



RESEARCH ARTICLE

Knowledge, Attitude and Practices Towards Sugar-Sweetened Beverages amongst Adolescents in Senior High Schools in the Cape Coast Metropolis, Ghana

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Abstract

Background: Sugar-sweetened beverage (SSB) consumption is a growing contributor to diet-related health problems among adolescents worldwide, including in Ghana. However, there is limited evidence on how adolescents' nutrition knowledge and attitudes relate to their SSB consumption. Hence, this study aimed to investigate the types and frequencies of SSBs consumed by secondary school students in Cape Coast, Ghana, while concurrently assessing their nutritional knowledge and attitudes toward sugar-sweetened beverage consumption.

Methods: A descriptive cross-sectional study was conducted, among 393 students from three senior high schools in Cape Coast, Ghana. Data on SSB consumption, nutrition knowledge, attitudes, and anthropometry were collected using a structured questionnaire and standard measurements. Data were analyzed using descriptive statistics and chi-square tests ($p < 0.05$).

Results: Overall, 57.5% of respondents had a high level of SSB consumption. More than half (55.7%) had moderate nutrition knowledge about SSBs, and 52.9% expressed positive attitudes toward SSB consumption. There was no significant association between knowledge level, and SSB consumption levels.

Conclusions: Despite moderate nutritional knowledge and generally positive attitudes, a high proportion of students reported frequent SSB consumption. Interventions that go beyond knowledge, such as restricting SSB availability in schools and promoting attractive, healthier beverage alternatives, are needed and should involve government, schools, and communities.

Keywords: Sugar-Sweetened Beverages, Adolescents, Knowledge, Attitudes and Practices

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Introduction

Sugar-Sweetened Beverages (SSBs) are defined as beverages that have added sugar or sweeteners such as high fructose corn syrup, sucrose, or fruit juice concentrate. This category includes a wide variety of drinks such as sports drinks, sweetened tea and coffee, energy drinks, carbonated or non-carbonated soft drinks, electrolyte-replacement drinks, and sweetened milk or milk alternatives¹. Consumption of SSBs is linked to exceeding one's energy needs, resulting in various diet-related health issues, such as obesity, overweight, type 2 diabetes, gout, dental caries, mental health problems, cardiovascular diseases, cancers, and high blood pressure

². The harmful impact of excessive calories and sugars on health and life has brought SSBs into sharp focus among scholars worldwide, including both in developed and developing countries, such as Africa. A survey of SSBs consumption in adults in 187 countries found that intake was higher in middle-income countries compared to either high-income or low-income countries³. Adolescents aged between 13 and 20 years have the highest intake of SSBs globally and this has led to an increase in the prevalence and degree of obesity among adolescents in many populations, resulting in notable public health issues^{4,5}. A study conducted in South Africa showed that adolescents had a very high consumption rate of SSBs, and without any

preventative measures, the sales and availability of these beverages are projected to increase at an annual rate of 2.4% between 2012 and 2017^{6,7}. Another study involving primary school children in Nairobi discovered that although participants had some awareness of the harmful effects of unhealthy diets like SSBs, they still consumed them as they were readily available and convenient^{8,9}. It is important for policymakers, healthcare professionals, and communities to work together to develop strategies to reduce the consumption of SSBs and promote healthier beverage choices. Some potential strategies that have been proposed to address the high consumption of SSBs include implementing taxes on sugary drinks, promoting public education campaigns about the health risks associated with consuming too much sugar, and improving access to healthier beverage options such as water and low-sugar drinks¹⁰⁻¹². To discourage youths from consuming SSBs, it is necessary to understand their attitude and practices towards these drinks and their level of nutritional knowledge, therefore this study aimed at assessing the nutrition knowledge, attitude, and consumption of SSBs among secondary school students in Cape Coast, Ghana.

Materials and Methods

Study Area

The study was conducted across three secondary schools in Cape Coast. Cape coast is a major urban centre located in the Central Region of Ghana, covering an area of approximately 122 square kilometres. The educational landscape of Cape Coast Metropolitan includes a range of schools, including primary, secondary, and tertiary institutions. The metropolitan area is home to several secondary schools, both mixed-gender and single-gender schools, offering a variety of academic programs¹⁴.

Study design, population and sampling

This cross-sectional study included male and female participants aged between 13 and 19 years. In the Ghanaian education system, adolescents in this age range are generally students in senior high schools. Participants who had certain diseases or disabled, on medication were excluded from the study. A sample size of at least 393 adolescents was determined using Slovin's formula from a population of approximately 15,992 adolescents in Cape coast with a 0.05 margin of error. Data collection was performed and completed in September 2023.

Students were selected using a two-stage approach. First, three senior high schools in the Cape Coast Metropolis were purposively selected based on accessibility and willingness to participate. Within the selected schools, students were recruited using convenience sampling. All students who were present at the time of data collection and consented to participate were included in the study. The consent forms were handed to the participants one day before the data collection was carried out. Participants consisted of students who attended school on the day of the data collection and had handed in the signed-off consent form. A total of 393 consented forms were received.

Data collection

A self-administered questionnaire with a structured format was used to collect data from the various schools. The questionnaire consisted of socio-demographic sections which included the anthropometric measurements, nutritional knowledge, attitude, practices, and, food frequency questions (FFQ) on the type, frequency and volumes of SSBs consumed which were adopted from Teng³. The Knowledge, Attitude and Practices (KAP) questionnaire consists of 22 dichotomous questions and 5 multiple answers out of 13 items for knowledge, 11 items for attitude and 3 items for practices that require a response of either Yes/No or Agree/Disagree. The KAP scores were computed following standard approaches used in adolescent nutrition KAP studies. Knowledge was assessed using 13 dichotomous items (correct = 1, incorrect/"don't know" = 0; total score 0–13) and classified into poor (0–4), moderate (5–9), and good (10–13) levels using tertile-based cut-offs, similar to methods used by Kigaru et al. and Najam et al^{67,68}. Attitude was measured using 11 statements on a 3-point Likert scale (Agree = 3, Neutral = 2, Disagree = 1), with reverse-coded negative items, yielding a total possible score of 11–33 which was categorized into negative (11–18), neutral (19–26), and positive (27–33) attitudes. Practice was evaluated using three items assessing weekly SSB consumption frequency, aggregated into a composite score and classified as low or high consumption. These scoring criteria ensure consistent interpretation of KAP domains and reflect approaches validated in previous nutrition KAP studies¹⁵.

The adapted FFQ on frequency and volumes investigated the frequency of plain water and SSBs intake on a daily, weekly, and monthly basis. It consisted of seven types of beverages, including plain water, milk products and tea beverages, sweetened fruit beverages, regular soft drinks, energy and sports drinks, and homemade/local drinks. This questionnaire estimated the habitual intake of these beverages, which were part of the measurement of practices. There are six categories of responses, ranging from "once daily", to "4 or more times per week".

Anthropometric measurements such as body weight and height were measured by a trained research team. Body weight was measured in light clothing, without shoes, using a portable digital electronic scale [Omron HBF-514C Full body sensor body composition and scale; 1665708-0E; China]. Height was measured at the distance from the top of the head to the bottom of the feet, without shoes, using Seca 213 Portable Height Measure; China] Both weight and height were measured twice and the average documented. The BMI was calculated as weight(kg)/height (m²). The classification of BMI-for-age was based on World Health Organization (WHO) criteria¹⁶.

Statistical analysis

The Statistical Package for Social Science (SPSS) version 21.0 was used for tabulation and analysis of the data. The demographic data was examined using descriptive statistics, and the results were reported as frequency, percentage, mean and standard deviation. The KAP scores were calculated by summing up the participant's

number of correct responses. The frequency of plain water and SSB consumption were described via descriptive statistics, and the results were reported in frequencies and percentages. Association between Knowledge, attitudes and SSB consumption was tested using chi-square tests. All p-values were significant at <0.05.

Ethics

The protocol for the study was reviewed and approved by the Institutional Review Board of the University of Cape Coast, Ghana (UCCIRB/CHAS/2023/118). A written permission to undertake the study was obtained from the Ghana Education Service and the head teachers of the senior high schools. Participation in the study was voluntary and adolescents who agreed to participate in the study were made to thumb print or append their signatures on a participant consent form in the presence of a witness (mostly classmates or class teachers).

Results

Socio-demographic characteristics

The data involved socio-demographic aspects such as gender, age, class level of the participants, as well as the educational background and income of their parent or guardian. The findings in Table 1 showed that out of 393 participants, 53.9%, were male, while 46.1%, were female.

Table 1. Socio-demographic characteristics

	Frequency	Percent
Gender		
Male	212	53.9
Female	181	46.1
Age		
13 - 15	62	15.7
16 - 19	331	84.3
Class		
Form 1	146	37.2
Form 3	247	62.8
Education level of guardians		
None	47	12.0
Primary	10	2.5
Secondary	115	29.3
University	192	48.9
Don't know	29	7.4
Employment status of guardians		
Employed	327	83.2
Unemployed	43	10.9
Retired	23	5.9
Categorical data are presented as percentages.		

For the age distribution, 15.7% of the participants were between the ages of 13 -15 years while 84.3% fell between the ages of 15 – 19. The mean age is 16.83 (+-SD). Based on their class level, most of the participants, constituting about 62.8% of the total, were in Form 3 while 37.2% of the participants were in Form 1. Concerning the educational attainment of their guardian, 12% had guardians with no formal education. A very small percentage, 2.5% had guardians with primary education. About 29.3% had guardians with a secondary level of education. The majority

(48.9%) had guardians with a university education. A smaller portion, about 7.4% did not know the education level of their parent or guardian. For the employment status of their guardians, the majority, (83.2%) had guardians who were employed. Almost 11% had guardians who were unemployed and a smaller portion of 5.9% had guardians who were on retirement.

Nutritional status of respondents

The mean weight (SD) was 60.1±11.1 and the mean height (SD) was 165.4±9.7. The mean BMI-for-age of 1.23 suggests that, on average, most of the participants were within the "Normal" BMI category. The presence of individuals in the "Overweight" (11.5%) and "Obese" (7.1%) categories indicates that there is a portion of the population at risk for weight-related health issues.

Table 2. Nutritional status of respondents

	Mean	SD	Percent
Weight (kg)	60.1	11.1	
Height (cm)	165.4	9.7	
BMI-for-age	1.2	0.6	
underweight <-2SD			2.5
normal -2SD to 1SD			78.9
overweight 1SD to 2SD			11.5
obese 30+			7.1

Nutritional knowledge level, SSB Consumption, and BMI-for-Age

Table 3 presents the distribution of respondents according to their nutritional knowledge of SSBs, level of SSB consumption, and BMI-for-age by gender. Overall, 26.7% of participants demonstrated poor knowledge of SSBs, 55.7% had moderate knowledge, and 17.6% exhibited good knowledge regarding SSBs and their health effects. When disaggregated by sex, 26.0% of males and 27.6% of females had poor knowledge, while moderate knowledge was observed among 53.3% of males and 58.6% of females. A higher proportion of males (20.8%) demonstrated good knowledge compared to females (13.8%).

Table 3. Distribution of Nutritional Knowledge, SSB Consumption, and BMI-for-Age by Gender (N = 393)

	Both sexes N(%)	Male N(%)	Female N(%)
Level of Knowledge			
Poor knowledge	105(26.7)	55(25.9)	50(27.6)
Moderate knowledge	219(55.7)	113(53.3)	106(58.6)
Good knowledge	69(17.6)	44(20.8)	25(13.8)
Level of SSBs consumption			
Low	167(42.5)	96(45.3)	71(39.2)
High	226(57.5)	116(54.7)	110(61)
BMI-for-age			
underweight <-2SD	10(2.5)	8(3.8)	2(1.1)
normal -2SD to 1SD	310(78.9)	185(87.3)	125(69.1)
overweight 1SD to 2SD	45(11.5)	14(6.6)	31(17.1)
obese 30+	28(7.1)	5(2.4)	23(12.7)
Frequency - N, Percentage - %			

Regarding consumption patterns, 57.5% of respondents reported high SSB consumption, whereas 42.5% reported low consumption. The distribution of BMI-for-age categories showed that a greater proportion of males (53.9%) fell within the normal BMI range compared to females (46.1%). Females were more represented in the overweight (17.1% vs. 6.6%) and obese (12.7% vs. 2.4%) categories, while underweight status was more prevalent among males (3.8%) than females (1.1%).

General attitude and Level of Consumption

Table 4 presents respondents' general attitudes toward sugar-sweetened beverages (SSBs) and the level of SSB consumption stratified by gender. Overall, 52.9% of participants demonstrated a positive attitude toward SSB consumption, whereas 47.1% exhibited a negative attitude.

Regarding consumption patterns by gender, 45.3% of males reported low SSB consumption and 54.7% reported high consumption. Among females, 39.2% had low consumption while a higher proportion, 61.0%, reported high consumption. Across the total sample of 393 participants, 42.5% had low SSB consumption and 57.5% had high SSB consumption.

Table 4. Distribution of Nutritional Knowledge, SSB Consumption, and BMI-for-Age by Gender (N = 393)

	Frequency	Percent
General Attitude		
Negative	185	47.1
Positive	208	52.9
Level of SSB consumption		
Low	167	42.5
High	226	57.5

Association between Knowledge, Attitude and SSB Consumption

Table 5 presents the association between participants' level of knowledge regarding sugar-sweetened beverages (SSBs), their general attitude, and their level of SSB consumption. The analysis showed no statistically significant association between knowledge and general attitude toward SSBs (χ^2 test, $p > 0.05$). Similarly, there was no statistically significant association between participants' level of knowledge and their level of SSB consumption (χ^2 test, $p > 0.05$). This shows that variations in nutritional knowledge

about SSBs were not significantly related to either attitude toward SSBs or actual consumption patterns within the study population.

Multivariable Logistic Regression Analysis of Predictors of High SSB Consumption

Binary logistic regression analysis showed that none of the sociodemographic or behavioural factors were significant predictors of high SSB consumption. After adjusting for age, sex, parental education, BMI-for-age, nutrition knowledge, and attitude, none of these variables showed statistically significant associations with consumption level (all $p > 0.05$). Students aged 16–19 years were no more likely to consume SSBs than those aged 13–15 years (AOR = 1.14; 95% CI: 0.76–1.72; $p = 0.52$). Similarly, positive attitude toward limiting SSB intake did not predict lower consumption (AOR = 1.05; 95% CI: 0.72–1.55; $p = 0.79$).

Discussion

In interpreting the findings of this study, it is important to recognize that the measure of SSB encompassed a diverse range of seven beverage categories, each with distinct nutritional profiles and implications for adolescent health. Although plain water served as the reference beverage and reflects healthy hydration behaviour, adolescents in many settings often substitute water with caloric alternatives³. While milk and tea products offers essential nutrients such as calcium and high-quality protein, flavoured milks and commercially sweetened teas contribute substantial amounts of added sugars comparable to those found in soft drinks⁴¹. Similarly, sweetened fruit beverages, frequently perceived as healthier choices, are typically formulated with added sugars and provide energy densities similar to regular sodas, thereby contributing significantly to total sugar intake⁵¹. Energy and sports drinks pose additional risks due to their sugar content and the presence of caffeine and other stimulants, which may exacerbate sleep disturbances, hyperactivity, and cardiovascular strain among adolescents³⁶. Homemade or locally prepared drinks which include sweetened porridges, cocoa beverages, hibiscus drinks, and other culturally embedded preparations are typically prepared without standardized recipes, leading to high variability in sugar content and portion size, and are consumed frequently within households³. Taken together, these categories illustrate that adolescents are exposed to multiple forms of SSBs beyond commercially packaged soft drinks.

Table 5. Association Between Knowledge, Attitude, and SSB Consumption

	General Attitude				SSB Consumption			
	Negative N(%)	Positive N(%)	χ^2 (df)	p-value	Low N(%)	High N(%)	χ^2 (df)	p-value
Level of Knowledge								
Poor	51 (13.0)	54 (13.7)	0.031	0.535	47 (28.0)	58 (25.7)	0.076	0.134
Moderate	104 (26.5)	115 (29.3)			98 (58.7)	121 (53.5)		
Good	30 (7.6)	39 (9.9)			22 (13.2)	47 (20.8)		
Total	185 (47.1)	208 (52.9)			167 (42.5)	226 (57.5)		

Frequency- N, Percentage- %

Table 6. Crude and Adjusted Odds Ratios Predicting High SSB Consumption

	OR	95% CI	p-value	AOR	95% CI	p-value
Age (16–19 vs 13–15)	1.09	0.75–1.60	0.62	1.14	0.76–1.72	0.52
Sex (Male vs Female)	1.13	0.78–1.64	0.51	1.09	0.74–1.60	0.67
Parental Education (Higher vs Lower)	1.25	0.86–1.82	0.25	1.21	0.80–1.83	0.37
BMI-for-Age (Non-normal vs Normal)	1.16	0.78–1.72	0.45	1.08	0.71–1.63	0.71
Nutrition Knowledge (Moderate/Good vs Poor)	1.18	0.82–1.72	0.38	1.12	0.78–1.75	0.44
Attitude (Positive vs Negative)	1.07	0.74–1.53	0.73	1.05	0.72–1.55	0.79

Note: OR = Crude Odds Ratio. AOR = Adjusted Odds Ratio. CI = Confidence Interval. Adjusted for age, sex, parental education, BMI-for-age, nutrition knowledge, and attitude.

Assessment of Adolescents' Knowledge Regarding SSBs

The first objective of the study was to evaluate the knowledge of adolescents regarding SSBs. The level of nutritional knowledge holds significant sway over individuals' dietary habits. In this study, an assessment was conducted to gauge the students' understanding of SSBs. An analysis of composite knowledge scores revealed that, on the whole, the participants possessed a moderate level of knowledge concerning the health consequences associated with SSBs. This finding aligns with prior studies conducted, which reported that most students possessed a moderate level of awareness regarding the detrimental effects of SSBs^{19,20,21}. However, these studies did not find any significant correlation between nutritional knowledge and actual SSB consumption patterns. This underscores the critical importance of enhancing awareness among adolescents regarding the health implications of consuming SSBs. Interestingly, no discernible disparities were observed in knowledge levels when considering gender and BMI categories ($P > 0.05$). Consequently, it can be inferred from this findings that factors such as gender, BMI categories, and class year do not exhibit any meaningful association with knowledge levels which is consistent with prior researches conducted^{22,23}. Enhancing knowledge regarding the nutritional value of foods can facilitate better dietary choices, equipping individuals with the understanding of how to adopt a healthier diet for improved overall well-being. Achieving this goal necessitates the implementation of clear and easily accessible methods for displaying nutritional information tailored to this age group. Nevertheless, variables like gender, class year, and age groups did not display any significant associations with attitudes toward SSBs ($P > 0.05$). A clear link between socio-demographic factors and nutritional knowledge has not been consistently confirmed but it is imperative to continue increasing awareness among adolescents regarding the health implications of consuming SSBs.

Determination of Adolescents' Attitudes Towards SSBs

The second objective aimed to investigate the attitudes of adolescents towards SSB intake. The findings of this study indicated that more than half of the respondents expressed a positive attitude toward the consumption of SSBs. This observation is in line with the results of a Nigerian study by Fadupin and others²⁴ among university students, where the majority of students exhibited a positive attitude toward SSBs. A Taiwanese study²⁵ among high school students similarly established that students with negative attitudes toward SSBs tended to consume fewer SSBs. This also aligns with a study conducted which found

that individuals who were heavy users of soft drinks, regardless of the frequency, had more positive general attitudes toward their consumption^{26,27}. In terms of the relationship between knowledge and attitudes, the study identified an extremely weak positive linear relationship between the level of knowledge and general attitudes towards SSBs. However, the statistical analysis showed that this correlation was not statistically significant, as the p-value of 0.535 was much higher than the significance level of 0.05. This indicated that the observed correlation between knowledge and attitudes was not strong enough to be considered statistically meaningful. Furthermore, the study revealed gender-based differences in attitudes towards SSB consumption, with males exhibiting a slightly more favorable mean attitude score compared to females. This could be attributed to the higher number of male participants in the study. A similar gender-based difference in SSB consumption attitudes was also noted in a study, where men and younger individuals consumed more regular soft drinks compared to women²⁹. However, in this study, no statistically significant difference in general attitudes towards SSB consumption was found between males and females ($P = 0.572$), which contrasts with the findings of Malik et al.¹, who reported that females had more negative attitudes toward the normal sweetness of soft drinks compared to males. Additionally, this study identified a significant difference in general attitudes toward soft drink consumption based on participants' BMI. Normal-weight individuals had more favorable attitudes towards soft drink consumption compared to overweight and obese individuals. These findings are consistent with the findings³², which found that obese individuals had a higher preference or implicit attitude toward soft drink consumption compared to their non-obese counterparts. These results are supported by evidence showing that although low-energy foods and drinks provide few calories, excessive intake can lead to calorie accumulation, potentially resulting in overweight and obesity³⁴. However, it's important to note that this study alone cannot establish a causal relationship between excessive diet soft drink consumption and the development of overweight and obesity; further prospective research is needed to investigate this potential link. Interestingly, the study did not find a significant correlation between knowledge levels and general attitudes toward soft drink consumption ($P > 0.05$), which differs from the findings³⁵, who reported a weak and negative correlation between knowledge levels and general attitudes toward soft drink consumption ($P = 0.041$). This suggests that individuals with more positive general attitudes toward soft drink consumption may have lower levels of nutrition knowledge.

Consequently, interventions aimed at reducing regular soft drink consumption should be tailored specifically to adolescents.

Investigation of Adolescents' Practices Regarding SSBs

The third objective of this study aimed to investigate the behaviors and practices of adolescents in relation to SSBs. The findings revealed that more than half of the high school students surveyed had a substantial intake of SSBs. This observation is consistent with a study conducted in the United States, which also reported high daily consumption of SSBs among both young adults and children³⁶. Similar trends were noted in previous studies³⁷⁻³⁹, which found that children had a higher consumption of soft drinks, often more than once per day, compared to adults. Consequently, there is a clear need for robust campaigns targeting this demographic, focusing on excessive or frequent consumption of SSBs. These campaigns could be integrated into the school curriculum or delivered through seminars. Recently, SSBs have been at the center of discussions related to obesity. However, when examining specific beverage consumption patterns, some variations emerge. For instance, a significant proportion of respondents reported consuming carbonated drinks, aligning with study on SSB consumption patterns in the USA, where soda (carbonated drinks) was the most commonly consumed SSB among adolescents⁴⁰. Furthermore, the frequency of consumption revealed that SSBs like tea and coffee were consumed at least once a day by 18.8% of the respondents. Across all the listed beverages, a volume of 250ml was the most commonly consumed. In interpreting these findings, it is important to consider the range of beverages captured in the study. The questionnaire included plain water, milk products, tea beverages, sweetened fruit drinks, regular soft drinks, energy and sports drinks, and homemade or local beverages. Although most students reported frequent consumption of commercially available soft drinks and sweetened fruit beverages, energy and sports drinks also contributed to overall SSB intake. Homemade beverages such as "sobolo," sweetened cocoa drinks, and locally prepared fruit juices were commonly consumed and may contribute substantial amounts of added sugar despite being perceived as "natural" or healthier options. This variety of beverages likely influences total sugar intake and may explain why consumption remained high even among students with moderate knowledge and positive attitudes. Interestingly, the study found that plain water was the most frequently consumed beverage on a daily basis, a finding consistent with the results of a study conducted by Miller⁴¹, where a majority of participants also reported daily consumption of plain water. It's important to acknowledge that the findings regarding the frequency of SSB consumption were based on self-reports, which may be subject to reporting bias. Therefore, these findings should be interpreted with caution and may not be generalized to other populations of the same age group. High consumption of soft drinks, especially sugar sweetened (regular drinks) have been reported by various studies to have a direct link with diet related health problems^{42,43}. SSBs have been implicated as one of the contributory factors to increased body weight and high risk of obesity observed among many population

3,36,42. The high consumption of SSBs observed among the students in this study could be as a result of their perception of SSBs. For example, many of the respondents perceived SSBs as social drinks and it is alarming that the majority consumed SSBs regularly despite their awareness of health implications of excessive consumption of these drinks. The relatively lower consumption frequency of carbonated drinks, fruit drinks, and energy drinks, often limited to at least once a week or less, could be influenced by factors such as affordability, accessibility, and availability.

Relationship Between Demographic Factors and SSB Consumption

The study utilized correlation coefficients to explore the potential links between demographic factors and SSB consumption. Interestingly, the analysis revealed that neither gender nor the class of the participants exhibited any significant associations with SSB consumption levels. This finding contrasts with the results of⁴⁴, where a thorough inferential analysis established a notable link between respondents' class and their consumption of SSBs. In stark contrast, a national cross-sectional study conducted among American high school students pointed to a considerable reduction in soda consumption over the years⁴⁵. It's noteworthy that all the participants in our survey were teenagers, with the majority falling in the 16 to 19 age group. Intriguingly, our analysis did not show any association between age and the frequency of SSB consumption. This finding contradicts the results⁴⁶ which found a significant correlation between increasing age among respondents and a higher likelihood of frequent SSB consumption. Furthermore, in our bivariate analysis, we could not establish any significant associations between the educational levels or occupations of parents or guardians and the frequency of SSB consumption among the students. This outcome contradicts the findings suggested by Magriplis⁴⁷, which supported the notion that adolescents' frequency of SSB consumption is influenced by the educational backgrounds of their parents. With regards to the anthropometric indices among adolescents and young adults, significant association was observed between frequent intake of SSBs and being overweight among the students by many researchers in other countries⁴⁸⁻⁵⁰. These reports highlighted that, as a result of plausible physiological mechanism, frequent or excessive intake of SSBs could lead to overweight and obesity, due to imprecise and incomplete compensation for energy consumed in liquid form⁵¹⁻⁵³. It was also reported in a national survey data in the United States that, over the past 20 years, there has been an increase in rates of overweight and obesity due to high consumption of carbohydrates, largely in the form of SSBs⁵⁴.

Implications and Recommendations

The findings of this study have several implications for future research and interventions. It is evident that there is a gap between knowledge, attitude, and actual practices regarding SSB consumption among adolescents. Therefore, strategies are needed to bridge this gap and translate positive attitudes into healthier practices. Education on SSBs and their health consequences should be strengthened within school curricula. It is recommended that such strategies take

into account the socioeconomic status of students, with an emphasis on nutritional education about SSBs and healthy eating for those from higher-income families. Additionally, efforts should be made to reinforce the understanding of the adverse effects of high SSB consumption to motivate healthier practices. Reducing the availability of SSBs both in schools and at home can support lifestyle changes and promote healthier beverage choices. Furthermore, Intervention to reduce soft drinks consumption especially sugar sweetened drinks should have theoretical basis as review of the literature shows theory-based interventions of other health behaviour change has substantial effects^{54,55}. On this aspect the theory of planned behaviour has been found to be promising in explaining and predicting eating and drinking behaviours^{54,55}. Although this study found generally low consumption of soft drinks and low attitudes towards consumption of soft drinks, it sheds some light for policy implication and practices. Adults can still play a significant role in behavioural change of their children and adolescents. This can be implemented through reinforcement of parental rules, knowledge, and skills, since children and adolescents are mostly affected by negative health consequences resulting from excessive soft drink consumption. Another policy implication could be promoting awareness through information campaigns and addressing environmental cues related to soft drink consumption^{56,57}. Moreover, soft drink industries should innovate and produce new soft drinks products with regulated amounts of sugars and small size packages to limit intake of sugar and reduce the amount of intake. Also, soft drinks should not form the essential part of the meal and/or can be completely avoided during meals. Alternatively, water and low-fat milk products can replace sugar-rich soft drinks⁵⁸.

Before implementing policy measures to reduce soft drinks consumption the government should consider; the prevalence of health effects caused by consumption of soft drinks (such as obesity and cardiovascular diseases) in the target population. The levels of soft drinks intake (which are determined by consumption frequency and amount) in the general population and the existing policy measures which have worked⁵⁹. To check for effectiveness of informative intervention targeting at adolescents' soft drink consumption, their attitude and nutrition knowledge, and long prospective studies are needed. Increase of nutrition knowledge is also necessary since this knowledge is not static, it changes as knowledge on health and diet increase, subjecting dietary recommendations to changes as well⁶⁰.

Limitations

While this study provides valuable insights, it is not devoid of limitations. The sample was drawn from a limited number of schools, which may reduce the applicability of the findings to the wider adolescent population, and the use of convenience sampling may have introduced selection bias, as participants were selected based on availability rather than random sampling. As a result, the study sample may not be fully representative of all students, and the findings should therefore be interpreted with caution and may not be generalisable to the wider adolescent

population. Additionally, the reliance on self-reported data for beverage intake introduces the possibility of reporting bias, particularly in overweight or obese adolescents. Moreover, the study did not consider various other factors such as dietary habits, physical activity, genetic factors, or environmental influences that could impact body composition. For a more comprehensive understanding of adolescent SSB consumption, future research should incorporate these factors. Furthermore, this study covered numerous variables within a relatively limited timeframe. While this breadth of exploration provides a valid overview of the population, it also hinders in-depth analysis of specific issues. The findings from this study can serve as a foundation for further research aiming to delve deeper into the topics explored herein. Regrettably, due to resource and time constraints, the study's design does not permit the establishment of causality. Longitudinal studies are necessary to ascertain causative relationships. The use of self-administered questionnaires and, consequently, self-reported data, despite its advantages, introduces potential biases, including recall and social desirability biases. Additionally, the absence of accompanying clinical examinations prevents the validation of self-reported findings against objective measurements. Integrating clinical examinations could enhance the perceived validity of the reported results. Therefore, it is essential to consider these limitations when interpreting the study's outcomes.

Conclusion

This study delved into the factors influencing adolescents' knowledge, attitudes, and practices regarding SSBs. The findings revealed that, on the whole, adolescents possessed a moderate level of knowledge about the health implications of SSBs and generally held positive attitudes toward their consumption. However, there was a disconnect between this knowledge and their actual practices, with a significant portion of adolescents consuming substantial quantities of SSBs. Notably, factors such as gender, BMI categories, and class did not significantly impact knowledge, attitudes, or practices related to SSBs. These results underscore the imperative need for targeted interventions aimed at augmenting knowledge and translating these positive attitudes into healthier practices among adolescents. Adolescents unequivocally require nutritional education. While there is a paucity of pre- and post-intervention studies, existing research^{60,61}, has demonstrated positive outcomes post-intervention. Their study reported increased fruit and vegetable consumption and decreased sweet intake, particularly among females. Among males, a noticeable reduction in soft drink consumption and an increase in fruit and vegetable intake were observed. Nutritional interventions during adolescence have the potential to influence eating behaviours, which can have long-term effects extending into adulthood. Attitudes toward food, especially healthy options, may be influenced by concerns about body image, particularly among adolescent girls. Some students, particularly females, may adopt healthy eating habits not solely due to increased nutritional knowledge but also by emulating their parents' eating habits. Older adolescents tend to assert more

independence in choosing their foods, while younger ones are more likely to follow their parents' eating patterns⁶¹⁻⁶³. Government policy interventions can have a substantial impact on controlling SSB consumption and addressing obesity among adolescents and young adults. Continuous campaigns and advertisements highlighting the detrimental effects of excessive SSB consumption should be intensified to discourage students from consuming these beverages. Additionally, the government should consider regulating the production and consumption of SSBs through policy measures to curb the increasing intake and associated health-related harms resulting from their misuse⁶².

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Data Availability

Data cannot be shared publicly because it contains sensitive identifying information. However, data are available from the Institutional Review Board of the University of Cape Coast, Ghana (Email: irb@ucc.edu.gh) for researchers who meet the criteria for access to confidential data.

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