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Impact of the School Food Environment on Dietary Choices and Body Mass Index Among Adolescents: A Case Study of Secondary Schools in Suakoko District, Bong County, Liberia

Washington Kezelee[1*], Jae George[1], Musu M. Mulbah[1], Felecia N. Bendoe[1], Zomie N. Yelegon[1], Decontee T. B. Kwiyarhe[1]
Jimmy Lormie[1], Gertrude T. Kollie[1], Joseph Gweemei[1], Emmanuel Solon[1]

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ABSTRACT

Adolescence is a critical period for developing lifelong dietary habits, and the school food environment plays a significant role in shaping these behaviors. With increasing rates of obesity and malnutrition among adolescents, understanding the influence of the school food environment is crucial, particularly in sub-Saharan Africa, where traditional diets are transitioning towards more processed, calorie-dense foods. This study aimed to assess the impact of the school food environment on dietary choices and body mass index (BMI) among adolescents in Suakoko District, Bong County, Liberia. A cross-sectional design was employed involving 275 students from 23 randomly selected public and private secondary schools. Data were collected using structured questionnaires, direct observations of the school food environment, and anthropometric measurements. Statistical analysis, including chi-square tests, was conducted to explore the relationships between school food environment, dietary choices, physical activity, and BMI. The results revealed that 64% of the students did not frequently choose fruits and vegetables, with food choices primarily influenced by availability and taste. A significant relationship was found between physical activity and nutritional status ($p = 0.017$), with regular physical activity being linked to a healthier BMI. However, no significant associations were found between school promotion of healthy eating, nutrition education, or the presence of school gardens, and students' BMI. In conclusion, although schools play a vital role in shaping dietary habits, this study emphasizes the need for more effective interventions to improve access to nutritious foods and promote physical activity. Addressing the gaps in school infrastructure and enhancing nutrition education could contribute to better health outcomes for adolescents in Liberia.

INTRODUCTION

Adolescence is a critical period in the development of dietary habits that can affect lifelong health outcomes. During this stage, adolescents undergo rapid physical, emotional, and social changes that necessitate adequate nutrition to support their growth and development. Poor dietary choices during adolescence are associated with an increased risk of non-communicable diseases (NCDs), such as obesity, diabetes, and cardiovascular disease later in life (WHO, 2016). The global rise in obesity, particularly among children and adolescents, is currently one of the most pressing public health concerns. The World Health Organization (WHO) reported that over 340 million children and adolescents aged 5–19 years were overweight or obese in 2016, with a prevalence more than doubling since 1980 (WHO, 2020). This global trend is exacerbated by the increasing consumption of processed foods high in sugars, fats, and salts combined with a decline in physical activity (Keeley *et al.*, 2019).

The school environment plays a crucial role in shaping adolescents' dietary behaviors. School-based food environments influence students' food choices as they often have limited autonomy over what they eat during school hours (Story *et al.*, 2006). Research has shown that school meals, vending machines, and tuck shops offering unhealthy snacks can contribute to poor dietary intake and increased body mass index (BMI) in adolescents (Harrington *et al.*, 2020; Jacob *et al.*, 2021). Interventions targeting the school food environment are recognized as effective strategies for improving adolescents' dietary patterns and promoting healthier body weight (Pastor & Tur, 2020).

In sub-Saharan Africa, the issue of adolescent nutrition has become increasingly concerning. Many African countries face a double burden of malnutrition, wherein undernutrition and micronutrient deficiencies coexist with rising rates of overweight and obesity (Pencil *et al.*, 2024). The transition from traditional diets to more Westernized diets, characterized by an increased intake of processed and calorie-dense foods, has contributed to the growing prevalence of obesity in urban areas (Popkin 1998; Popkin 2022). In West Africa, including Liberia, the increasing availability of unhealthy food options in schools has been identified as a key factor that influences adolescents' dietary choices (Steyn & Mchiza, 2014).

Liberia, like many other countries in sub-Saharan Africa, is experiencing an epidemiological shift from infectious diseases to NCDs such as obesity and hypertension.

[1] Department of Public Health Nutrition, Cuttington University School of Graduate & Professional Studies, Liberia
[*] Corresponding author's e-mail: wkezelee@up.edu.ph

According to the Liberia Demographic and Health Survey (2019), the prevalence of overweight and obesity among adolescents aged 10–19 years has been steadily rising. This trend is particularly evident in urban settings where the school food environment is characterized by the sale of sugary beverages, fried snacks, and other unhealthy foods (LDHS, 2019). Bong County, located in central Liberia, is no exception to these challenges as the rapid urbanization and commercialization of food markets are affecting the food choices available to adolescents in secondary schools.

The school food environment includes types of food and beverages that are available, accessible, and promoted within school settings. It encompasses school meal programs, food sold at canteens or tuck shops, and food marketing practices. Several studies have highlighted that unhealthy school food environments contribute to poor dietary habits among adolescents, such as a high consumption of energy-dense and nutrient-poor foods (Driessen *et al.*, 2014; Mâsse *et al.*, 2014). For instance, in Urban Ethiopia, a study found that adolescents identified foods high in salt, fat, and sugar, including processed/packaged foods, as unhealthy but still consumed them frequently because of their taste, affordability, availability, and accessibility in and around schools (Iyassu *et al.*, 2024). Similarly, a study among Canadian adolescents showed that the availability of sugar-sweet beverages at school was linked to higher consumption and increased obesity rates among students. Less healthy foods are associated with overweight, but not obesity (Mâsse *et al.*, 2014). School food environment alone was not significantly associated with dietary intake or BMI3. Other factors, such as socioeconomic status and sex, play a more substantial role (Alston *et al.*, 2019).

Despite the growing body of research on the impact of the school food environment on adolescent dietary behaviors, there remains a significant gap in understanding this relationship in the Liberian context. Most studies in sub-Saharan Africa have focused on urban areas in countries with more developed school food programs, leaving no data from rural or semi-urban regions where school food environments may differ substantially (Popkin & Reardon, 2018; Casari *et al.*, 2022).

Furthermore, while the prevalence of overweight and obesity is increasing among adolescents in Liberia, there is limited research on the role of school food environments in shaping dietary choices and BMI, particularly in secondary schools in rural districts, such as Suakoko in Bong County. This study sought to address this gap by investigating the impact of the school food environment on dietary choices and BMI among adolescents in Suakoko District, Bong County.

Global Perspective on School Food Environment and Adolescent Health

The school food environment, which encompasses the availability, accessibility, and quality of food provided in schools, plays a pivotal role in shaping adolescents' dietary habits. Numerous studies have shown that schools significantly influence children and adolescents' eating behaviors, given that students often consume at least one meal during school hours. According to Story *et al.* (2009), schools can either promote healthy dietary habits or foster the consumption of unhealthy foods, depending on the food choices available on the school premises. In the United States, for example, it has been observed that the presence of vending machines and cafeterias offering energy-dense, nutrient-poor foods such as sugary drinks, snacks, and fast-food items is associated with higher calorie consumption and, consequently, higher BMI among adolescents (Briefel *et al.*, 2009). Similarly, a systematic review by Driessen *et al.* (2014) found that schools offering fruits, vegetables, and whole grains as part of their lunch programs reduced the risk of obesity among students by encouraging healthier dietary habits.

School Food Environment in Africa

In sub-Saharan Africa, changes in dietary patterns due to the "nutrition transition"—characterized by increased consumption of processed foods, refined carbohydrates, fats, and sugars—have been linked to rising levels of adolescent obesity (Popkin *et al.*, 2012). Several African countries are grappling with this shift, as school environments often offer energy-dense and nutrient-poor foods, which contribute to poor dietary choices and weight gain among students.

A study by Mukanu *et al.* (2022) on the school food environment in urban Zambia revealed that adolescents' food choices were influenced by personal preference, affordability, and social acceptability. However, healthy foods are often inaccessible and unaffordable. Similar trends have been reported in South Africa, where Erzse *et al.* (2023) found that schools significantly influenced children's dietary behaviors, making them critical for obesity prevention. The study identified easy access to sugary snacks, sodas, and fast food within school premises and insufficient emphasis on teaching students about healthy eating habits as drivers of unhealthy school food environments.

Body Mass Index and Dietary Choices among Adolescents

Body Mass Index (BMI) is a commonly used measure to assess overweight and obesity in adolescents. Studies have shown a strong correlation between unhealthy dietary choices influenced by the school food environment and increased BMI. For instance, the consumption of sugary drinks and high-calorie snacks sold in schools has been directly associated with higher BMI scores among adolescents (Harrington *et al.*, 2020; Klein *et al.*, 2023), particularly concerning the long-term health implications of childhood and adolescent obesity, which can lead to increased risks of chronic diseases such as diabetes and cardiovascular diseases later in life.

MATERIALS AND METHODS

Research Design

This study employed a cross-sectional research design to assess the impact of the school food environment on dietary choices and body mass index (BMI) among adolescents in Suakoko District, Bong County, Liberia. The cross-sectional approach is observational and designed to capture data at a specific point in time from a population of students in selected secondary schools. In this case, owing to financial and logistical challenges, a random selection process was used to choose 26 schools (13 public and 13 private) from 86 schools in the district (data obtained from the Office of the District Education Officer). Students from three of the selected 26 schools were unable to participate in the study because of the administration of the West African Examination Council Test for ninth graders. The final sample consisted of 23 schools (12 public and 11 private).

Sample Size and Sampling Methods

This study employed a stratified random sampling method, which is a probability sampling technique in which the population is divided into subgroups (or strata) that share similar characteristics. In this case, the population comprised all secondary schools (public and private) in the Suakoko District, Bong County, Liberia. The total number of secondary schools with 7th, 8th, and 9th-grade classes was 84, consisting of 47 private schools and 37 public schools. The population is divided into two distinct strata: public and private. A random sample of 13 schools was selected from each stratum, resulting in 26 schools included in the study. The selection was constrained by financial and logistical limitations, which restricted the scope of the study despite the larger population of 86 schools.

Of the 26 schools, the total student population was 5,475, with 56% attending public schools and 44% attending private schools. Using Krejcie and Morgan's (1970) table to determine the sample size, a sample size of 5,475 students was established for 359 students. According to the table, for a population of approximately 5,000, the recommended sample size is 357, whereas for a population of 6,000, it is 361. Based on these guidelines, a sample size of 359 was determined to be appropriate for this study. To ensure representativeness, the number of students recruited from each school was determined based on the proportionality of the total student population within each stratum (public and private), ensuring that the sample size accurately reflected the distribution of students across the district. Data were not obtained from three randomly selected schools (one public and two private schools) because their campuses were utilized by the government of Liberia for the administration of the West Africa Examination Council Test for ninth graders. This further reduced the sample size to 275 students as participants.

Table 1: Sample Size Based on Proportionality by Size (n = 359 students)

Strata	**Total Population**	**Proportion of Population**	**Sample size Based on proportionality by size**
Public	3,057	56%	201
Private	2,418	44%	158
Total	**5,475**	**100%**	**359 students**

Table 2: Sample Size Selection from Each School (n = 359)

Public Schools		
Names	**Total Students**	**Selected sample size from each school**
Suakoko Central High	431	431÷3,057 ×201 = 28
G.W. Gibson	663	43
Balama	94	6
Yaendawon	93	6
Donfah	187	12
David Fejue	451	29
Pengai	113	7
Suakoko Rehab	130	8
Garwoquelleh	215	14
Flomo Wenneh	328	21
Kandakai	164	10
Galia Public School	151	9
Gwetamue Public School	135	8
Private Schools		
Calvary Baptist	141	141÷2,418 × 158 = 9

S.D.A. School	65	4
Taylor Ta	114	7
Cuttington Garden	130	8
Cuttington Campus	281	18
Gbatala Methodist	246	16
Phebe Lutheran	574	38
Francis Kelekai	167	11
Morac Village	121	8
Capernoun	98	6
Dumah Comm	157	10
Gbanykpoloyalleh	116	8
T.T. Harris	208	14

Data Collection Method

This study employed multiple methodologies to gather comprehensive data on the school's food environment and students' dietary choices. The primary method involved administering a structured questionnaire to students in selected secondary schools, focusing on dietary habits, food choices, and perceptions of the school's food environment. Questions covered commonly consumed foods, access to nutritious and non-nutritious options, and the availability of nutritional education. Direct observations were conducted to assess the nutritional and health-related features of the school environment. Observers documented the types of food available on campus, including fruits, vegetables, and non-nutritious snacks; designated eating areas; promotional materials for healthy eating; access to potable water; and handwashing facilities. Anthropometric measurements, including students' weight and height, were used to calculate the Body Mass Index (BMI), an essential indicator of nutritional status. Weight was measured using electronic standing scales, and height was measured using a wall-mounted tape to ensure accuracy. These measurements helped assess the relationship between the school food environment and students' BMI.

Data Analysis Methodology

This study used quantitative analysis to explore the impact of the school food environment on students' dietary choices and Body Mass Index (BMI). Data collected through student questionnaires, anthropometric measurements (weight and height), and observational assessments were analyzed using descriptive statistics, including mean, standard deviation, frequency, and percentage, to provide an overview of dietary habits, food availability, and BMI trends. Chi-square tests were employed to examine the relationship between the school food environment and the nutritional status of each student. BMI was calculated by measuring each student's weight (kg) and height (cm). The Centers for Disease Control and Prevention (CDC) adult body mass index calculator was used to compute the BMI values. The CDC (2022) calculator was used to classify each student's nutritional status.

RESULTS AND DISCUSSION

Table 3 presents the demographic profiles of the students involved in the study. The total number of respondents was 275, with a mean age of 16 (± 3) years. Regarding gender distribution, 52% (142) of the students were boys and 48% (133) were girls. The grade levels of the students varied, with 20% (162) in grade 7, 30% (65) in grade 8, and 40% (48) in grade 9. In terms of the type of school attended, the majority of students (70%, 193) were enrolled in public schools, while 30% (82) attended private schools. These demographic characteristics provided a representative overview of the student population in this study.

Table 3: Demography Profiles of Students

Variables	**Total Respondents**	**% (n)**	**Mean ± SD**
Age (yrs.)			**16± 3**
Gender	**275**		
Boys		52 (142)	
Girls		48 (133)	
Grade level	**275**		
Grade 7		20 (162)	
Grade 8		30 (65)	
Grade 9		40 (48)	

Type of schools	**275**		
Private		30 (82)	
Public		70 (193)	

Table 4 reveals the key insights into the dietary habits of students on campus. A large majority (70%) of students sometimes buy food on campus, with a smaller percentage purchasing food often (11%) or always (8%). Availability (36%) and taste (32%) were the primary factors influencing food choices, while cost (22%) and peer pressure (8%) also played a role. Only 2% of students considered knowledge of healthy eating in their decisions. Additionally, 64% of students did not usually choose fruits and vegetables when eating at school, indicating a preference for less healthy options and a potential gap in awareness or access to nutritious foods.

Table 4: Dietary Habits

Research Question & Response	**Frequency (n)**	**Percentage (%)**
How often do you buy food on campus?		
sometimes	193	70
Often	29	11
Always	23	8
Rarely	20	7
Never	10	4
What factors influence your choice of food on campus?		
Availability	98	36
Taste	88	32
Cost	60	22
Peer Pressure	23	8
Knowledge	6	2
Usually choose fruits and vegetables when eating at school		
Yes	95	35
No	175	64

Table 5 provides insights into students' perceptions of the school food environment. A majority of students (72%) believed that their school promoted healthy eating habits, 21% were unsure, and 8% felt that the school did not promote such habits. Regarding the nutritional quality of meals available at school, 73% of the respondents provided positive feedback, indicating that they perceived the meals as nutritionally adequate, while 27% gave negative responses. These results suggest that most students are generally satisfied with the promotion of healthy eating and the nutritional quality of meals offered at their schools, although a notable proportion remains either unaware or dissatisfied, highlighting potential areas for improvement in health education and food quality.

Table 5: Rating School Food Environment

Response Category	**Frequency**	**Percentage (%)**
The school promotes healthy eating habits		
Yes	197	72
No	57	21
Don't know	21	8
Nutritional quality of the meals available at your school		
Positive Response	201	73
Negative Response	74	27

Table 6 presents the frequency of student engagement in physical activity outside school hours. Among the 275 students surveyed, the majority (49%) reported participating in physical activity 1-2 days per week, indicating that occasional exercise was common. A smaller percentage (17%) engaged in physical activity every day, while 14% were active 3-4 days per week. Only 7% of students reported being physically active throughout the weekday, and 13% indicated that they did not engage in any physical activity outside of school.

Table 6: Frequency of Engagement in Physical Activity Outside of School Hours (e.g., Sports, Exercise)

Respond Category	Count	Percentages (%)
Frequency (n = 275)		
1-2 days per week		49
Every Day		17
3-4 days per week		14
Entire weekdays		7
none		13

Figure 1 shows the percentage of students with access to recreational facilities within the school premises. The bar chart shows that a significant majority of the students (approximately 73 %) reported having access to these facilities. In contrast, only approximately 27% of the students indicated that they did not have access. This suggests that most schools in the study provided recreational facilities, which could play a crucial role in promoting physical activity among students. However, a notable proportion of students without access highlights potential gaps in infrastructure or resource availability in some schools.

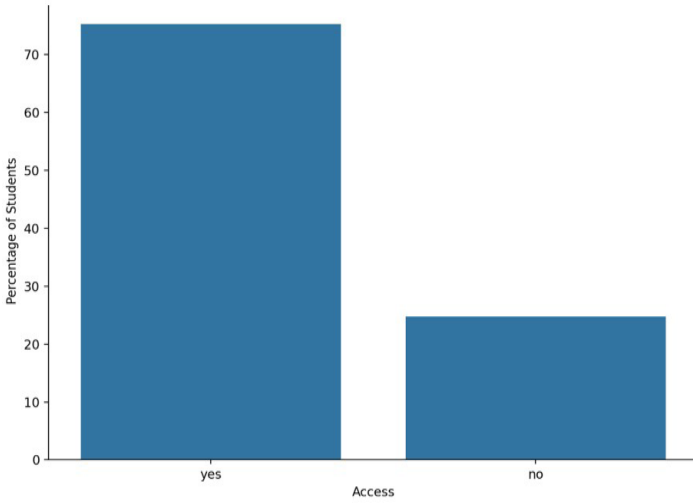

Figure 1: The percentage of students with access to recreational facilities within the school premises

Table 7 shows that 81% of the students had received education about nutrition and healthy eating at school, while 19% had not. Of those educated, 94% received it through classroom lectures, with only 3% being exposed to workshops or printed materials. This indicates that most nutrition education is lecture-based, with a limited use of other interactive or informative methods. Expanding delivery methods can improve the effectiveness of nutritional education.

Table 7: Availability of Nutrition Education Programs on School Campuses

	Percentage (%)
Have you ever received education about nutrition and healthy eating habits at your school?	
Yes	81
No	19
	Percentage (%)
b. If yes, what type of nutrition education have you received?	
Classroom lecture	94
Workshops or seminars	3
Printed materials (e.g., pamphlets, posters)	3

The mean BMI of 275 students was 22.3, indicating a generally healthy average weight. However, 27% of the students were underweight, 24% were overweight, and 5% were obese. While 44% fell within the normal weight range, the significant proportions of underweight and overweight students suggest a need for targeted nutritional interventions to address these disparities and improve overall health (Table 8)

Table 8: Nutritional Status of Students Based on BMI classification (n = 275)

BMI Category	Cutoff point	Mean ± SD	Percentage (%)
BMI		22.3 ±4.9	
Normal weight	BMI 18.5 to 24.9		44
Underweight	BMI less than 18.5		27
Overweight	BMI 25 to 29.9		24
Obese	BMI 30 or greater		5

The chi-square test results showed that there was no statistically significant relationship between fruit and vegetable consumption habits at school and students' nutritional status. The chi-square value was 1.52, with a p-value of 0.91, which is much higher than the common significance threshold of 0.05. This high p-value suggests that the observed differences in nutritional status (healthy weight, overweight, obesity, severe obesity, and underweight) between students who consume fruits and vegetables at school and those who do not are likely due to chance rather than any meaningful association (Table 9)

Table 9: Relationship between fruit and vegetable consumption habits at school and nutritional status

	No (n)	Yes (n)	Chi-square Test p-value
Healthy weight	80	45	
Overweight	39	23	1.52(0.91)
Obesity	8	5	
Severe Obesity	1	0	
Underweight	46	22	

The chi-square test showed a significant relationship between the frequency of physical activity outside school hours and students' nutritional status. With a chi-square value of 35.5 and a p-value of 0.017, the results indicate that how often students engage in physical activities is linked to their likelihood of being underweight, healthy weight, overweight, or obese. This suggests that regular physical activity plays an important role in maintaining or improving nutritional status (Table 10).

Table 10: Relationship between the frequency of physical activity outside school hours and nutritional status

	1-2 days per week	3-4 days per week	5-6 days per week	Every day	None	Chi-square test p-value
Healthy weight	64	17	10	18	20	
Overweight	40	8	3	7	5	35.5 (0.017)
Obesity	7	2	0	3	1	
Severe obesity	0	0	0	0	1	
Underweight	25	11	4	18	10	

Chi-square test results indicated no statistically significant relationship between school promotion of healthy eating habits and students' nutritional status. With a chi-square value of 11.7 and a p-value of 0.29, which is well above the common significance threshold of 0.05, the findings suggest that the differences in nutritional status (healthy weight, overweight, obese, severe obesity, and underweight) between students from schools that promote healthy eating and those that do not are likely due to chance (Table 11).

Table 11: Relationship between School promotion of Healthy Eating Habits and Nutritional Status

	Don't	No	Yes	Chi-square test p-value
Healthy weight	12	27	90	
Overweight	2	17	44	11.7 (0.29)
Obese	0	2	12	
Severe obesity	0	0	1	
Underweight	7	11	50	

The chi-square test results showed a value of 8.74 and a p-value of 0.12, indicating no significant relationship between the presence of a school garden and students' nutritional status. Since the p-value is above 0.05, the differences in nutritional status between students at schools with and without gardens are likely due to chance, suggesting that school gardens do not significantly impact students' nutritional outcomes (Table 12).

Table 12: Relationship Between the Presence of School Garden and Nutritional Status

Presence of School Garden	Healthy weight	Overweight	Obesity	Severe obesity	Underweight	Chi-square test p-value
No	87	37	5	1	48	
Yes	42	26	8	0	20	8.7 (0.12)

The chi-square test results showed a value of 5.2 and a p-value of 0.39, indicating no significant relationship between receiving nutrition education and students' nutritional status. The p-value was above 0.05, suggesting that any observed differences in nutritional status between students who received education and those who did not are likely to be due to chance, implying that nutrition education does not significantly impact students' nutritional outcomes (Table 13).

Table 13: Relationship between Education about Nutrition and Healthy Eating on Campus and Nutritional Status

Received Education	Healthy weight	Overweight	Obesity	Severe obesity	Underweight	Chi-square test p-value
No	28	9	0	0	14	
Yes	101	54	13	1	54	5.2 (0.39)

Table 14 highlights the key gaps in the school environment that impact students' health and nutrition. Most students were in schools lacking designated eating areas (72%) and promotional materials for healthy eating (92%), which may hinder healthy eating practices. While over half have access to safe drinking water (56%), many schools lack handwashing facilities with soap (62%), raising hygiene concerns. Additionally, 65% of students attended schools without gardens, limiting their engagement with healthy food production. Addressing these issues could enhance students' health and well-being.

Table 14: Observation of School Environment of Each Student

Presence of	No n (%)	Yes n (%)
Designated area for eating in school	195 (72)	76 (28)
Promotional materials for healthy eating habits	253 (92)	22 (8)
Access to safe drinking water	120 (44)	155 (56)
Hand washing area with soap to places food is prepared or sold	170 (62)	105 (38)
Any school gardens	178 (65)	97 (35)

Discussion

The study titled "Impact of the School Food Environment on Dietary Choices and Body Mass Index Among Adolescents: A Case Study of Secondary Schools in Suakoko District, Bong County, Liberia" highlights the significant role of the school food environment in shaping adolescents' dietary behaviors and body mass index (BMI). The findings revealed that a large proportion of students (64%) did not frequently choose fruits and vegetables, favoring less nutritious options influenced by availability (36%) and taste (32%). Although 72% of students believe that their schools promote healthy eating habits, the consumption of healthy foods remains low, which aligns with previous studies that show that unhealthy school food environments contribute to poor dietary intake (Mâsse *et al.*, 2014).

The study also revealed that physical activity outside school was significantly correlated with nutritional status, with students engaging in more frequent physical activity being more likely to maintain a healthy weight ($p = 0.017$). However, no significant association was found between the school's promotion of healthy eating habits, the presence of school gardens, or receiving nutrition education and students' BMI. This finding is consistent with previous research, such as that of Alston *et al.* (2019), who found that socioeconomic status and other factors may play a more substantial role than the school food environment alone in influencing students' BMI.

Compared to global findings, such as those from Mukanu *et al.* (2022), who highlighted personal preferences and affordability as major drivers of food choices in Zambia, the results of this study align with trends seen across sub-Saharan Africa, where unhealthy food options remain prevalent in schools. Similarly, the findings of this study support the findings of Erzse *et al.* (2023), who demonstrated that insufficient emphasis on teaching healthy eating and easy access to unhealthy snacks contributes to adolescent obesity in South African schools.

CONCLUSION

This study demonstrates the critical influence of school food environment on adolescents' dietary choices and body mass index (BMI) in Suakoko District, Bong County, Liberia. Despite efforts to promote healthy eating within schools, students' food choices remain driven primarily by availability and taste, with a limited selection of fruits and vegetables, indicating a gap between health promotion and actual behavior. The significant correlation between physical activity and healthier BMI highlights the importance of integrating nutrition and exercise into school programs. Although nutrition education is prevalent, its lack of impact on BMI suggests the need for more effective and interactive approaches. Structural deficits such as the absence of designated eating areas and healthy eating promotion materials further hinder healthy dietary practices. These findings underscore the necessity for comprehensive interventions targeting both the availability of nutritious foods and the promotion of physical activity within schools to improve the nutritional health of adolescents.

Authors' Contributions

1. Washington Kezelee: He was the lead author. He initiated the research project, took the lead in designing the study, analyzed the data, and wrote the manuscript.

2. Jar George: He is a co-author. He helped in the collection of data, wrote sections of the manuscript, helped maintain the integrity of the manuscript, and helped to ensure that the manuscript was completed in time. He provided leadership support to the research team.

3. Musu M. Mulbah: She is a co-author. She helped in the collection of data, wrote sections of the manuscript, maintained the integrity of the manuscript, and ensured that the manuscript was completed in time.

4. Felecia N. Bendoe: She is a co-author. She helped in the collection of the data, wrote sections of the manuscript, helped in maintaining the integrity of the manuscript, and helped in ensuring that the manuscript was completed in time

5. Zomie N. Yelegon: He helped in the collection of data, wrote sections of the manuscript, helped maintain the integrity of the manuscript, and helped to ensure that the manuscript was completed on time.

6. Decontee T.B. Kwiyarhe: She is a co-author. She helped in the collection of data, wrote sections of the manuscript, maintained the integrity of the manuscript, and ensured that the manuscript was completed in time.

7. Jimmy Lormie: He helped in the collection of the data, wrote sections of the manuscript, helped maintain the integrity of the manuscript, and helped ensure that the manuscript was completed on time.

8. Gertrude T. Kollie: She is a co-author. She helped in the collection of data, wrote sections of the manuscript, maintained the integrity of the manuscript, and ensured that the manuscript was completed in time. She also provided leadership support to the research team.

9. Joseph Gweemei: He helped in the collection of the data, wrote sections of the manuscript, helped maintain the integrity of the manuscript, and helped ensure that the manuscript was completed on time. He also provided leadership support to the research team.

10. Emmanuel Solon: He helped in the collection of the data, wrote sections of the manuscript, helped maintain the integrity of the manuscript, and helped ensure that the manuscript was completed on time.

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