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The relationship between calcium, zinc and mothers height consumption with stunting incidence in Bengkulu City in 2024

Hubungan konsumsi kalsium, zink dan tinggi badan ibu dengan kejadian stunting di Kota Bengkulu tahun 2024

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Abstract

Stunting is a chronic nutritional problem influenced by multiple factors, including dietary intake and maternal conditions. Low calcium and zinc intakes can hinder bone growth and metabolic processes, thereby increasing the risk of stunting. In addition, short maternal height, as a reflection of past nutritional status, played a role in fetal growth. This study aimed to analyze the association between calcium and zinc intake, maternal height, and the incidence of stunting among children in Bengkulu City. This quantitative study employed a cross-sectional design and was conducted at the Sawah Lebar Primary Health Center, Bengkulu City, from April to May 2024. A total of 77 children aged 6–59 months were selected using simple random sampling. Dietary intake data were obtained through interviews using a semi-FFQ, while nutritional status was assessed using the height-for-age index. Data were analyzed using Pearson's correlation test. The results showed a significant association between calcium intake (r = 0.636), zinc intake (r = 0.280), and maternal height (r = 0.290) and stunting. In conclusion, the importance of adequate Ca and Zn intake and maternal nutritional status in supporting child growth. Therefore, nutritional interventions should be implemented early, not only for children but also for adolescent girls as future mothers.

Keywords: Calcium, mothers height, stunting, zinc

Abstrak

Stunting merupakan masalah gizi kronis yang dipengaruhi oleh berbagai faktor, termasuk asupan gizi dan kondisi ibu. Asupan kalsium dan zinc yang rendah dapat menghambat pertumbuhan tulang serta proses metabolisme, sehingga meningkatkan risiko stunting. Selain itu, tinggi badan ibu yang pendek sebagai cerminan status gizi masa lalu berperan dalam pertumbuhan janin. Penelitian ini bertujuan untuk menganalisis hubungan antara konsumsi kalsium, zinc, dan tinggi badan ibu dengan kejadian stunting pada balita di Kota Bengkulu. Penelitian menggunakan desain kuantitatif dengan pendekatan potong lintang (cross-sectional) yang dilaksanakan di Puskesmas Sawah Lebar, Kota Bengkulu, pada bulan April hingga Mei 2024. Sampel sebanyak 77 balita berusia 6–59 bulan dipilih dengan teknik acak sederhana. Data asupan gizi dikumpulkan melalui wawancara menggunakan formulir Semi-FFQ, sedangkan status gizi anak diukur berdasarkan indeks tinggi badan menurut umur. Analisis data dilakukan dengan uji Korelasi Pearson. Hasil penelitian menunjukkan terdapat hubungan yang bermakna antara asupan kalsium (r = 0,636), asupan zinc (r = 0,280), dan tinggi badan ibu (r = 0,290) dengan kejadian stunting. Kesimpulan, pentingnya kecukupan asupan kalsium, zinc, dan kondisi gizi ibu dalam mendukung pertumbuhan anak. Oleh karena itu, intervensi gizi perlu dilakukan sejak dini, tidak hanya pada anak, tetapi juga pada remaja putri sebagai calon ibu.

Kata Kunci: Kalsium, stunting, tinggi ibu, zinc

Introduction

Indonesia is a developing country that faces nutritional problems that are often found in toddlers, which can inhibit their growth and development. This is a nutritional problem caused by long-term malnutrition, which occurs when the available food is not sufficient to meet the nutritional needs of the body (Thamrin et al., 2021).

Stunting is a condition in which children experience impaired growth and development due to prolonged malnutrition during the critical early years, from birth up to 59 months, measured by nutritional indices such as Body Length or Height, compared to age. A Z-score <-2 standard deviation indicates that the child's height does not match their age (Niland et al., 2020). According to 2022 data from the World Health Organization (WHO), approximately 22,3% of children worldwide around 148,1 million are affected by stunting. These children are under 5 years old, so further action is needed to achieve it WHO's target in 2025 is to reduce the number of cases to 100 million (UNICEF et al., 2023).

The Indonesia Nutritional Status Study 2022 revealed that the incidence of stunting has decreased every year, reaching 24,4% in 2021. In 2022, the prevalence rate of stunting reached 21,6% (Kemenkes, 2022). The Indonesia Nutritional Status Study 2022 reported that the Bengkulu Province Nutritional Status Survey ranked 24th, with a stunting prevalence of 19,8% (Kemenkes, 2022). Based on the 2023 Indonesian Health Survey, the national toddler stunting trend in 2023 decreased to 21,5%. Nineteen provinces experienced a decline. There are 4 provinces that experienced the largest decline, namely Bali Province (7,2%), Jambi (13,5%), Riau (13,6%), Lampung (14,9%). The four provinces that experienced the highest increase in stunting were NTT Province (37,9%), Papua (33,6%), West Sulawesi (30.3%), and Southeast Sulawesi (30%) (Kemenkes, 2023).

The high prevalence of stunting can be caused by various factors, including the number of children, spacing between births, mother's height, parenting and diet patterns, and maternal age (Thurstans et al., 2022; Vaivada et al., 2020). Children born to mothers with short stature are at risk of stunting because this physical factor can be passed down through the genetic structure. This increases the likelihood of a child inheriting the gene and growing up stunted (Yulianti et al., 2022).

Zinc deficiency can result in slower physical and cognitive growth, reduced immunity, increased risk of acute illness in toddlers, and stunting in childhood (Lassi et al., 2020). The novelty of this study is that it used more complex variables than previous studies, with the aim of determining the relationship between calcium, zinc, and mothers' height consumption with the incidence of stunting.

Methods

This research design uses a quantitative research type with a cross-sectional approach, using a simple random sampling technique with a sample size of 77 toddlers. This study was conducted in the working area of the Sawah Lebar Health Center in Bengkulu City from April to May 2024. The data collection procedure involved measuring the height of toddlers under 2 years using an infantometer, the height of toddlers over 2 years, and mothers of toddlers using a stadiometer and conducting SQ-FFQ interviews to obtain toddler consumption data. Data processing techniques begin with editing, coding, entry, tabulation, and cleaning. Data analysis was performed using univariate and bivariate analyses, namely, using the Pearson test. Before this study begins, research ethics permission must first be submitted to the KEPK Poltekkes Kemenkes Bengkulu, with the ethics approval number KEPK.BKL/247/05/2024.

In this study, a simple random sampling technique was adopted. This method ensured that each research subject in the population had an equal chance of being selected as a participant. The number of participants in this study was set at approximately 77 based on statistical calculations. The method of using the simple random technique in addition to determining the population to be studied is infants aged 6-59 months in the Sawah Lebar Health Center Work Area, Bengkulu City, in 2024, taken proportionally from each integrated health post.

The nutritional status of toddlers and the height of mothers were measured by weighing body weight and measuring height at the Integrated Health Post, while calcium and zinc intake were assessed using a semi-FFQ form. The data were then processed using Pearson's correlation.

Result and Discussion

The frequency distribution according to the participant characteristics is shown in Table 1.

Table 1. Characteristics of research participants

Characteristics	n	%
Gender		
Female	41	53,2
Male	36	46,8
Age (Months)		
6-11	9	11,7
12-23	24	31,2
24-35	28	36,4
36-47	12	15,6
48-59	4	5,2
Mother Job		
Work	74	96,1
Doesn't work	3	3,9
Toddler Nutritional Status		
Stunting	25	32,5
Normal	52	67,5
Calcium Consumption		
Not enough	35	45,5
Enough	42	54,5
Zinc Consumption		
Not enough	31	40,3
Enough	46	59,7
Mother Height		
Short	3	3,9
Normal	74	96,1

This study involved 77 toddlers, including 41 females (53,2%) and 36 males (46,8%). Based on age group, most toddlers were aged 24–35 months (36,4%), followed by those aged 12–23 months (31,2%), 36–47 months (15,6%), 6–11 months (11,7%), and the lowest in the 48–59 months group (5,2%). The majority of mothers did not work (96,1%), and only 3,9% were employed. In terms of nutritional status, 25 toddlers (32,5%) were stunted, whereas 52 toddlers (67,5%) had normal nutritional status. Regarding calcium intake, 35 toddlers (45,5%) had insufficient intake, whereas 42 toddlers (54,5%) had sufficient intake. Regarding zinc intake, 31 toddlers (40,3%) had inadequate intake, whereas 46 toddlers (59,7%) had adequate intake. As for mother's height, only 3,9% were categorized as short, while 96,1% had normal height. This study showed that toddlers aged 12-23 months are more susceptible to stunting, in accordance with the theory that stunting is caused by a lack of nutritional intake during pregnancy and the lack of fulfillment of toddler nutritional needs, especially before the age of 2 years, which can be caused by a lack of quality breast milk.

Calcium and zinc consumption in stunted toddlers in this study describes toddlers' eating habits over the past month. The amount consumed was clearly lower than the recommended nutritional requirement. This greatly affects the growth of toddlers, which affects the incidence of stunting. Lack of consumption of calcium and zinc sources is the main cause of this, and the majority of toddlers who experience stunting do not consume foods that are high in calcium, such as dairy products, cheese, and their derivatives, as well as high-zinc sources such as beef, chicken, and beef liver. Calcium is an essential mineral for bone formation and can be found in daily foods, especially in calcium-rich dairy products. Therefore, adequate calcium consumption is crucial. to maintain the physiological functions of the body, especially to support bone growth and development (Wati & Suryana, 2022).

Mothers' work is also related to family income, and the type of work can affect the ability to meet family nutritional needs. Other studies have revealed a relationship between maternal employment status and children's nutritional and health status. Working mothers can increase their family income, which in turn contributes to increased food intake (Setyaningsih et al., 2023).

This study also indicated that women with low height tend to have children who experience stunting. However, not all stunted children were born to short mothers. Other factors, such as lack of nutritional intake, which is important for bone growth, also play a role, so that when nutritional needs are not met, toddler growth is disrupted, causing stunting. Even if the mother is short, her child does not always experience stunting if nutritional needs are met, and is not exposed to other aspects, including infection or inadequate parenting. Mother height is one of the elements that impact stunting caused by family elements, including heredity, and plays a role in growth and development. Families with a tendency to be tall or short can affect a child's growth, and some genetic disorders such as dwarfism can also contribute (Thurstans et al., 2022; Miko & Al-Rahmad, 2017).

Female height reflects the nutritional and socioeconomic status of women in the past. Short body size can be influenced by hereditary factors or disease situations such as hormone deficiency, which increases the possibility of passing on short genes to children. Maternal health factors influenced by nutritional deficiencies or diseases can also contribute to suboptimal body growth (Baidho et al., 2021).

Therefore, it is crucial to ensure adequate nutrient consumption to support development so that subsequent offspring can avoid growth problems, such as stunting (Baidho et al., 2021). If mothers with short stature do not support their children's growth through other factors, it can lead to continued growth failure between generations (Sholeha, 2023). Height is also a result of inherited genetic expression, where adult individuals with low gene expression can pass on these characteristics to their offspring, which in turn is associated with the risk of stunting (Jannah et al., 2020).

Table 2. The relationship between Calcium, Zinc and mothers height with stunting incidence in Bengkulu City in 2024

Independent Variable	Mean±SD	Median	Min	Max	Correlation Coefficient (r)	p-value
Calcium Intake (mg)	482,76±129,76	523,20	153,7	713,8	0,636	0,000
Zinc Intake (mg)	2,64±0,77	2,70	0,8	5,2	0,280	0,014
Mothers Height (cm)	153,42±4,42	153	139	164	0,290	0,010

Based on the results of the Pearson correlation analysis, a significant relationship was found between calcium intake, zinc intake, and mothers' height and the incidence of stunting among children aged 6–59 months. The correlation coefficient for calcium intake was r = 0,636 (p = 0,000)**,** zinc intake showed a correlation of r = 0,280 (p = 0,014)**,** and for mother's height, it was r = 0,290 (p = 0,010) indicating strong and statistically significant positive correlations with the child's Z-score. These findings suggest that all nutritional factors equally affected the incidence of stunting in this population**.**

Calcium intake was significantly positively associated with stunting outcomes. This strong correlation indicates that higher calcium consumption is associated with higher Z-scores, meaning that children with adequate calcium intake are less likely to experience stunting. This reinforces the understanding that calcium is a critical nutrient during early childhood growth, particularly in supporting bone development and linear growth during the first few years of life (Sudiarmanto & Sumarmi, 2020).

Calcium plays an essential role in bone mineralization and elongation. Chronic calcium deficiency during the growth period can lead to impaired skeletal development, which directly affects a child's height. Inadequate calcium intake disrupts bone density and linear growth, contributing to stunted growth (Priyantini et al. 2023). Therefore, ensuring sufficient calcium intake during early childhood is a crucial step in preventing growth delays and reducing the prevalence of stunting (Pratiwi et al., 2024).

This finding was supported by Stuijvenberg et al. (2015), who noted that adequate calcium consumption plays a significant role in supporting healthy bone formation and preventing stunting. Therefore, nutritional interventions targeting stunting should prioritize calcium adequacy. Parental education about calcium-rich foods, such as dairy products, small fish consumed with bones, and green leafy vegetables, is essential to promote optimal child growth (Stuijvenberg et al., 2015).

Wati (2021) reported that early childhood with zinc deficiency had a 4,667 fold greater chance of suffering from developmental delays than the comparison group. In addition, Rohmah & Mardiana (2023) found similar results, where low zinc consumption was significantly associated with an increased risk of stunting in Semarang City. Zinc deficiency can inhibit physical and cognitive growth, reduce immunity, increase the risk of acute illness in toddlers, and contribute to childhood stunting (Lassi et al., 2020). Zinc plays a role in various metabolic functions, and insufficient zinc intake can lead to immune system disorders, cognitive problems, and growth retardation (Abdollahi et al., 2019).

A systematic review and meta-analysis by Monfared et al. (2023) found that zinc supplementation in healthy children over the age

of two significantly improved height (average +0.9 cm), weight (+0,51 kg), and Height for Age Z-score (HAZ +0,07; $p < 0,001$), indicating that zinc intake plays an important role in linear growth during early childhood to school age. This finding is supported by a cross-sectional study conducted by Priyantini et al. (2023), which showed that toddlers aged three years who consumed less than 3 mg of Zn per day had a significantly higher risk of stunting ($p = 0,001$), although no significant difference was observed in monthly height gain. These results support the hypothesis that adequate zinc intake, while not always linked to short-term growth acceleration, has a meaningful impact on reducing stunting prevalence through improved height-for-age status.

A meta-analysis of 54 randomized controlled trials found that zinc supplementation significantly improved linear growth and height for age (HAZ) z-scores in children aged 2–5 years. On average, children receiving zinc showed an increase of approximately 1,37 cm in height and a HAZ improvement of +0,12, highlighting zinc's positive effect on early childhood growth (Ahmad et al., 2022). Supporting this, a study in Nepal revealed that low Zn levels in agricultural soil led to decreased Zn content in staple crops, contributing to a higher prevalence of stunting among children in the region (Bevis et al., 2023). Together, these findings emphasize that improving Zn intake through supplementation or enhancing the nutritional quality of the food supply is essential for preventing stunting in children.

In addition to calcium intake, zinc intake and mother height also showed a significant relationship with child stunting. A correlation coefficient of $r = 0,290$ ($p = 0,010$) indicates that taller mothers are more likely to have children with better growth outcomes. Mothers height is an anthropometric indicator reflecting long-term nutritional status and health during adolescence and early adulthood, both of which contribute to a mother ability to support fetal and child growth (Khatun et al., 2019). Low maternal height potentially increases the risk of children experiencing various types of malnutrition by two–three times ($p < 0,041$), and no significant association was found between wasting, overweight/obesity, and the nutrition paradox (Khaliq et al., 2024).

Amaha & Woldeamanuel (2021), demonstrated a significant association between maternal height and childhood stunting in Ethiopia. Mothers with a height below 150 cm were two to three times more likely to have stunted children than those taller than 160 cm. Additionally, each 1 cm increase in maternal height was associated with a 0,5% reduction in the risk of stunting. These findings underscore the critical role of maternal nutritional status and physical development reflecting intergenerational nutritional influences in determining child growth outcomes. Therefore, stunting prevention efforts should begin before pregnancy by improving the health and nutritional status of women, particularly in addressing chronic undernutrition that leads to short stature.

The results of this study align with those of Baidho et al. (2021), who emphasize that short mother stature increases the likelihood of stunting in children. This underscores the importance of early intervention targeting not only children, but also adolescent girls and young women to improve maternal nutrition and break the cycle of stunting. A life-cycle approach is essential to ensure that future mothers are nutritionally prepared to support the growth and development of their children.

Conclusion

Calcium and zinc consumption in toddlers who experience stunting is usually lower than the age-recommended RDA. In addition, maternal height tends to be lower than that of mothers without stunted children. The findings showed an association between calcium and zinc intake and maternal height with the incidence of stunting in children aged 6-59 months in the Working Area of Puskesmas Sawah Lebar Bengkulu City 2024.

The role of nutrition workers is very important in working together and advocating for health centers in the stunting control plan. Counseling and education about nutrition for guardians are needed so that they can provide adequate food according to the needs of toddlers to support optimal growth and development.

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