

Sugar-sweetened beverages intake as a correlate of nutritional status in students at SDN Sandana Tolitoli

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Abstract. Sugar-sweetened beverages are a major source of added sugar among school-aged children and may increase the risk of overweight and obesity. In elementary schools, consumption tends to rise due to easy access to packaged products. This study examined the frequency and amount of sugar-sweetened beverage consumption and its association with the nutritional status of elementary school students at Sekolah Dasar Negeri (SDN) Sandana, Tolitoli Regency. A descriptive analytic study with a cross-sectional approach was conducted involving 70 students from grades IV and V, selected through purposive sampling. Data were collected via interviews using a Semi Quantitative Food Frequency Questionnaire (SQ-FFQ), 24-hour dietary recall, and anthropometric measurements. Statistical analysis used the Spearman Rank correlation test. Results showed that 27 students (38.6%) frequently consumed sugar-sweetened beverages, while 43 (61.4%) consumed them infrequently. Despite this, 28 students (40.0%) had excessive daily sugar intake (>50 grams/day), and 42 (60.0%) were within the adequate category, with an average intake of 43.2 grams/day close to the WHO recommended limit. These findings suggest that low consumption frequency does not necessarily reflect low sugar intake. No significant association was found between sugar intake and nutritional status, although average intake remained relatively high.

1 Introduction

Sugar-sweetened beverages (SSBs), drinks with high sugar content, are among the most frequently consumed beverage categories globally. These beverages are defined by the addition of sweeteners, such as simple sugars, to increase caloric density, yet they typically possess low concentrations of other essential nutrients. As simple carbohydrates, SSBs are rapidly digested and absorbed, and their excessive consumption can lead to body fat accumulation and increase the risk of obesity [1].

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International guidelines advise strict limits on this intake. The World Health Organization (WHO) advises restricting added sugar to less than 5% of total daily energy, while the American Heart Association (AHA) recommends less than 25 grams per day for individuals aged 2 to 18 [2,3]. In Indonesia, the Ministry of Health Regulation (Permenkes 2013 No. 30) advises a daily sugar limit of 50 grams (10% of total energy) [4]. However, many SSBs in Indonesia (300–500 ml) contain 37–54 grams of sugar per package, often exceeding these daily recommendations in a single serving [5].

This high consumption is a significant concern for school-aged children, a demographic undergoing rapid physical growth. Adequate nutritional fulfillment is essential to support their development, yet this population faces a dual burden of nutritional problems, encompassing both undernutrition and overnutrition. Consumption habits, particularly of high-sugar beverages, are a key behavior that can negatively impact their nutritional status.

Data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia, SKI) highlights this nutritional challenge. Nationally, among children aged 5–12 years, 19.7% were overweight or obese, while 11.0% were thin or severely thin. In Central Sulawesi province, the prevalence for the same age group was 15.3% overweight/obese and 13.5% thin/severely thin. This coincides with high sugar consumption patterns. The 2023 SKI reported that 42.2% of Indonesians (43.0% for ages 5–9) consume items from the "sugar, syrup, and confectionery" category at least once per day. In Central Sulawesi, this figure was 38.5% [6].

2 Methods

2.1 Study Design, Location, and Population

This quantitative study utilized an analytical cross-sectional design. The research was conducted in October 2024 at elementary school SDN Sandana, located at Jln H. Moh Saleh No. 68, Sandana Village, Galang District, Tolitoli Regency, Central Sulawesi. The total study population comprised all 234 students enrolled at SDN Sandana during 2024.

2.2 Sample and Sampling

A purposive sampling method was employed. The required sample size was calculated using the Slovin formula, resulting in a total sample of 70 students. Participants were selected from grades IV and V based on inclusion criteria: 1) students aged 9–12 years, an age chosen for their ability to understand instructions and provide relevant responses, and 2) students present at school during data collection.

2.3 Data Collection and Instruments

Data for this study included both primary and quantitative data, collected via questionnaires, interviews, and anthropometric measurements.

Primary data was collected directly from respondents. A questionnaire was used to gather demographic information (name, date of birth, age, sex, class, etc.). Nutritional status was determined using anthropometric data: weight was measured with a digital scale and height with a microtoice. Consumption of high-sugar beverages was assessed using researcher-led interviews based on a 24-hour recall form and a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ).

Secondary data, providing a general profile of SDN Sandana, was obtained from existing reports and records at the school.

3 Result

This study involved 70 students from grades IV and V at SDN Sandana, selected through purposive sampling. Data were collected using structured dietary assessment tools namely the 24-hour dietary recall and the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) to evaluate sugar-sweetened beverage (SSB) consumption patterns. Nutritional status was determined through anthropometric measurements (weight and height), analyzed using BMI-for-age indicators. The following table presents the demographic characteristics of respondents, their frequency of SSB consumption, and daily sugar intake levels.

Table 1. Distributions of Respondent

Variabels		Respondent (n=70)	Percentage (%)
Age (year)	9	21	30.0
	10	38	54.3
	11	10	14.3
	12	1	1.4
Gender	Male	31	44.3
	Female	39	55.7
Nutritional Status	Underweight	15	21.4
	Normal	45	64.3
	Overweight	8	11.4
	Obese	2	2.9
Frequency of SSBs Consumption	Rarely	43	61.4
	Frequently	27	38.6
Daily Sugar Intake	Adequate (<50g)	42	60.0
	Excessive (>50g)	28	40.0

The respondent profile in this study consisted of 70 elementary school students from grades IV and V. Age distribution revealed that the majority were 10 years old (54.3%), followed by 9 years (30.0%), 11 years (14.3%), and only one student aged 12 years (1.4%). This age range represents a critical period for growth and behavioral development, making it highly relevant for assessing dietary patterns and nutritional status. In terms of gender, female students comprised a slightly higher proportion (55.7%) compared to males (44.3%), allowing for balanced representation in the analysis.

Assessment of nutritional status using BMI-for-age indicators showed that most students were within the normal category (64.3%). However, 21.4% were classified as underweight, 11.4% as overweight, and 2.9% as obese. These findings suggest the presence of both undernutrition and overnutrition within the same population, highlighting the need for targeted nutritional interventions.

Regarding dietary behavior, 61.4% of students reported infrequent consumption of sugar-sweetened beverages (SSBs), while 38.6% consumed them frequently. Despite the lower frequency among most respondents, daily sugar intake data revealed that 40.0% of students exceeded the recommended threshold of 50 grams per day, while 60.0% remained within the adequate range. This discrepancy indicates that even occasional consumption of high-sugar drinks can contribute significantly to total sugar intake, especially when portion sizes are large or multiple sweetened items are consumed in a single day. These findings underscore the importance of evaluating both frequency and quantity of intake when assessing dietary risk factors in school-aged children.

Table 2. Association Between Frequency of Sugar-Sweetened Beverage (SSB) Consumption and Nutritional Status

SSB Consumption Frequency	Underweight n=15	Normal n=45	Overweight n=8	Obese n=2	<i>p-value</i>
Rarely	13 (18.6%)	29 (41.4%)	1 (1.4%)	0 (0.0%)	0.151
Frequently	2 (2.9%)	16 (22.9%)	7 (10.0%)	2 (2.9%)	

The analysis of Table 3 explores the relationship between the frequency of sugar-sweetened beverage consumption and students' nutritional status. Among students who consumed SSBs infrequently, the majority had normal nutritional status (41.4%), while 18.6% were underweight and only one student (1.4%) was overweight. No cases of obesity were recorded in this group. In contrast, among students who frequently consumed SSBs, 22.9% had normal nutritional status, but a higher proportion were overweight (10.0%) and obese (2.9%). Despite these differences, the Spearman Rank correlation test yielded a *p*-value of 0.151, indicating no statistically significant association between SSB consumption frequency and nutritional status. The correlation coefficient of 0.173 suggests a very weak relationship.

Table 4. Association Between Daily Sugar Intake and Nutritional Status

SSB Consumption Frequency	Underweight n=15	Normal n=45	Overweight n=8	Obese n=2	<i>p-value</i>
Adequate (<50g)	15 (21.4%)	27 (38.6%)	0 (0%)	0 (0%)	0.294
Excessive (>50g)	0 (0%)	18 (25.7%)	8(11.4%)	2(2.9%)	

Table 4 presents the relationship between total daily sugar intake and nutritional status. Among students with adequate sugar intake (50 grams/day), 25.7% had normal nutritional status, while 11.4% were overweight and 2.9% were obese. The Spearman Rank correlation test produced a *p*-value of 0.294, indicating no statistically significant association between daily sugar intake and nutritional status. The correlation coefficient of 0.127 reflects a very weak positive relationship. These findings suggest that while higher sugar intake may be associated with increased prevalence of overweight and obesity, the relationship is not statistically significant in this sample.

4 Discussion

This study explored the relationship between sugar-sweetened beverage (SSB) consumption and the nutritional status of elementary school students in a rural Indonesian setting. The participants were primarily in the middle childhood age range, with most being 10 years old. Female students slightly outnumbered males. This age group is particularly important for nutritional surveillance, as it represents a period of rapid physical growth, increasing autonomy in food choices, and heightened exposure to environmental influences such as school food environments and peer behaviors [7].

Analysis of consumption habits showed that most students were categorized as infrequent consumers of high-sugar beverages, while substantial portion still exceeded the recommended daily sugar intake. In this study, commonly consumed beverages included locally popular sweetened snack drinks such as *teh jus*, *ale-ale*, *pop ice*, and *jasjus*. These are non-carbonated, flavored beverages typically sold in school canteens or neighborhood kiosks, often prepared from powdered sachets, or pre-packaged in small plastic cups. While not classified as soft drinks, they are high in added sugars and widely accessible to school-

aged children. Factors such as affordability, peer purchasing habits, and limited parental supervision were cited as reasons for preferring these beverages over water.

The average sugar intake among students approached the upper limit recommended by national and international guidelines. According to the World Health Organization, free sugars should contribute less than 10% of total daily energy intake, with additional health benefits observed when reduced below 5% [2]. The American Heart Association recommends that children aged 2–18 years consume no more than 25 grams of added sugars per day to reduce the risk of obesity and cardiovascular disease [3]. These findings highlight the gap between recommended and actual intake levels, even in populations where SSB consumption is not reported as frequent.

Most students in this study were classified as having normal nutritional status, although cases of both undernutrition and overnutrition were observed. This reflects the double burden of malnutrition increasingly seen in low- and middle-income countries, where traditional dietary inadequacies coexist with emerging risks of diet-related noncommunicable diseases [8]. The presence of overweight and obesity, even in a rural school setting, underscores the need for early preventive strategies.

Statistical analysis revealed no significant association between either the frequency of SSB consumption or the level of daily sugar intake and students' nutritional status. This suggests that SSB consumption alone may not be a strong predictor of nutritional outcomes in this population. Nutritional status is shaped by overall dietary patterns, not just beverage choices. A child who consumes sweetened drinks may still maintain a balanced diet if their main meals are nutrient-dense. Conversely, a child who avoids SSBs may still be undernourished if their overall caloric and nutrient intake is insufficient [9].

Physical activity also plays a critical role in modulating energy balance. Children who are physically active may offset the caloric impact of sugar intake through increased energy expenditure. In contrast, sedentary behavior can exacerbate the effects of even moderate sugar consumption. Research shows that physical inactivity is a stronger predictor of childhood obesity than sugar intake alone [10].

Environmental and behavioral factors such as school food policies, parental supervision, and socioeconomic status further influence dietary behaviors. Some students bring meals and water from home, while others rely on canteen purchases. Parental practices vary widely, with some caregivers closely monitoring their children's food choices and others granting full autonomy over pocket money. These contextual differences contribute to the variability in sugar intake and nutritional status observed in this study [11].

Moreover, sugar intake is not limited to beverages alone. Children may consume added sugars from cakes, candies, and processed snacks, which were not the primary focus of this study. This could dilute the measurable impact of SSBs on nutritional outcomes. Additionally, individual differences in metabolism, growth rates, and underlying health conditions may further obscure direct associations [12,13].

The findings of this study are consistent with global evidence indicating that SSBs contribute to excessive sugar intake among children but are not the sole determinant of nutritional status. According to WHO, reducing free sugars intake is a key strategy to prevent noncommunicable diseases in children, particularly obesity and dental caries [2]. The AHA emphasizes that added sugars provide no nutritional benefit and should be minimized in children's diets [3]. Effective interventions must be multifaceted, addressing not only beverage choices but also overall dietary quality, physical activity, and parental and school-based support.

5 Conclusion

In conclusion, the nutritional status of school-aged children is influenced by a complex interplay of dietary habits, physical activity, environmental exposures, and parental guidance. Although SSBs contribute to overall sugar intake, they are not the sole determinant of nutritional outcomes. Future interventions should address the broader dietary landscape and consider the socio-cultural context in which children make food choices.

This study received no specific funding support and was conducted independently through direct field data collection at SDN Sandana, Tolitoli Regency. All authors contributed equally to the research process, including data collection, data cleaning, statistical analysis, manuscript drafting, article preparation, and oral presentation at the international conference. The dataset generated and analyzed during the study is available from the corresponding author upon reasonable request.

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