

INDIVIDUAL AND ENVIRONMENTAL FACTORS ASSOCIATED WITH SUGAR-SWEETENED BEVERAGE CONSUMPTION AMONG ADOLESCENTS IN PADANG, Indonesia

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Abstract

The consumption of sugar-sweetened beverages (SSBs) among adolescents has continued to rise and represents a major contributor to added sugar intake, which is associated with an increased risk of non-communicable diseases. This study aimed to analyze individual and environmental factors associated with SSB consumption patterns among adolescents in Padang City. A cross-sectional study was conducted involving 248 adolescents aged 15–17 years. Data were collected using a semi-quantitative food frequency questionnaire (SQ-FFQ) and a structured questionnaire assessing age, sex, pocket money, access, home availability, peer influence, and social media exposure. Data were analyzed descriptively and bivariate using the chi-square test, with a significance level of $p < 0.05$. The majority of respondents consumed SSBs 2–3 times per week, with a consumption volume of 201–400 mL per occasion. No significant associations were found between age ($p = 0.700$), sex ($p = 0.448$), pocket money ($p = 0.218$), and access ($p = 0.199$) with SSB consumption patterns. In contrast, home availability of SSBs ($p = 0.048$), peer influence ($p = 0.001$), and social media exposure ($p < 0.0001$) were significantly associated with consumption patterns. Social environmental factors appear to play a more dominant role than individual factors in influencing SSB consumption among adolescents. Therefore, effective interventions should adopt a multilevel approach involving family, school, and media environments to reduce SSB consumption among adolescents.

Keywords: Adolescents, Consumption Patterns, Enviromental Factors, Peer Influence, Social Media Exposure, Sugar-Sweetened Beverages

Introduction

Adolescence represents a critical transitional period between childhood and adulthood, characterized by substantial physical, psychological, and social changes. During this stage, behavioral patterns—particularly dietary habits—are established and often persist into adulthood. However, adolescents are also highly vulnerable to unhealthy dietary behaviors, including the frequent consumption of sugar-sweetened beverages (SSBs) ⁽¹³⁾. SSBs contribute significantly to total energy intake without providing substantial nutritional value, as they contain added simple sugars introduced during processing. These beverages include commercially produced drinks as well as homemade sweetened beverages such as tea and coffee, sports and energy drinks, and carbonated beverages ^(17,21).

The increasing consumption of SSBs among adolescents has become a major global public health concern over the past two decades. Globally, SSB intake among children and adolescents aged 3–19 years has increased by approximately 23% since 1990, with an average consumption of 3.6 servings per week ⁽¹⁰⁾. Data from the Centers for Disease Control and Prevention indicate that more than 60% of

adolescents in the United States consume SSBs at least once per day ⁽⁴⁾. Multi-country studies also report that daily SSB consumption among adolescents ranges from 20% to 70%, depending on socioeconomic context and food environment ⁽²⁾. In Southeast Asia, rapid urbanization, expansion of the beverage industry, and the growing influence of digital marketing have further increased adolescents' exposure to and preference for SSBs ⁽¹⁴⁾

In Indonesia, national data from the Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) 2023 show that 45.8% of adolescents aged 15–19 years consume SSBs daily ⁽¹⁾. Additionally, data from the Individual Food Consumption Survey (Survei Konsumsi Makanan Individu/SKMI) indicate that the contribution of sugar from beverages to total daily sugar intake among adolescents continues to rise, particularly in urban areas. Padang City, as one of the major urban centers in West Sumatra, has experienced rapid growth in modern retail outlets, trendy beverage shops, and online food delivery services, which potentially increase adolescents' exposure to and access to SSBs.

Excessive consumption of SSBs among adolescents is associated with both short-term and long-term health consequences. In the short term, high intake contributes to increased total energy consumption without adequate satiety, leading to weight gain and a higher risk of overweight and obesity ^(10,23). Adolescents who consume SSBs frequently (≥ 7 times per week) are reported to have up to 11.6 times higher odds of being overweight or obese, while those with high sugar intake from SSBs may have up to 42.5 times greater risk ⁽¹⁹⁾. Regular consumption of SSBs is also associated with dental caries, insulin resistance, dyslipidemia, and increased risk of anxiety and depression ^(9,22). Over the long term, habitual intake may increase the risk of type 2 diabetes, cardiovascular diseases, and metabolic syndrome ^(7,14). Given that adolescence is a critical period for establishing long-term dietary behaviors, understanding the determinants of SSB consumption during this stage is essential for effective prevention strategies.

Previous studies have identified several determinants of SSB consumption among adolescents, including increasing urbanization, accessibility and availability of packaged beverages at home and around schools ⁽¹⁸⁾, and intensive marketing exposure through social media ⁽¹²⁾. Socio-cognitive factors such as attitudes, peer norms, and perceived risks also play a significant role in shaping adolescents' consumption behaviors ⁽³⁾. In addition, demographic factors such as sex and the ability to interpret nutrition labels may influence SSB consumption patterns ⁽¹¹⁾.

Despite the growing body of evidence, there is still limited research that simultaneously examines the relative contribution of individual and environmental factors to SSB consumption among adolescents, particularly in the Indonesian urban context. Understanding how these factors interact is essential for designing effective, context-specific interventions.

Therefore, this study aims to analyze factors associated with sugar-sweetened beverage consumption among adolescents in Padang City. Specifically, this study evaluates the role of individual characteristics, access and home availability of SSBs, social media exposure, and peer influence on adolescents' SSB consumption patterns.

Method

This study employed a cross-sectional design to examine the association between sugar-sweetened beverage (SSB) consumption patterns and related factors among adolescents at a single point in time. The study was conducted from September to November 2025. A total of 248 adolescents aged 15–17 years who had consumed sugar-sweetened beverages at least once within the past month were recruited using purposive random sampling from four senior high schools located within the service areas of Pauh and Andalas Public Health Centers in Padang City.

Data were collected using a structured, pre-tested questionnaire designed to capture the variables of interest. The independent variables included social media exposure, peer influence, access to SSBs, and home availability of SSBs.

Social media exposure was assessed using 10 items covering platform type, duration of use, frequency of exposure to SSB-related content, and the perceived influence of such content on consumption behavior. The total score was calculated and categorized into low and high exposure levels. Peer influence was measured using 13 items that assessed peers' consumption habits, individual behavior in peer contexts, perceived norms, and social pressure. Responses were scored using a five-point Likert scale, and total scores were categorized into weak and strong. Access to SSBs was evaluated based on perceived ease of access, affordability, and purchasing options. Home availability of SSBs was assessed based on frequency, types of beverages available, parental control, and parental modeling. All items were scored and categorized into rarely and strong.

The dependent variable was the pattern of SSB consumption, which included beverage type, consumption frequency, and intake volume. Data on SSB consumption were collected using a semi-quantitative food frequency questionnaire (SQ-FFQ) tailored to reflect locally available beverages and consumption habits.

SSBs were categorized into five groups: tea-based beverages, coffee-based beverages, energy drinks, fruit-flavored beverages and juices, and carbonated beverages. The questionnaire captured both frequency of consumption and average intake per occasion. Consumption frequency was categorized into ≥ 1 time/day, 2–3 times/week, 4–6 times/month, and 1–3 times/month. Intake volume per occasion was categorized into 0–200 mL, 201–400 mL, 401–600 mL, and ≥ 600 mL.

The overall SSB consumption pattern was derived from a composite score combining beverage type, frequency, and volume. The total score was then dichotomized into two categories: low consumption and high consumption, using the median as the cut-off point. Scores $\leq$ median were classified as low consumption, while scores $>$ median were classified as high consumption.

Data were collected through self-administered questionnaires and interviewer-assisted sessions involving all participants, supported by three trained enumerators with a background in nutrition. Each questionnaire required approximately 10–15 minutes to complete. All data were analyzed using statistical software. Descriptive analysis was conducted to summarize respondent characteristics and consumption patterns. Bivariate analysis was performed using the chi-square test to examine the association between independent and dependent variables. Statistical significance was set at $p < 0.05$.

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Universitas Andalas (No. B/79c/UN16.12.D/PP/2025). Written informed consent was obtained from all participants prior to data collection.

Results

A total of 248 adolescents participated in this study. The majority of respondents were female (60.08%) and aged 16 years (70.16%). More than half of the participants reported receiving a daily allowance of $\geq 25,000$ IDR (53.63%).

Table 1. Characteristic of Study Respondents

Characteristics	Frequencies (n)	Percentages (%)
Sex		
Male	99	39,92
Female	149	60,08
Ages		
15 Years	62	25,0
16 Years	174	70,16
17 Years	12	4,84
Daily Allowances		
< 25.000 IDR	115	46,37
≥ 25.000 IDR	133	53,63
Preferred Types of Sugar Sweetened Beverages (SSB)		
Tea	87	35,08
Energy and Isotonic beverages	12	4,84
Coffee base beverages	44	17,74
Fruit juice/fruit flavors beverages	31	12,50
Soda beverages	74	29,84
Number of SSB Type Consumed in the Past Month		
1 type	24	9,68
2 type	60	24,19
3 type	83	33,47
4 type	62	25,00
5 type	19	7,66
Frequency of Consumption		
4-6x /month	26	10,48
1-3x /month	55	22,18
2-3x /week	102	41,53
>1x /day	64	25,81
Size of Consumption		
<200 mL	57	22,98
201-400 mL	101	40,73
401-600 mL	87	35,08
>600 mL	3	1,21

Regarding beverage preferences, tea-based sugar-sweetened beverages were the most commonly consumed (35.08%), followed by carbonated beverages (29.84%) and coffee-based beverages (17.74%). In contrast, energy drinks (4.84%) and fruit-flavored beverages (12.50%) were less frequently preferred.

In terms of consumption diversity, more than 65% of respondents reported consuming at least three different types of SSBs within the past month, indicating a relatively varied consumption pattern. The most common consumption frequency was 2–3 times per week (41.53%), while 25.81% of respondents reported consuming SSBs more than once per day. The majority of respondents consumed between 201–400 mL per occasion (40.73%), followed by 401–600 mL (35.08%).

Table 2 Frequency of Consumption and Preferred Serving Size

Variable	Type of SSB				
	Fruit Juice/Flavored	Soda	Tea	Energy Drinks	Coffee
Frequency of Consumption					
4-6x /month	17 (11,18)	14 (9,79)	13 (9,42)	15 (11,11)	14 (9,52)
1-3x /month	36 (23,38)	29 (20,28)	32 (23,19)	26 (19,26)	30 (20,41)
2-3x /week	59 (38,82)	64 (44,76)	53 (38,14)	57 (42,22)	66 (44,90)
>1x /day	40 (26,32)	36 (25,17)	40 (28,99)	37 (27,41)	37 (25,17)
Size of Consumption					
<200 mL	39 (25,66)	31 (21,68)	32 (23,19)	27 (20,00)	40 (27,21)
201-400 mL	63 (41,45)	69 (48,25)	57(41,30)	61 (45,19)	67 (45,58)
401-600 mL	49 (32,24)	43 (30,07)	47 (34,06)	44 (32,59)	37 (25,17)
>600 mL	1 (0,66)	0 (0,00)	2 (1,45)	3 (2,22)	3 (2,04)

As shown in Table 2, most respondents consumed various types of SSBs at relatively high frequencies. The most dominant consumption frequency category across all beverage types was 2–3 times per week, particularly for carbonated beverages (44.76%), coffee-based beverages (44.90%), energy drinks (42.22%), fruit-flavored beverages (38.82%), and tea-based beverages (38.14%).

A considerable proportion of respondents also reported consuming SSBs more than once per day, ranging from 25.17% to 28.99%, with the highest proportion observed in tea-based beverages (28.99%) and fruit-flavored beverages (26.32%). These findings suggest that regular exposure to SSB consumption is common among adolescents.

In terms of consumption volume per occasion, the most frequently reported category across all beverage types was 201–400 mL, including carbonated beverages (48.25%), coffee-based beverages (45.58%), energy drinks (45.19%), fruit-flavored beverages (41.45%), and tea-based beverages (41.30%). Notably, a substantial proportion of respondents consumed ≥ 401 mL per occasion, particularly for tea-based beverages (34.06%) and energy drinks (32.59%). Although the proportion of very high consumption (>600 mL) was relatively small (0–2.22%), it still indicates the presence of a subgroup with excessive intake.

Table 3. Bivariate Analysis

Variable	Consumption of SSB		<i>p-value</i>
	Rarely (%)	Often (%)	
Age			
15	24 (38,71)	38 (61,29)	0,700
16	75 (43,10)	99 (56,90)	
17	4 (33,33)	8 (66,67)	
Sex			
Male	44 (44,44)	55 (55,56)	0,448
Female	59 (39,60)	90 (60,40)	
Daily Allowances			
< 25.000 IDR	43 (37,39)	72 (62,61)	0,218
≥ 25.000 IDR	60 (45,11)	73 (54,89)	
Access			
Low	16 (33,33)	32 (66,67)	0,199
High	87 (43,50)	113 (56,50)	
Home Availability			
Rarely	34 (34,00)	66 (66,00)	0,048*

Variable	Consumption of SSB		<i>p-value</i>
	Rarely (%)	Often (%)	
Often	69 (46,62)	79 (53,38)	
Peer Influence			
Weak	31 (29,52)	74 (70,48)	0,001*
Strong	72 (50,35)	71 (49,65)	
Social Media Exposure			
Low	28 (27,72)	73 (72,78)	<0,0001*
High	75 (51,02)	72 (48,98)	

The results of the bivariate analysis are presented in Table 3. Sociodemographic factors, including age ($p=0.700$), sex ($p=0.448$), and pocket money ($p=0.218$), as well as access to SSBs ($p=0.199$), were not significantly associated with SSB consumption patterns ($p>0.05$). In contrast, several environmental and social factors showed significant associations with SSB consumption patterns. Home availability of SSBs was significantly associated with consumption patterns ($p=0.048$), as were peer influence ($p=0.001$) and social media exposure ($p<0.0001$).

Interestingly, the proportion of frequent SSB consumption was higher among adolescents with lower home availability (66.00%) compared to those with higher availability (53.38%). Similarly, higher proportions of frequent consumption were observed among respondents with lower peer influence (70.48%) and lower social media exposure (72.78%). Overall, these results indicate that both the frequency and volume of SSB consumption among adolescents are relatively high, which may contribute to excessive daily sugar intake.

Discussion

The findings of this study indicate that the most common pattern of sugar-sweetened beverage (SSB) consumption among adolescents in Padang City is moderate frequency, with the majority consuming SSBs 2–3 times per week (38.14%–44.90%). This pattern is consistent with previous studies conducted among adolescents in Indonesia, which also reported relatively high levels of SSB consumption ⁽⁶⁾. This consistency suggests that moderate-to-frequent SSB consumption has become a common behavioral pattern among adolescents across different regions in Indonesia.

In terms of consumption volume, most adolescents reported consuming 201–400 mL per occasion. However, a small proportion reported consuming more than 600 mL per occasion, which warrants attention due to its association with increased risks of obesity, metabolic disorders, and mental health problems ^(5,24). These findings highlight that not only frequency but also portion size contributes to excessive sugar intake among adolescents.

Home availability of SSBs was found to be significantly associated with consumption patterns ($p=0.048$). Interestingly, the proportion of frequent consumption was higher among adolescents with lower home availability (66.00%) compared to those with higher availability (53.38%). This finding contrasts with previous research by Wardhani ⁽²⁰⁾, which reported no significant association. The inverse relationship observed in this study may be explained by a behavioral compensation mechanism, whereby adolescents with limited access at home may compensate by purchasing SSBs outside the home environment, particularly in school settings ⁽¹⁶⁾. Additionally, the concept of psychological reactance may also explain this pattern, as restrictions may increase the desirability of restricted items ⁽⁸⁾.

Peer influence was also significantly associated with SSB consumption patterns ($p=0.001$), which is consistent with previous studies ^(6,20). However, similar to home availability, the proportion of frequent consumption was higher among adolescents with lower peer influence (70.48%). Although

this finding appears counterintuitive, it may be interpreted through the lens of the dual-process model, where habitual behavior can override social influences ⁽³⁾. While peer norms are often associated with consumption frequency, habitual consumption may become a stronger determinant of intake volume and regularity. Adolescents with lower peer influence may have already internalized SSB consumption as a habitual behavior, making it less dependent on external social reinforcement.

Social media exposure was also found to be strongly associated with SSB consumption patterns ($p < 0.0001$). Unexpectedly, higher proportions of frequent consumption were observed among adolescents with lower social media exposure (72.78%). This finding diverges from the common assumption that higher exposure to digital marketing leads to increased consumption ⁽²³⁾. One possible explanation is that adolescents with lower reported social media exposure may still be exposed to SSB promotion through other channels, such as traditional media or the physical food environment. Furthermore, the effect of media exposure on behavior may be mediated by unmeasured variables such as attitudes toward advertising, media literacy, or perceived credibility of content.

In contrast, individual factors such as age, sex, pocket money, and access to SSBs were not significantly associated with consumption patterns. This finding is consistent with previous research indicating that SSB consumption is widely prevalent among adolescents regardless of individual demographic characteristics ⁽¹³⁾. The lack of association with pocket money is also supported by a meta-analysis by Purohit et al. ⁽¹⁵⁾, which suggests that the relationship between socioeconomic status and SSB consumption is complex and context-dependent. In some cases, higher socioeconomic status may even serve as a protective factor due to greater health awareness.

Conclusion

This study demonstrates that social and environmental factors—particularly home availability, peer influence, and social media exposure—are significantly associated with sugar-sweetened beverage (SSB) consumption patterns among adolescents, whereas individual demographic factors show no significant association. These findings highlight that adolescent SSB consumption is shaped more by the surrounding social environment than by personal characteristics.

Given this evidence, interventions aimed at reducing SSB consumption should adopt a multilevel approach. At the interpersonal level, peer-based education programs may be effective in shaping healthier consumption norms. At the environmental level, policies restricting the availability and sale of SSBs in and around schools should be considered. In addition, media-based interventions, including digital literacy and the use of social media influencers to promote healthier behaviors, may serve as strategic tools to counteract the widespread promotion of SSBs.

This study has several limitations. The SQ FFQ may introduce recall bias and social desirability bias. The study was conducted in a single urban setting, which may limit the generalizability of the findings. Furthermore, this study did not assess other potential influencing factors such as nutrition knowledge, label-reading behavior, and local policy context.

Future research should incorporate longitudinal designs and multivariate analyses to better understand causal relationships and the relative contribution of various determinants. Expanding the scope to include behavioral and policy-related variables would also provide a more comprehensive understanding of adolescent SSB

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