is related to the mother's last education level where most of the stunting toddler mothers do not pursue education up to university. As many as 25.93% of stunted toddler mothers had their education up to the junior high school level and 66.67% were at the senior high school level, while 7.4% of stunted toddler mothers had their last education up to university. This is in line with research conducted by Putri [13] which states that the highest level of education for mothers of stunting toddlers is high school/equivalent.

### Zinc Intake of Stunting and Non-Stunting Toddlers

Stunted toddlers consume more foods that are high in zinc such as meat, fish and nuts. In their daily diet, they can consume these foods by combining animal and vegetable ingredients for two or three meals. Meanwhile, non-stunted toddlers consume more zinc-derived foods from vegetable sources than from animals. In a day, stunted toddlers consume one or two types of foods high in zinc in their diet or there are even some stunted toddlers who rarely consume foods high in zinc but instead consume lots of high-carbohydrate foods and extruded snacks. The average zinc intake of stunted and non-stunted toddlers can be seen in the following table.

Table 5. Average Intake of Zinc in Stunting and Non-Stunting Toddlers for Three Days

Status Gizi	Mean	SD	Min	Max
Stunting	3,68	1,46	1,3	5,97
Non Stunting	4,89	1,13	3,58	7,76

Based on table 5, it can be seen that the average intake of zinc for stunting toddlers for three days is 3.68 milligrams and the standard deviation is 1.46 with zinc intake consumed at least 1.3 milligrams and most consumed at 5.97 milligrams per day. The average intake of zinc for non-stunted toddlers for three days was 4.89 milligrams and the standard deviation was 1.13 with the least amount of zinc consumed per day being 3.58 milligrams and the most consumed being 7.76 milligrams.

In this research zinc intake was divided into two categories: insufficient, if zinc intake for toddlers aged 25-36 months <3 milligrams per day and for toddlers aged 37-59 months <5 milligrams per day and said to be sufficient, if zinc intake for toddlers aged 25- 36 months  $\geq$ 3 milligrams per day and for toddlers aged 37-59 months  $\geq$ 5 milligrams per day (AKG, 2019). Based on this categorization, the number of toddlers whose intake of zinc is sufficient or lacking can be seen in the following table.



Table 6. Results of Zinc Intake in Stunting and Non-Stunting Toddlers

Intake of Zinc	Category			
	Stunting Toddlers		Non Stunting Toddlers	
	<i>n</i>	%	<i>n</i>	%
<b>Sufficient</b>	9	33,33	17	62,96
<b>Insufficient</b>	18	66,67	10	37,04
<b>Total</b>	27	100	27	100

Based on table 6, it can be seen that 18 toddlers (66.67%) have insufficient zinc intake for stunted toddlers and the sufficient number of stunted toddlers to fulfill zinc intake is 9 toddlers (33.33%). The zinc intake of non-stunted toddlers who was less than the RDA was 10 toddlers (37.04%) and those who were sufficient from the RDA were 17 toddlers (62.97%).

### Analysis of Differences in Zinc Intake of Stunting and Non-Stunting Toddlers

Based on research conducted on stunting and non-stunting toddlers, the average zinc intake for 3 days was obtained and tested using the wilcoxon rank sum test to find out the difference between the them, which is presented in the following table.

Table 7. Wilcoxon Rank Test Results Sum Intake of Zinc in Stunting and Non-Stunting Toddlers

	Z	Asymp. Sig. (2-tailed)
Average Zinc Intake of Stunting and Non-Stunting Toddlers	-2,138	,020

Based on table 7. it can be seen that the significance value is  $0.020 < 0.05$ . This shows that there is a significant difference between zinc intake in stunted and non-stunted toddlers. These results are in line with research conducted by Mutu which states that there are differences in zinc intake between stunted and non-stunted children. According to research from Hidayati (2010) in Mutu [14] states that a lack of zinc intake in children can increase the risk of stunting by 2.67 times. This significant difference is thought to be caused by differences in eating patterns between stunted and non-stunted toddlers. Non-stunted toddlers often consume foods that are varied and contain high zinc. At the time of the research, it was found that non-stunted toddlers consumed a wide variety of foods that were high in zinc, such as meat, eggs, shrimp, goldfish and tuna. Zinc plays a role in activating and initiating the synthesis of growth hormone needed by the body in the process of growth and development of toddlers. Low zinc levels have an influence on the production of growth hormone, which can change growth hormone to become resistant, thereby inhibiting the effects of growth hormone metabolites. Growth Hormone (GH) is responsible for the growth process so that when the effect of GH metabolites is inhibited, this can cause a child's growth to become stunted as well because the synthesis and secretion of IGF-1 decreases .

Meanwhile, the food consumed by stunting toddlers is unbalanced and less varied. The types of side dishes that are often consumed include tempeh, tofu and eggs, then the types of vegetables that are often consumed are vegetable soup and vegetable tamarind, but stunting toddlers often consume only the broth. This type of food that is not diverse is associated with low majority family income, namely as much as 55.56%. Low family income affects the household budget to maximize purchases of plant-based foodstuffs because they are relatively cheaper. The intake data for stunting toddlers shows that the dominant food consumed by respondents is plant-based foods such as tofu, tempeh, long beans, green beans, spinach and kale. Meanwhile, this plant-based food ingredient does not have adequate zinc content because it contains phytate which can inhibit zinc absorption [15], so this can cause zinc deficiency. People with low incomes will further limit access to identically more expensive animal-based foodstuffs such as meat, poultry and fish, while animal-based foodstuffs have a higher zinc content because they contain amino acids [16].

Differences in eating patterns in toddlers are also influenced by different parenting styles. Parenting is an important thing to pay attention to in supervising the growth and development of children. The first two years are a golden period for children in pursuing brain growth and development so that the nutrients consumed by children must be fulfilled. Some stunted toddlers experience problems with no appetite and are bored with the food that has been provided at home but the mothers of toddlers do not provide other food alternatives or try to modify food so that children want to eat it. They choose to obey their children's wishes by eating in moderation and try to buy extruded snacks that have less nutritional value so that their children want to eat them. The parenting style of stunted toddler mothers is thought to be influenced by the age factor where the majority of stunted toddler mothers are 59.26% aged 19-29 years. This age is relatively young. At this age, usually the mother's level of knowledge regarding parenting and nutrition is still lacking, so this can be a factor in the occurrence of stunting in toddlers. This is in line with research conducted by Dewa [17] which states that one of the causes of stunting is the practice of caring for toddlers carried out by mothers in the 19-29 year age category with a total of 27 people (60%).

#### 4. CONCLUSION

There is a significant difference between protein intake in stunted and non-stunted toddlers with a significance value of 0.014. There is a significant difference between zinc intake in stunted and non-stunted toddlers with a significance value of 0.020.

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