Description of calcium intake in children aged 9-15 years old

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ABSTRACT

Introduction: *Calcium is a main mineral that forms the hard structures of bone and teeth. The Government set standard of calcium intake by Recommended Dietary Allowances (RDA). RDA of children aged 9 years old was 600mg/day and RDA of children aged 10-15 years old was 1000mg/day. The aim of this research was to get description of calcium intake in children aged 9-15 years old in Bandung.* **Methods:** *The research method was descriptive method with survey technique. Sample selected by cluster random sampling technique, an amount of children of 609 children aged 9-15 years old which was 157 children aged 9 years old and 452 children aged 10-15 years old.* **Results and Discussion:** *The result of this research shows that the average of calcium intake in children aged 9 years old is 435.47 mg/day and children who lack calcium intake is 86 children or 61.43%. The average of calcium intake in children aged 10-15 years old is 613.85 mg/day and children who lack calcium intake is 317 children or 71.72%.* **Conclusion:** *The conclusion of this research is calcium intake in children aged 9-15 years old is less than RDA.*

Keywords: *Age, Calcium, Recommended Dietary Allowances*

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INTRODUCTION

Growth and development are continuous processes that begin during the intrauterine period and persist throughout an individual's life[1]. Growth refers to changes in size, quantity, and volume at the cellular, organ, or individual level, while development refers to the acquisition of increasingly complex structural and functional capabilities resulting from maturation. These processes are influenced by both genetic and environmental factors. Genetics provide the foundation for a child's growth and developmental potential, whereas environmental factors determine whether that potential is realized. Among these, environmental influences are more prominent, as they affect individuals from conception to the end of life[2].

Nutrition is a key environmental factor essential to optimal growth and development in children. It supports tissue maintenance, physiological functions, and cellular protection. Inadequate nutrition can result in stunted growth, weakened immunity, and delayed mental development[3]. Essential nutritional components necessary for optimal growth and development include protein, minerals, vitamin C, and vitamin D. One critical mineral is calcium.

Calcium is the most abundant mineral in the human body. Approximately 99% of the body's total calcium is stored in hard tissues—primarily bones and teeth—in the form of hydroxyapatite, while only a small amount circulates in plasma and extracellular fluids[4]. Calcium plays a key role in tooth formation and various physiological and biochemical functions such as blood clotting, nerve signaling, cell membrane integrity, enzyme activation, and hormone secretion[5]. Calcium, phosphorus, and vitamin D are interdependent nutrients. Vitamin D is essential for the absorption of calcium and phosphorus in the small intestine[6]. Calcium also plays a vital role in bone growth, contributing to bone strength and health in old age.

Bone growth in children follows a specific acceleration curve. The initial phase of bone growth occurs between the ages of 9-12 years, followed by the most rapid growth

phase between 12–15 years. Growth then decelerates between ages 16–20 years. Adequate calcium intake during the early and rapid growth phases is critical for optimal bone development and the achievement of peak bone mass (PBM)[7]. Therefore, children aged 9–15 years require sufficient calcium intake in accordance with established standards to attain their PBM.

In Indonesia, the recommended dietary allowance for calcium, according to the Nutritional Adequacy Rate (AKG), is 600 mg/day for children aged 9 years and 1,000 mg/day for those aged 10–15 years. A study by Fikawati (2005) reported that adolescent calcium intake in the city of Bandung was only 559.05 mg/day, amounting to merely 55.9% of the recommended AKG. According to the Indonesian Hospital Association (PERSI, 2006), national calcium consumption is even lower, averaging just 240 mg/day. This indicates a significant calcium deficiency that may hinder bone growth and increase the risk of osteoporosis later in life.

Several factors are associated with calcium deficiency in Indonesia. Research indicates that low calcium intake is significantly related to limited knowledge about calcium and low parental income. A study by Endang Mulyani (2009) found that 71.9% of low calcium consumption was associated with poor knowledge, while 61.2% was linked to low family income.

Given the background above and the limited data available on calcium intake in the city of Bandung, this study aims to examine the dietary calcium intake patterns among children aged 9–15 years.

METHODS

This study employed a descriptive research design utilizing a survey technique. Descriptive research aims to provide a systematic overview of the subject under investigation. The study population consisted of children aged 9–15 years residing in Bandung City. A two-stage cluster random sampling method was used to select the sample. In the first stage, six out of thirty districts in Bandung City were randomly selected. In the second stage, one elementary school and one junior high school were randomly chosen from each selected district. The final sample included the following schools: SD Karang Pawulang, SD Sejahtera, SDN 1 Babakan Ciparay, SDN 1 Bandung Kulon, SDN 1 Babakan Surabaya, SMPN 13, SMPN 19, SMPN 21, SMPN 31, SMPN 36, and SMPN 37. Data were collected by the researchers and processed using computer-assisted analysis with specialized software.

RESULTS

Sample characteristics were categorized by gender, school, age, and household income. Diagram 1 presents the number of respondents by gender. A total of 609 students participated in the study. The majority of respondents were female, comprising 389 individuals (63.88%), while the remaining 220 individuals (36.12%) were male.

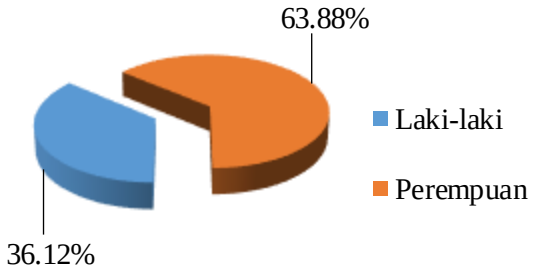

Figure 1 Number of Respondents by Gender

Based on the data presented in Diagram 2, the number of respondents by school can be identified. The majority of respondents came from SD Bandung Kulon, with a total of 135 students (22.17%), while the fewest were from SMP 13, with only 23 students (3.78%).

Based on the data presented in Diagram 2, the distribution of respondents by school name is illustrated. The highest number of respondents came from SD Bandung Kulon, totaling 135 individuals (22.17%), while the lowest number of respondents was from SMPN 13, with 23 individuals (3.78%).

Table 1 Number of Respondents by Age

Age (Years)	Frequency	(%)
9	157	25,78%
10	114	18,72%
11	93	15,27%
12	97	15,93%
13	86	14,12%
14	45	7,39%
15	17	2,79%
Total	609	100,00%

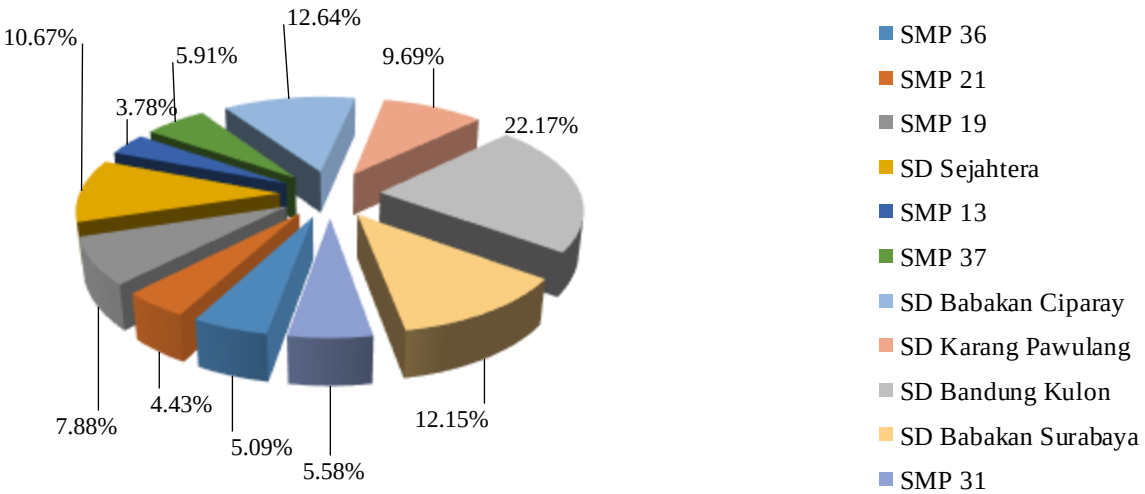

Figure 2 Number of Respondents by School

Based on the data presented in Table 2, the number of respondents by income can be observed. The majority of respondents had an income ranging from IDR 1,000,000 to IDR 5,000,000, totaling 249 individuals (40.89%), while the smallest group consisted of unemployed respondents, with only 1 individual (0.16%).

Table 2 Number of Respondents by Income

Income	Frequency	(%)
< Rp500.000	80	13,14%
Rp500.000 - Rp1.000.000	236	38,75%
Rp1.000.000 - Rp5.000.000	249	40,89%
> Rp5.000.000	43	7,06%
Unemployed	1	0,16%
Total	609	100,00%

Calcium Intake

Based on the data presented in Table 3, the mean, maximum, and minimum values of calcium intake among all respondents were identified. The maximum calcium intake recorded was 1,977.80 mg/day, while the minimum was 9.23 mg/day. The mean calcium intake across all respondents was 570.94 mg/day, with a standard deviation of 331.09 mg/day.

Tabel 3 Total Calcium Intake Calculation Results

Intake Measure	Value (mg/day)
Maximum Intake	1977,80
Minimum Intake	9,23
Mean Intake	570,94
Standard Deviation	331,09

Total Calcium Intake of All Respondents by Gender

Based on the data presented in Table 4, the total calcium intake of all respondents by sex was determined. The mean calcium intake among male respondents was 554.48 mg/day, with a standard deviation of 329.50 mg/day. In comparison, the mean calcium intake among female respondents was 579.96 mg/day, with a standard deviation of 332.06 mg/day.

Table 4 Total Calcium Intake of All Respondents by Gender

Gender	Intake Measure	
	Mean Intake	Standard Deviation
Male	554,48	329,50
Female	579,96	332,06

Calcium Intake Among 9-Year-Old Children

Based on the data presented in Table 5, the maximum and minimum calcium intake values for respondents aged 9 years were identified. The maximum calcium intake was 1,977.80 mg/day, and the minimum was 10.50 mg/day. The mean calcium intake for this age group was 435.47 mg/day, with a standard deviation of 309.87 mg/day.

Table 5 Calcium Intake Among 9-Year-Old Children

Intake Measure	Value (mg/day)
Maximum Intake	1977,80
Minimum Intake	10,50
Mean Intake	435,47
Standard Deviation	309,87

Based on the data in Table 6, the calcium intake distribution among 9-year-old children was evaluated. The majority of children (86 respondents or 61.43%) had calcium intake levels below 75% of the Recommended Dietary Allowance (RDA). The smallest proportion was found among children whose calcium intake was between 110–125% of the RDA (6 children or 4.29%).

Table 6 Distribution of 9-Year-Old Respondents by Calcium Intake Level

Calcium Intake (% RDA)	n	%
< 75%	86	61,43%
75 - 89%	16	11,43%
90 - 109%	12	8,57%
110 - 125%	6	4,29%
> 125%	20	14,29%
Total	140	100%

Calcium Intake Among Children Aged 10–15 Years

Based on the data presented in Table 7, the maximum and minimum calcium intake values for respondents aged 10–15 years were identified. The maximum intake was 1,749.97 mg/day, and the minimum was 9.23 mg/day. The mean calcium intake for this age group was 613.85 mg/day, with a standard deviation of 326.32 mg/day.

Table 7 Calcium Intake Among Children Aged 10–15 Years

Intake Measure	Value (mg/day)
Maximum Intake	1749,97
Minimum Intake	9,23
Mean Intake	613,85
Standard Deviation	326,32

According to Table 8, the calcium intake distribution among children aged 10–15 years shows that the majority (317 respondents or 71.72%) consumed less than 75% of the RDA. The smallest group consisted of children with intake levels between 110–125% of the RDA (17 respondents or 3.85%).

Table 8 Distribution of Respondents Aged 10–15 Years by Calcium Intake Level

Calcium Intake (% RDA)	n	%
< 75%	317	71,72%
75 - 89%	42	9,50%
90 - 109%	44	9,95%
110 - 125%	17	3,85%
> 125%	22	4,98%
Total	442	100%

DISCUSSION

The findings of this study on calcium intake patterns among children aged 9–15 years in Bandung, as shown in Table 4.5 and Table 4.7, indicate that the recommended Dietary Allowance (RDA) established by the government has not yet been met. Table 4.5 shows that the mean calcium intake of 9-year-old children was only 435.47 mg/day, although the RDA is 600 mg/day. Similarly, Table 4.7 shows that the mean calcium intake of children aged 10–15 years was 613.85 mg/day, while the recommended intake is 1,000 mg/day.

The National Food and Nutrition Workshop (Widyakarya Nasional Pangan dan Gizi, 2004) categorizes nutrient adequacy as follows: adequate if intake reaches 75%–125% of the RDA, inadequate if <75%, and excessive if >125%. Table 4.6 shows that the majority of 9-year-olds had inadequate calcium intake, with 61.43% consuming less than 75% of the RDA. Table 4.8 presents a similar pattern in children aged 10–15 years, with 71.72% also falling below the 75% threshold. These findings indicate that children aged 10–15 years are more likely to experience calcium deficiency compared to those aged 9 years.

Low calcium intake, according to Gopalan (2003), is due to dietary patterns in Asian populations, which are dominated by cereal-based foods and high-phytate content, both of which reduce calcium bioavailability. Additionally, the consumption of milk and dairy products—the main sources of dietary calcium—is low, as is the intake of green leafy vegetables, which are also excellent sources of calcium[9].

A deficiency in calcium, phosphorus, or both can result in poor tooth calcification and increased risk of dental caries. Experiments in rats with different calcium ratios have shown that low calcium intake affects dentin formation, resulting in thickening of the predentin layer and increased interglobular dentin. Reduced phosphate intake alters apatite composition, producing carbonated apatite, which is more soluble in acid than low-carbonate apatite. Calcium deficiency also triggers mobilization of calcium from bone. Osteoporotic changes have been observed in the mandibles of elderly women with low calcium intake, leading to recommendations for calcium supplementation[10].

Low calcium intake also affects maxillofacial and skeletal development. Bone mineral mass, or Bone Mineral Content (BMC), is directly influenced by calcium intake. Inadequate calcium consumption results in lower BMC. One important bone in the maxillofacial region is the alveolar bone, which may exhibit restricted superior-inferior growth due to low calcium intake. This can affect the alignment of teeth and increase the risk of malocclusion[11].

Excess calcium intake was also observed in this study. A total of 20 children aged 9 years (14.29%) and 22 children aged 10–15 years (4.98%) had calcium intake levels above the RDA. Although these levels were still considered tolerable by the body, consistent excessive intake may result in kidney dysfunction, delayed blood clotting, and digestive disorders[12].

Table 4 shows that there was no significant difference in calcium intake between boys and girls. However, the National Institutes of Health (NIH) has reported that girls are at greater risk of calcium deficiency, especially between the ages of 10 and 17, when intake typically declines. One of the contributing factors is frequent consumption of carbonated soft drinks, which are often consumed in place of milk. These beverages usually contain caffeine, which increases calcium excretion through urine[13].

Low calcium intake may also stem from the perception that milk causes weight gain among adolescent girls. This is supported by findings showing that more girls than boys had inadequate calcium intake[14]. Differences in calcium consumption between sexes are critical for understanding the risk of osteoporosis. Girls are more susceptible to calcium deficiency and tend to experience greater reductions in intake, which increases their osteoporosis risk. Inadequate calcium intake during the bone-forming years leads to a lower peak bone mass (PBM). If calcium intake remains low beyond the PBM phase, the rate of bone mass loss increases and osteoporosis risk rises substantially[15].

Lower calcium intake in girls also poses risks to growth and development. Girls require more calcium than boys to achieve maximum PBM and prevent osteoporosis later in life. The risk is higher in females due to physiological and biological factors such as menopause, during which estrogen levels decline, increasing bone turnover and bone resorption. Additionally, menstruation causes calcium loss through blood, which must be compensated by adequate dietary intake to maintain calcium balance[16].

The insufficient calcium intake identified in this study aligns with previous research by Mulyani (2009) and Fikawati (2005). Mulyani reported a mean intake of 759.22 mg/day, or 75.92% of the RDA, while Fikawati reported 559.05 mg/day, or just 55.9% of the RDA[17].

The failure to meet calcium intake recommendations may be influenced by several factors, one of which is household income. Table 2 shows that the largest group of parents earned between IDR 1,000,000 and IDR 5,000,000, followed by those earning IDR 500,000 to IDR 1,000,000. These findings are consistent with Mulyani's (2009) research linking parental income to calcium consumption.

Socioeconomic status, particularly purchasing power, plays a crucial role in determining health outcomes. A family's ability to buy nutritious food is dependent on income level and food prices. Households with limited income are often unable to meet their nutritional needs, especially for essential nutrients such as calcium[18].

The standard deviations in calcium intake—309.87 mg/day for 9-year-olds and 326.32 mg/day for 10–15-year-olds—demonstrate a wide range of intake variation. This suggests considerable diversity in dietary patterns, which may be due to sample heterogeneity. Respondents came from various regions of Bandung, with varying socioeconomic conditions, resulting in a broad distribution of intake levels.

Individual dietary intake can be assessed through several methods, including 24-hour recall, food record, dietary history, and food frequency questionnaires (FFQ). In this study, data collection was conducted using FFQs filled out by either the parents or the respondents themselves. While this method is practical, it also has limitations, including potential reporting errors, misunderstanding of instructions, inattention to researcher explanations, or inaccurate responses, all of which may compromise data quality[19].

CONCLUSION

The calcium intake among children aged 9–15 years in Bandung was below the Recommended Dietary Allowance (RDA) set by the government.

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