

Serum Calcium Levels in Stunting Toddlers Ages 24-59 Months

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Abstract. *Stunting* is a condition of failure to thrive in children under five due to chronic malnutrition, especially in the First 1,000 Days of Life (DoL). Malnutrition that occurs early in life can lead to failure to thrive, resulting in a shorter than normal child. Good quality food intake is an important component in children's growth, because it contains sources of macro (energy, carbohydrates, protein, fat) and micro (vitamins and minerals) nutrients. Micronutrients that have been proven to be very important to prevent stunting are zinc, iron, vitamin A and iodine. However, several other micronutrients such as vitamin D, calcium and phosphorus also play an important role in children's linear growth. The special function of vitamin D in this case is to help harden bones by regulating so that calcium and phosphorus are available in the blood to be deposited in the process of bone hardening. During growth, the process of bone mineralization often occurs, calcium deficiency will affect linear growth if the calcium content in the bone is less than 50% of the normal content. Lack of calcium in the bones in infants can cause rickets, whereas in children, lack of deposits can cause stunted growth. This research is an observational analytic study with a *cross sectional design* conducted in Mestong District, Muaro Jambi Regency in March 2022. The research sample was normal and stunted toddlers aged 24-59 months as many as 41 people taken using proportional consecutive sampling technique. Examination of serum calcium levels was carried out on toddlers using the Calcium (Ca) Colorimetric Assay Kit method. The results showed that there was no difference in serum calcium levels in normal and stunted children

Indonesia still faces nutritional problems that have a serious impact on the quality of human resources. One of the nutritional problems that is currently a major concern is the high number of stunted children with stunting (Ministry of Development of Disadvantaged Regions and Transmigration, 2017). Stunting is a condition of failure to thrive in children under five due to chronic malnutrition, especially in the First

1,000 Days of Life (DoL). The condition of failure to thrive in children under five is caused by a lack of nutritional intake for a long time and the occurrence of repeated infections, and these two factors are influenced by inadequate parenting, especially in first 1000 DoL. A child is classified as stunted if the length or height according to age is lower than the applicable national standard. The standard is contained in

the Maternal and Child Health book and several other documents (Ministry of PPN/Bappenas, 2018). Muaro Jambi Regency in Jambi Province has the highest stunting rate of 27.2% above the province stunting average number (22.4%), especially in Mestong sub-district (SSGI, 2021)

Stunting, becomes a burden and threat to the nation in the future. Stunting is related to morbidity and mortality in child, deterioration of intellectual and cognitive ability and low quality of human resources and degenerative disease problems in adulthood. Countermeasures (Tri Siswati, 2018). More than 1/3 of children under 5 years old in Indonesia are below the average height. Malnutrition-caused stunting is a major concern in children under 5 years in low and middle income countries (Uday et al., 2021). The causes of stunting are very complex. One of the factors that influence stunting is the low intake of nutrients consumed. Good quality food intake is an important component in children's growth, because it contains sources of macro (carbohydrates, protein, fat) and micro (vitamins and minerals) nutrients. Micronutrient deficiency as a cause of growth retardation has become a concern, especially in developing countries with low average income. Micronutrients that have been proven to be very important to prevent stunting are zinc, iron, vitamin A and iodine. However, several other micronutrients such as vitamin D, calcium and phosphorus also have very important roles in children's linear growth (Chairunnisa et al., 2018).

Calcium and magnesium are bone formation minerals that work complementary to the matrix formation process, deposits in the formation of bone tissue so that if there is a deficiency of calcium and magnesium it will inhibit cell division, growth and tissue repair so that it will affect body weight and height (Yona Amir). et al., 2021). The level of calcium varied depending on the type of human bones. The highest Ca concentration is found in the head of the femur, and the lowest in the femoral neck. This may be related to the fact that the femoral head is better vascularized and thus better nourished (Ciosek et al., 2021). Calcium needs depends on the development of bone mass. Ca is mainly

contained in milk, cheese, yoghurt and vegetables. Calcium deficiency in pre-adolescent age causes rickets. In the 6–12 months interval, the adequate intake is 280 mg/day, during the second year, the recommended intake for the population increases to 450 mg/day (Savarino et al., 2021).

Calcium plays a myriad of key roles in cellular biochemistry and in the physiology of living organisms. Calcium participates as a secondary messenger in signal-transduction pathways and is involved with the contraction of muscle cells and the release of neurotransmitters by nervous cells. Calcium is also the cofactor of many enzymes, and is essential for the maintenance of the electrical potential difference across cellular membranes. Finally, 70% of bone is made up of hydroxyapatite, a mineral composed of different calcium salts (Perrone and Monteiro, 2016). Infection will cause decreased food intake, impaired nutrient absorption, direct loss of micronutrients, increased metabolism, loss of nutrients due to increased catabolism and impaired transport of nutrients to tissues.

Indicators of bone repair in stunting toddlers can use several indicators, one of which is blood calcium levels. Patients with linear growth disorders (Body Height/Ages) both short and very short did not all experience problems with impaired nutritional status when viewed from the Body Weight/Ages index, where the measurement results obtained in most samples are 84.44% showed good nutritional status according to research (Hendrayati et al., 2021) that patients with linear growth disorders (Body Height/Ages) both short and very short do not all experience problems with impaired nutritional status when viewed from the Body Weight/Ages index, where the measurement results obtained in most samples are 84.44% showed good nutritional status, other data that can support to determine changes in biomarkers of bone growth improvement and linear growth improvement are energy and nutrient intakes, both macro and micro.

In acute conditions, proinflammatory production such as cytokines have a direct impact on bone remodeling which will inhibit bone growth (Rostika Flora, 2021). Several studies

found differences in the increase in calcium levels in stunted children after giving lemuru fish nuggets (Martony et al., 2020). Another study showed that there was a significant difference in calcium and phosphorus intake between stunted and non-stunted children aged 12-24 months in the city of Semarang (Chairunnisa, 2017).

Therefore, based on the background, a study was conducted to analyze the relationship between serum calcium levels and the incidence of stunting in toddlers aged 24-59 months in Mestong District, Muaro Jambi Regency.

METHOD

This study was an observational analytic study with a cross-sectional design. The research was conducted in the working area of the Health Office of Muaro Jambi Regency in March 2022. Research permits and ethical feasibility were obtained from the Research Ethics Commission of the Faculty of Public Health, Sriwijaya University (No: 081/UN9.FKM/TU.KKE/2022).

A total of 41 samples were selected by simple random sampling. The inclusion criteria were children aged 24-59 months, resided in the study location, had information of date of birth and birth weight and parents or caregivers agreed that their child was involved in the study by signing the informed consent. Exclusion criteria were children suffering from severe disease (parathyroid gland disease, kidney disease and cancer), congenital abnormalities (congenital heart disease), physical disability, and chronic infection. Height and weight of body were measured by microtoise and scales, respectively. The nutritional status of children was determined by using the 2005 WHO standard which is grouped into two categories, namely stunting (z-score < -2 SD) and not stunting (z-score ≥ -2 SD). Subject and family information was taken by interviewing and filling out a questionnaire. The examination of total serum calcium levels in children's blood at the time of the study was carried out using the Calcium (Ca) Colorimetric Assay Kit method (E-BC-K103-M, Elabscience) following the manufacturer's procedure. Data analysis used the

independent parametric T-Test test and continued with the correlation test using the *chi square test* with a significance level of $p < 0.05$.

RESULTS AND DISCUSSION

Characteristics Child

There was 41 subjects in total that participated in the study and 11 participants (26.8%) were categorized as stunting. The gender composition was almost balanced between man and woman (table 1).

Table 1 Characteristics

No.	Characteristics of Respondents	Normal (n)	Stunting (n)
1	Age (months)	42 ± 10	40 ± 11
2	Weight (kg)	13.89 ± 2.13	11.31 ± 1.45
3	Height (cm)	96 ± 7	88 ± 7
4	Z Score (TB/U)	-1 ± 1	-3 ± 1
5	Kids Calcium	1.93 ± 0.20	2.01 ± 0.19
6	Mother's Age (years)	33 ± 6	33 ± 8
7	Gender		
	Man	15	6
	Woman	15	5
8	Family Income		
	Low < Rp. 2,649,034,-	24	9
	Height 2,649,034,-	6	2
9	Mother's Education		
	No school	0	0
	Primary school	6	1
	Junior high school	10	5
	Senior High School	13	5
	College	1	0
10	Mother's Job		
	IRT	26	11
	Farmer	1	0
	Other	3	0
11	Calcium level		
	Normal	18	8
	Low	12	3

Based on Table 1, the characteristics of respondents (mothers of children under five) according to the sex of boys were 21 people (51.2%) with 15 normal people and 6 stunting people. while for girls there were 20 people (48.8%) consisting of 15 normal people and 5 stunting toddlers. Family income based on the Regional Minimum Wage (UMR) is the highest below the minimum wage as many as 33 people (80.48%), the highest maternal education is Senior High School (SMA) 13 people for normal children and 5 people for stunting children, the mother's occupation is mostly as 37 housewives, 26 normal children and 11 stunted children. Normal calcium levels were 26 people, 18 were normal children and 8 were stunted children,

while low calcium levels were 15 people, 12 normal children and 3 stunted children.

chi-square independence test inform that there is no significant association between gender, mother's education on the incidence of stunting, while the results of the *chi-square independence test* inform that there is a significant association between family income, mother's occupation, calcium intake and calcium levels of toddlers with stunting. in toddlers.

Calcium, magnesium and phosphorus are essential for bone tissue homeostasis. a study observed that supplementation with calcium (Ca) had a significant positive effect on bone mineral density (BMA) at puberty; however, in late adolescence this effect is weaker. As stated by these authors, BMD may catch up during the bone consolidation phase to compensate for impaired BMA during the growth spurt associated with insufficient Ca intake. However, this study also makes it clear that people with low calcium intakes may not be able to catch up completely and thus may not reach the baseline metabolic panel peak bone mass (PMB) target (Ciosek et al., 2021) .

There is a significant relationship between calcium intake and stunting. Children under five who lack calcium consumption have a 5,400 times higher risk of experiencing stunting compared to toddlers who consume sufficient calcium (Windra et al., 2021) in line with research conducted (Ferani, 2019) in the Work Area of the Siulak Mukai Kerinci Health Center Jambi showed that calcium intake had a statistically significant relationship with the incidence of stunting with OR = 20,727 meaning that toddlers with low calcium intake had a 20,727 times risk of suffering from stunting compared to toddlers with sufficient calcium intake.

There is a significant relationship between Characteristics Adequacy Nutrition Child and the incidence of stunting, it can be seen in table 2.

It can be seen that the research (Azriful et al., 2018) found that there was no relationship between the level of family income and stunting, in accordance with the opinion of Nursalam, 2005 in Putri Anindita, 2012, which said that infant growth did not have much effect on family income. If families with low incomes are

able to manage nutritious food with simple and inexpensive ingredients, the baby's growth will also be good.

is in line with research (Susindra et al., 2020) which shows that there is a significant relationship between family income and the incidence of stunting in children under five, both in rural and urban areas. When viewed from the characteristics of family income, the root cause of the impact of infant growth and various other nutritional problems is one of them caused and stems from the economic crisis.

Mother's education has no significant association with the incidence of stunting, this is in line with research (Maywita, 2018) even though mothers are highly educated if they do not know about the definition of nutrition, the problem, the causes of nutritional problems in toddlers, the problem of stunting cannot be overcome, for that it is necessary government policy on nutrition education in the community, this can be seen in table 1.

The results of the *chi-square* independence test there is no significant relationship between maternal education and the incidence of stunting in toddlers, with p value = 0.540 p value <0.05 this is in line with research (Susindra et al., 2020) Spearman test results obtained p value value> 0.05, i.e. p value = 0.19 with r = 0.12, meaning that there is no significant relationship between the mother's education level and the incidence of stunting in children under five. between mother's work and the incidence of stunting where mothers who do not work have a significant relationship with the incidence of stunting. There is a difference with the study (Susindra et al., 2020) with the results of the Spearman test obtained p value > 0.05, namely p = 0.95 with r = 0.00 meaning that there is no significant relationship between mother's work and the incidence of stunting in toddlers . According to Dahlan (2011) the range of r = 0.0 to <0.2 is included in the category of very weak correlation strength. The following is table 2 which shows the relationship Among intake calcium with Nutritional Status

Table 2 Relationship Among intake calcium with Nutritional Status

Intake Calcium	Nutritional Status				Total	p value	PR (95% CI)
	Stunting		Not stunting				
	n	%	n	%	n	%	
Low	8	42.1	11	57.9	19	100	0.08 4.6 (1.007–21.072)
Normal	3	27.3	19	63.3	22	100	
Amount	11	26.8	30	73.2	41	100	

Table 2 show that proportion intake calcium low more many on child with those who are not stunting, namely 57.9%, while intake calcium low also more big on child with group that doesn't stunting that is 63.3%. Based on test statistics with use Chi square test is obtained p value $0.08 > \alpha(0.05)$, so that could concluded by statistics that no there is connection Among intake calcium with nutritional status.

The relationship between Factor Model Status risk nutrition and the incidence of stunting can be seen in table 3.

Table 3 Factor Model Status risk nutrition

Variable	B	p value	Exp (B)	95% CI
Serum calcium	1,527	0.049	4,606	1.007 – 21.072

Table 3 Based on test statistics with use regression logistics double, get p value $0.049 < \alpha(0.05)$, Value The prevalence ratio is 4.606 (1.007 – 21.072) so that could concluded by statistics that there is connection Among intake Serum calcium with nutritional status. Based on score association is known child with calcium low have risk child experiencing stunting 4,606 times more big compared with child with intake normal calcium after controlled by income family.

Calcium plays a myriad of key roles in cellular biochemistry and in the physiology of living organisms. Calcium participates as a secondary messenger in signal transduction pathways and is involved with muscle cell contraction and neurotransmitter release by nerve cells. Calcium is also a cofactor of many enzymes, and is essential for the maintenance of electrical potential differences across cell membranes. (Perrone and Monteiro, 2016).

CONCLUSION

The problem of stunting is a very complex problem, because many things can cause this problem, for that a multivariate analysis was carried out. From the results of this analysis, it was found that the most dominant factor causing stunting was the mother's occupation with a p-value of 0.02 so that the p-value < 0.005 . Parenting is one of the factors that play an important role in the nutritional status of toddlers. Nutritional problems are influenced by many factors that influence each other in a complex manner. One of the factors that influence it is the mother, nutritional status is influenced by the mother's ability to provide sufficient food for children and parenting is influenced by factors such as family income, education, behavior and number of siblings. Based on the results of the study, it was found that serum calcium levels did not affect the incidence of stunting in toddlers. However, the needs and intake of toddlers, especially calcium, must be prioritized, this is related to the toddler's growth period in order to avoid infectious diseases during growth. The health office and puskesmas must develop policies and strategies for health programs that can monitor the nutritional intake needs of toddlers containing calcium, and provide education about balanced nutritional intake.

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