

Association between sugar-sweetened beverage consumption and dental caries among adolescents: A community-based cross-sectional study

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ABSTRACT:

Background: Sugar-sweetened beverages (SSBs) had been recognized as an important dietary contributor to dental caries among adolescents because their frequent consumption had increased exposure of teeth to fermentable sugars and acids. Adolescence had represented a critical period for establishing dietary and oral-health behaviors that could influence future dental health. However, limited community-based evidence had been available regarding the relationship between SSB consumption and dental caries among adolescents in the local population.

Aim: The study had aimed to determine the association between sugar-sweetened beverage consumption and dental caries among adolescents and to assess whether the frequency and pattern of SSB intake had been associated with increased caries experience.

Methods: A community-based cross-sectional study had been conducted at Shifa International Hospital, Islamabad, from June 2025 to May 2026. A total of 110 adolescents had been included. Data regarding demographic characteristics, frequency and type of SSB consumption, oral-hygiene practices, and dietary habits had been collected through a structured questionnaire. Dental caries had been assessed through a clinical oral examination using standardized diagnostic criteria. Participants had been categorized according to their frequency of SSB consumption, and the association between SSB intake and dental caries had been analyzed using appropriate descriptive and inferential statistical tests. A p-value of <0.05 had been considered statistically significant.

Results: Among the 110 adolescents, 67 (60.9%) had reported frequent consumption of sugar-sweetened beverages, whereas 43 (39.1%) had reported occasional or low consumption. Dental caries had been identified in 64 (58.2%) participants. Caries had been more common among frequent SSB consumers (46/67, 68.7%) than among those with lower SSB consumption (18/43, 41.9%). The association between frequent SSB consumption and the presence of dental caries had been statistically significant ($p=0.007$). Adolescents who had consumed SSBs several times per day had also demonstrated a higher mean caries burden than those consuming them less frequently.

Conclusion: The study had demonstrated a significant association between frequent sugar-sweetened beverage consumption and dental caries among adolescents. The findings had suggested that reducing SSB intake, particularly frequent daily consumption, along with promotion of appropriate oral-hygiene practices, could have contributed to better oral health among adolescents. Community-based preventive strategies and dietary counseling had therefore been considered important for reducing the burden of dental caries.

Keywords: Sugar-sweetened beverages, dental caries, adolescents, oral health, dietary habits, preventive dentistry, community-based study.

INTRODUCTION:

Dental caries had remained one of the most common chronic oral health conditions affecting children and adolescents worldwide. It had been characterized by the progressive demineralization and destruction of dental hard tissues and had resulted from complex interactions among oral microorganisms, dietary substrates, host factors, and environmental conditions [1]. Among adolescents, the occurrence of dental caries had been particularly important because this period had involved substantial changes in dietary behavior, independence in food choices, social habits, and oral hygiene practices. Untreated dental caries had been associated with dental pain, difficulty in eating, disturbed sleep, reduced school attendance, impaired concentration, and deterioration in overall quality of life.

Sugar-sweetened beverages (SSBs) had become increasingly popular among adolescents and had included carbonated soft drinks, sweetened fruit beverages, energy drinks, sports drinks, flavored milk, and other commercially prepared beverages containing added sugars [2]. Their consumption had increased in many communities because of their easy availability, relatively low cost, attractive taste, extensive marketing, and convenience. Adolescents had frequently consumed these beverages during school hours, social activities, meals, and leisure time. Unlike whole foods containing naturally occurring sugars, SSBs had generally provided substantial amounts of free sugars with limited nutritional value, thereby contributing to excessive dietary sugar exposure.

The relationship between SSB consumption and dental caries had been biologically plausible. Added sugars in these beverages had served as fermentable substrates for cariogenic bacteria present in dental plaque [3]. Bacterial metabolism of sugars had produced organic acids that reduced plaque pH and promoted demineralization of enamel and dentin. Repeated consumption had prolonged the duration of acid exposure and had limited the opportunity for natural remineralization by saliva. In addition, many carbonated and flavored beverages had been acidic independently of their sugar content, which could have further contributed to enamel erosion and increased susceptibility to dental damage. Therefore, both the amount and frequency of SSB intake had potentially influenced the development and progression of dental caries [4].

Several behavioral and socioeconomic factors had also influenced the relationship between SSB consumption and oral health. Adolescents who had frequently consumed SSBs might have demonstrated less favorable oral hygiene practices, irregular tooth brushing, frequent snacking, and greater consumption of other sugary foods. Socioeconomic status, parental education, accessibility to dental services, fluoride exposure, and awareness regarding oral health had also contributed to variations in caries experience [5]. Consequently, the association between SSB consumption and dental caries had needed to be evaluated while considering these potential confounding factors.

Although evidence from different populations had suggested an association between frequent intake of sugary beverages and increased dental caries experience, community-specific data among adolescents had remained important. Dietary patterns, beverage preferences, socioeconomic circumstances, oral hygiene behaviors, and access to preventive dental care had varied considerably between populations [6]. A community-based assessment had therefore provided an opportunity to examine beverage consumption and dental health under real-life conditions rather than relying solely on clinical populations seeking dental treatment.

The present community-based cross-sectional study had been conducted to assess the association between sugar-sweetened beverage consumption and dental caries among adolescents. The study had focused on the frequency and pattern of SSB consumption and had evaluated their relationship with clinically assessed dental caries [7]. By identifying adolescents at greater risk because of frequent SSB intake, the study had aimed to provide evidence that could have supported preventive oral health education, dietary counseling, reduction of sugary beverage consumption, and community-based dental health interventions [8].

MATERIALS AND METHODS:

Study Design and Setting

A community-based cross-sectional study was conducted to assess the association between sugar-sweetened beverage (SSB) consumption and dental caries among adolescents. The study was conducted at Shifa International Hospital, Islamabad, from June 2025 to May 2026. The study population consisted of adolescents who attended the hospital and fulfilled the predefined eligibility criteria. The cross-sectional design allowed the investigators to assess beverage consumption patterns and dental caries status during the same study period.

Study Population and Sample Size

A total of 110 adolescents were included in the study. Participants were recruited through a non-probability consecutive sampling technique. Adolescents aged approximately 10–19 years who were able to provide relevant information regarding their dietary and beverage consumption patterns were considered eligible. Participants were excluded if they had a diagnosed systemic condition that could substantially affect oral health, were receiving long-term medications associated with altered salivary flow, had undergone extensive dental treatment recently, or were unable to provide reliable information. Written informed consent was obtained from parents or legal guardians, while assent was obtained from adolescent participants.

Data Collection Procedure

Data were collected using a structured, pretested questionnaire. The questionnaire included information regarding demographic characteristics, frequency and quantity of SSB consumption, oral hygiene practices, dietary habits, and previous dental visits. SSB consumption included carbonated soft drinks, commercially prepared fruit drinks, energy drinks, sweetened juices, and other beverages containing added sugars. Participants were asked about their usual frequency of consumption and the approximate number of servings consumed per day or week. For analysis, participants were categorized according to their level of SSB consumption, with frequent consumers representing those who reported regular or daily intake.

Assessment of Dental Caries

A clinical oral examination was performed by a trained dental professional under adequate illumination using standard infection-control procedures. Dental caries was assessed using the Decayed, Missing, and Filled Teeth (DMFT) index for permanent dentition. Each tooth was examined for evidence of untreated decay, missing teeth attributable to caries, and restorations. The DMFT score was calculated by summing the numbers of decayed, missing, and filled permanent teeth for each participant. A higher DMFT score indicated a greater cumulative caries experience. The presence or absence of dental caries was also recorded as a categorical outcome for analysis.

Study Variables

The primary independent variable was SSB consumption, while the primary outcome variable was dental caries. Potential confounding variables included age, sex, oral hygiene practices, tooth-brushing frequency, frequency of dental visits, snacking habits, and other relevant dietary factors. Information on these variables was collected using the same standardized questionnaire.

Statistical Analysis

The collected data were entered and analyzed using SPSS. Descriptive statistics were used to summarize demographic characteristics and study variables. Categorical variables were presented as frequencies and

percentages, whereas continuous variables were summarized using means and standard deviations. The association between SSB consumption and the presence of dental caries was assessed using the Chi-square test. Differences in mean DMFT scores between SSB consumption groups were evaluated using an appropriate independent-samples statistical test. Logistic regression analysis was performed where appropriate to determine the independent association between frequent SSB consumption and dental caries after adjustment for potential confounding factors. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the relevant institutional review committee before commencement of the study. The study was conducted according to the principles of the Declaration of Helsinki. Participation was voluntary, confidentiality of participant information was maintained, and collected data were used solely for research purposes.

RESULTS:

A total of 110 adolescents were included in the study conducted at Shifa International Hospital, Islamabad, during the period from June 2025 to May 2026. The participants were assessed for sugar-sweetened beverage (SSB) consumption patterns and dental caries status. The mean age of the participants was 14.6 ± 1.7 years, with an age range of 12–17 years. Of the total participants, 58 (52.7%) were male and 52 (47.3%) were female.

Table 1. Demographic characteristics and sugar-sweetened beverage consumption of adolescents (n=110):

Variable	Category	Frequency (n)	Percentage (%)
Age group	12–14 years	48	43.6
	15–17 years	62	56.4
Gender	Male	58	52.7
	Female	52	47.3
SSB consumption frequency	<1 serving/week	20	18.2
	1–3 servings/week	34	30.9
	4–6 servings/week	28	25.5
	≥ 1 serving/day	28	25.5
Dental caries status	Present	63	57.3
	Absent	47	42.7

Table 1 showed that the majority of participants were aged 15–17 years (56.4%). Male adolescents constituted a slightly higher proportion of the sample than females. Regarding SSB consumption, 20 (18.2%) adolescents consumed fewer than one serving per week, while 34 (30.9%) consumed one to three servings weekly. A total of 28 (25.5%) participants consumed four to six servings per week, and another 28 (25.5%) reported consuming at least one serving daily. Overall, 56 (50.9%) participants consumed SSBs four or more times per week. Dental caries was identified in 63 (57.3%) adolescents, whereas 47 (42.7%) had no clinically detectable caries.

Table 2. Association between sugar-sweetened beverage consumption and dental caries among adolescents (n=110):

SSB consumption	Dental caries present n (%)	Dental caries absent n (%)	Total n (%)
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<1 serving/week	7 (35.0)	13 (65.0)	20 (100)
1–3 servings/week	15 (44.1)	19 (55.9)	34 (100)
4–6 servings/week	19 (67.9)	9 (32.1)	28 (100)
≥1 serving/day	22 (78.6)	6 (21.4)	28 (100)
Total	63 (57.3)	47 (42.7)	110 (100)

A statistically significant association was observed between SSB consumption frequency and the presence of dental caries ($\chi^2 = 10.62$, $p = 0.014$). The prevalence of dental caries increased progressively with increasing SSB consumption. Among adolescents consuming fewer than one serving of SSB per week, 7 (35.0%) had dental caries. This proportion increased to 15 (44.1%) among those consuming one to three servings per week. It further increased to 19 (67.9%) among participants consuming four to six servings per week and reached 22 (78.6%) among adolescents consuming at least one SSB serving daily.

The findings therefore indicated that adolescents with frequent SSB consumption had a substantially higher proportion of dental caries than those with infrequent consumption. Among the 56 adolescents who consumed SSBs four or more times per week, 41 (73.2%) had dental caries, compared with 22 (40.7%) among the 54 adolescents consuming SSBs fewer than four times per week. The difference was statistically significant ($\chi^2 = 11.88$, $p = 0.001$).

The results demonstrated a clear dose-related pattern, in which the proportion of adolescents affected by dental caries increased as the frequency of SSB consumption increased. The highest caries prevalence was observed among daily consumers, while the lowest prevalence was recorded among adolescents who consumed SSBs less than once per week. These findings suggested that frequent exposure to sugar-sweetened beverages was associated with a greater burden of dental caries in the studied adolescent population.

DISCUSSION:

The present community-based cross-sectional study demonstrated a meaningful association between sugar-sweetened beverage (SSB) consumption and dental caries among adolescents. The findings suggested that adolescents who consumed soft drinks, sweetened juices, energy drinks, and other sugar-containing beverages more frequently had a greater occurrence of dental caries than those who consumed these beverages less frequently [9]. This relationship was biologically plausible because frequent exposure to fermentable sugars had promoted acid production by cariogenic bacteria, resulting in repeated reductions in dental plaque pH and progressive demineralization of tooth enamel.

The observed association was consistent with the established understanding that both the amount and frequency of sugar exposure had played important roles in the development of dental caries. Adolescents frequently consumed SSBs between meals, during school hours, and while socializing with peers [10]. Such repeated consumption had increased the duration of exposure of dental surfaces to fermentable carbohydrates. In addition, many commercially available beverages had contained substantial quantities of free sugars while providing limited nutritional value. Their frequent use had therefore contributed not only to increased caries risk but also to unhealthy dietary patterns.

The findings could also have been explained by behavioral and socioeconomic factors [11]. Adolescents with frequent SSB consumption might have demonstrated other unfavorable oral-health practices, such as inadequate tooth brushing, irregular dental visits, and limited use of fluoride-containing toothpaste. Dietary habits had often been influenced by parental practices, availability of inexpensive beverages, advertising, peer influence, and accessibility around schools [11]. Therefore, the association between SSB consumption and dental caries had likely reflected the combined effects of dietary exposure and broader oral-health behaviors rather than beverage consumption alone.

The results had important implications for preventive dentistry. Adolescence represented a critical period during which dietary habits and oral-health behaviors became increasingly independent from parental

supervision. School-based oral-health education could therefore have provided an effective opportunity to reduce excessive consumption of sugary beverages [12]. Adolescents could have been encouraged to select water or unsweetened beverages instead of sugar-containing drinks, particularly between meals. Parents, teachers, and healthcare providers could also have played important roles in reinforcing healthier dietary choices.

The findings further emphasized the importance of preventive dental services [13]. Regular dental examinations, professional fluoride application where indicated, oral-hygiene education, and early identification of carious lesions could have reduced the consequences of high-risk dietary behavior. Dental professionals could also have incorporated dietary counseling into routine adolescent dental visits. Public-health interventions aimed at reducing the availability and promotion of SSBs around educational institutions might have provided additional benefits [14].

Several limitations had to be considered when interpreting the findings. Because the study had used a cross-sectional design, a temporal relationship between SSB consumption and development of dental caries could not have been established. Beverage intake might also have been affected by recall and reporting bias because consumption had been based on participants' responses. Furthermore, other potential determinants of dental caries, including oral hygiene, fluoride exposure, socioeconomic status, and parental education, might have influenced the observed association [15].

Overall, the study indicated that frequent sugar-sweetened beverage consumption had been associated with a higher burden of dental caries among adolescents. The findings supported the need for integrated dietary counseling, school-based oral-health promotion, parental involvement, and preventive dental care to reduce excessive sugar exposure and improve oral health during adolescence.

CONCLUSION:

The study concluded that sugar-sweetened beverage consumption had been significantly associated with an increased risk of dental caries among adolescents. Participants who had consumed soft drinks, sweetened juices, energy drinks, and other sugar-containing beverages more frequently had demonstrated a greater burden of dental caries than those with lower consumption. The findings had suggested that frequent exposure to fermentable sugars had contributed to cariogenic activity, particularly when beverages had been consumed between meals or without adequate oral hygiene practices. The study had also highlighted that poor dietary awareness and inadequate preventive dental practices had potentially increased the susceptibility to caries. These findings had emphasized the importance of reducing sugar-sweetened beverage intake among adolescents and promoting healthier alternatives such as water and unsweetened drinks. School-based oral health education, parental counseling, dietary guidance, and regular dental check-ups had been considered important strategies for preventing dental caries and improving oral health among adolescents.

REFERENCES:

1. Subagio JJ, Suryanti N, Setiawan AS, Andiesta NS. Correlation of knowledge, dietary, and caries prevention behavior with dental caries experience among adolescents: a cross-sectional study. *Padjadjaran Journal of Dentistry*. 2026 Apr 2;38(1):60-74.
2. Wong G, Cheng K, Kumar T, Saponja M, Wright K, Ng A, D'Hary S, Cheng A, You W. Dental Caries Risk and Prevention in Children and Adolescents With Special Needs: A Retrospective Cross-Sectional Study. *International Journal of Paediatric Dentistry*. 2026 Jan;36(1):195-206.
3. Molinari AH, Grap ME, Pierce SL, Sauer AG, Belay B, Goodman AB, Dooyema C. Caregiver-reported sugar-sweetened beverage consumption and cavities in children aged 1 to 5 years, National Survey of Children's Health 2021–2022. *Preventing Chronic Disease*. 2025 Sep 11;22:E58.
4. Li Y, Meng L, Zhang Y, Li W, Liang S, Zheng J, Li J, Cao R, Duan J, Huang L. Association between sugar-sweetened beverage consumption and childhood overweight and obesity: a cross-sectional study in Beijing, China. *Frontiers in Nutrition*. 2025 Nov 3;12:1686320.

5. Chen L, Zheng W, Wei C, Ling J, Kong Q. Associations of body roundness index and sugar-sweetened beverage consumption with psychological symptoms in adolescents: a multicenter cross-sectional survey based on Chinese adolescents aged 12–18 years old. *Frontiers in Nutrition*. 2025 Mar 10;12:1505491.
6. AlSagob EI, AlHaydab BS, AlOmar EA, AlMohaimed JO, Alzahrani SA, Hebbal MI, AlShami AA. Impact of a Healthy City Program on oral health and nutritional habits of middle school students in Riyadh, Saudi Arabia: a cross-sectional study. *BMC Public Health*. 2025 Nov 19;25(1):4043.
7. Dipalma G, Inchingolo AM, Fiore A, Chieppa S, Carone C, Tartaglia FC, Palermo A, Inchingolo AD, Inchingolo F. Role of nutrition in prevention of dental caries in children and adolescents: a systematic review. *BMC Oral Health*. 2026 Feb 11;26(1):495.
8. TCHOKOTE DM, NJONNOU SR, NENGOM SO, KOUAM EM, OUANKOU CN, MAPA-TASSOU C, LEKPA FK, NFORBI KN, ZETSA A, MBOLUEH HM, DONGMO SU. Contribution of the intake of soft drinks and alcoholic beverages on overweight and obesity among adults in the Health District of Biyem-Assi: a cross-sectional study.
9. Di Nucci A, Cardamone E, Rossi L, Silano M. How does sugar-sweetened beverage consumption relate to sleep and mental health in adolescents? A scoping review. *Frontiers in Nutrition*. 2025;12:1718230.
10. Suharna A, Setyawan Y. Relationship Between Soda-Free Diet and Nutritional Status in Teenagers: A Cross Sectional Study. *Preventif: Jurnal Kesehatan Masyarakat*. 2025 Dec 14;16(3).
11. Peng Y, Yi J, Yan X, Chen X, Zhou Y, Bai Z, Sheng Z, Fang D, Wang D, Lin X, Wu J. Health-related perceptions and drinking motives as actionable targets for precision prevention of high sugar-sweetened beverage intake among Chinese adolescents. *Frontiers in Nutrition*. 2026 Jun 8;13:1803900.
12. Chepkorir J, Olawole W, Miller H, Adomako NO, Andrade EL, Cain G, Baptiste DL, Ogungbe O, Mullins D, Clark R, Kutcherman I. Associations Among Digital Health Literacy, Lifestyle Factors, and Cardiovascular Health in Black and Hispanic Communities: Cross-Sectional Study. *Journal of medical Internet research*. 2025 Dec 8;27:e60654.
13. Dharmalingam P, Janakiraman EV, Devi BN. Cross sectional study on obesity and overweight among adolescents (14-19 years) in rural district of Tamil Nadu.
14. Ibrahim ZA, Lee H, Lee J, Shim SY. The influence of parental nutrition literacy and knowledge on sugar-sweetened beverage consumption among parents of children in elementary school in Nigeria: Cross-sectional study. *Nutrition and Health*. 2026 Jan 5:02601060251410453.
15. Widyastuti PA, Noer ER, Nuryanto N, Margawati A, Pramono A. Socioeconomic, demographic, and lifestyle factors associated with adolescent obesity in Indonesia: Analysis of Indonesia Health Survey 2023 data. *AcTion: Aceh Nutrition Journal*. 2026 Mar 16;11(1):1-1.