



Research article

The relationship between nutrition and physical activity knowledge and body mass index-for-age of school-aged children in selected schools in Ghana

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ABSTRACT

Background: Nutrition knowledge contributes significantly to the nutritional status and habits of individuals as it influences their food consumption. And body mass index (BMI) of individuals. Recent data suggests a relationship between nutrition and physical activity knowledge, attitude, practices, and anthropometric indices of Ghanaian children.**Objective:** To determine the relationship between nutrition and physical activity knowledge and using BMI-for-age of school-aged children.**Methods:** A cross-sectional study involving 591 school-aged children (8–13 years) chosen at random from schools in Ghana's Ho Municipality. Socio-demographic information was gathered. Data on nutrition and physical activity knowledge, attitude, and practice were also collected using structured questionnaires. BMI was calculated after weight and height were measured.**Results:** Majority of the participants had poor knowledge on nutrition (46.6%) and physical activity (49.8%) even though more children in private schools (63.3%) had better (good and excellent) knowledge in nutrition than children from public schools (48.2%). Older children (11–13 years) had 'good' knowledge of physical activity (54.7%) as opposed to younger children. Males (59.5%) and children in private schools (66.3%) also had better overall scores in combined nutrition and physical activity knowledge than their female and public-school counterparts, respectively. Physical activity knowledge was significantly ($p < 0.05$) associated with the BMI-for-age categories. Nutrition knowledge ($p < 0.05$) and total nutrition and physical activity knowledge scores ($p < 0.001$) were weakly but positively associated with BMI-for-age.**Conclusion:** The results suggest that BMI-for-age of the participants was positively correlated to the nutrition knowledge and the total nutrition and physical activity knowledge (NutPA).

1. Introduction

Nutrition knowledge is a contributory factor in people's nutrition and nutritional status (Labban, 2015). According to Juma et al. (2019), rapid globalization, and urbanization in Africa has led to increased junk food availability with associated increased risk of associated non-communicable diseases.

Children in developing countries are making unhealthy food decisions due to a lack of proper dietary awareness and a lack of understanding of nutritious foods (Kigaru et al., 2015). The modern

understanding of food has evolved from; as a source of nourishment, to a lifestyle, enjoyment, social class/status, and other tertiary meanings (Kigaru et al., 2015; LaChance and Ramsey, 2018). Unfortunately, these tertiary perception of food definitions have gained traction in our society and children spend much of their eating patterns mimicking these unhealthy narratives resulting in obesity, sleep disorders, and other associated cardiovascular risk factors (Miller et al., 2013; Beccuti and Pannain, 2011). Most school-aged children spend more time away from their parents and with their peers mostly in school or on the playground (Rachmi et al., 2017). Moreover, part of the time they spend with and

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without their friends is also influenced by media contents (McDonald et al., 2016). Peer and media influence affect the formation and stabilization of dietary practices due to poor nutrition knowledge available through these outlets (Kigaru et al., 2015; Scaglioni et al., 2018). Children have a great likelihood to crave and consume what they see their peers eat (Mason et al., 2020). Furthermore, most food-related advertisements are about highly processed or energy-dense fast foods, mainly fat and sugar-based, and with little or no micronutrient content (World Health Organization, 2013). Recent research has shown that even school canteens are culprits in this trend, providing easy access to these sugar and fat-laden food items (Ochola and Masibo, 2014) since children lack the necessary nutritional information to be able to make healthy decisions about their consumption during mealtimes.

Nutrition knowledge alone, however, would not be sufficient to change children's dietary habits. Attitudes also play an important role in change, particularly when it comes to nutrition (Kigaru et al., 2015). People's dietary practices are influenced by a combination of nutrition knowledge and attitude in terms of the quantity and quality of nutrients derived from food (Sichert-Hellert et al., 2011), because food preference, knowledge of nutritional benefits, and frequency of intake all play a role (Carrillo et al., 2012). Knowledge and attitudes learned in childhood are easily retained because younger minds are very receptive to new information and are more likely to practice and carry on to their peers and families, making them agents of change (David et al., 2012; Waters et al., 2015).

The World Health Organization (WHO) recommends at least 60 min of daily physical activity (WHO, 2011) for children; however, the physical education session in most schools is usually 30 min weekly, which is inadequate (Al-Nuaim et al., 2012). Children's time spent at home mainly consists of physical inactivity coupled with extensive use of social media, and this increasing physical inactivity is further complicated with inappropriate food choices due to poor nutrition knowledge and attitudes (Al-Nuaim et al., 2012; Sodhi, 2010). Physical inactivity is usually compounded by a lack of appropriate nutrition practices even in the light of proper nutrition knowledge due to attitudinal change (Laz et al., 2015). These account for increasing BMI coupled with obesity-related cases among lower age groups, specifically children and adolescents (Appiah and Laar, 2014). The figures related to obesity and its comorbidities increase worldwide with rising prevalence in developing countries (Bhurosy and Jeewon, 2014). Physical activity influences the overall energy expenditure in most people. Calories utilized during physical activity is contingent on the type and length of these activities carried. Therefore, physical activity levels contribute to energy expenditure, affecting weight and corresponding BMI (Mogre et al., 2013).

Obesity is a condition of increased adiposity, which is usually the outcome of continuous positive energy balance over time, resulting from increased dietary intake and low physical activity (Romieu et al., 2017). A chronic positive or negative imbalance in dietary intake and physical activity levels is known to affect weight, resulting in BMI changes (Romieu et al., 2017). According to Escalante-Guerrero et al., (2012), since 1980, the occurrence of BMI-for-age at or above the 95th percentile (indicating obesity) has tripled among children at school going age and adolescents, and it remains at a relatively elevated prevalence of 17% in the United States.

Good nutritional knowledge can encourage appropriate food choices in children by giving them a fair idea of healthy foods available to them (Kigaru et al., 2015). To address the emerging issue of childhood obesity and overweight, as well as the associated health risks, schoolchildren must be empowered to make healthy food choices by providing nutrition education and changing their attitudes toward healthy eating and physical activity. A study by Escalante-Guerrero et al., (2012) in the USA observed that gaps existed in the nutritional knowledge and physical activity related knowledge of children. Also, 56% of the children did not meet their physical activity requirements and 46% reported spending more than 2 h a day in front of a screen.

Nutrition-related knowledge, attitudes, and practices are documented to be important solutions to malnutrition and its related complications (Goudet et al., 2017; Nassanga et al., 2018). Although schools have some form of nutrition education, they are woefully inadequate to develop proper nutritional attitudes and practices among school children, as noted in a study in Kenya that found poor adherence to children's dietary recommendations, such as inadequate intake of high protein, oil and nutritious vegetables, which was significantly associated with poor nutritional knowledge (David et al., 2012).

As a developing nation, Ghana has witnessed rapid urbanization, resulting in lifestyle and dietary changes exposing people to diet-related non-communicable disease. It is imperative to remember that these diseases originate from dietary and physical activity behaviours acquired in childhood (Hwenda, 2013). It is essential to understand how nutrition and physical activity knowledge, attitude, and practice (KAP) affects young children's nutritional status, which will help to better advocate for nutrition and physical activity education. It is against this background that this study seeks to explore the relationship between nutrition and physical activity knowledge, attitude and practices, and nutritional status of school-aged children using their body mass index for age z scores.

2. Materials and methods

2.1. Study design and participants

A cross-sectional study design was used in this study. The study included 591 schoolchildren aged 8 to 13 who lived in and attended either public or private schools. Participants were chosen at random from the Ho municipality's twelve (12) schools. The study was approved by the Committee on Human Research Publications and Ethics (CHRPE/KNUST) with reference number CHRPE/AP/239/18 at Kwame Nkrumah University of Science and Technology. Permission was sought and granted by the school authorities as well as the Regional and District Offices of the Ghana Education Service. Written letters from the children's parents or guardians were used to obtain informed consent for their participation. Prior to data collection, the procedures to be followed were communicated to parents at a Parents Teachers Association meeting. Sample size and sampling procedure.

Using the Cochran formula, a sample size of 527 students was determined with a 50% response rate and an estimated population of 20000 children, with a 95 percent confidence interval and a margin of error of 5%. A total of 12 public or private schools were chosen at random from a list of all schools in the Ho Municipality. From each of the 12 sampled schools, 50 schoolchildren between the ages of 8 and 13 were recruited to participate in the study. The final sample size for the study was 591, based on the availability of the recruited child in the school on the day of enrolment and the fact that some schools had less than 50 children between the ages of 8 and 13. Despite the fact that the final sample size was 591, there were questions that participants had to answer if they selected a particular option. As a result, the total number of responses differed slightly. The study only included children of school age who volunteered to participate and appeared to be in good health. Children with any physical disabilities, as well as those aged 13 and under 8, were excluded from the study.

2.2. Data collection

The data collection was done by researchers and trained field assistants between May 2018 and September 2018. Data on the nutrition and physical activity knowledge of the participants, and their attitude and practices, were collected using the standardized updated Food and Agriculture Organization (FAO KAPP) assessment of the school-aged children questionnaire (FAO, 2014) It consists of questions under various demographics, nutritional knowledge, attitudes, practices, and physical activity questions. The instrument contained simple multiple-choice questions. The questionnaire was administered face-to-face, which

avoided bias and ensured that all questions were answered according to the instructions. The instrument was pretested in a primary school in the same neighborhood as the target schools, in a similar setting. The purpose of the pretest was to observe and correct any errors in factors such as time and question comprehension. The instrument was modified in response to the pretest results. The data collection process was carried out in the 12 schools over a one-month period. The research assistants were thoroughly trained on the study's objectives and data collection techniques prior to data collection. The data collection process was overseen by the principal researcher and six research assistants, and questionnaires were checked daily for completeness, consistency, and clarity. The questionnaire was administered face-to-face, which eliminated bias and ensured that all questions were answered correctly.

2.3. Anthropometric assessment

The SECA (United Kingdom) stadiometer was used to obtain participants' height and which was read to the nearest 0.1 cm (cm). In taking the height measurement, the children were barefooted, had their buttocks and heels touching the vertical surface, stood straight against the measuring board while looking straight ahead and well-positioned. The Omron bathroom (Kyoto, Japan) weighing scale was employed to measure the body weight of the participants. The children stood on the scale with light clothing, without footwear, and measurement read to the nearest 0.1 Kilograms (kg). The children were weighed while dressed in light clothing and without shoes. Two measurements were taken at 0.1kg intervals, and the average was used to determine the child's actual weight. The BMI was calculated by dividing weight by height squared. The participants' BMI-for-age z scores were calculated using WHO AnthroPlus (WHO, 2006) software designed to calculate z scores.

2.4. Assessment of nutrition and physical activity knowledge

A modified FAO nutrition and physical knowledge, attitude, and practice (KAP) assessment of school-age children questionnaire was administered to participants in a quiet environment. They were a series of multiple answer questions on the questionnaire designed to assess students' awareness of nutrition and physical activity. The assessment objectives were explained to the participants before the assessment. Ten multiple-choice questions about food, nutrition, and healthy eating were used to assess nutritional knowledge. For each question, a correct response was coded as 1, and an incorrect response was coded as 0. The cumulative score for each child was calculated using a maximum of 10 correct answers. Following that, the scores were converted to a percentage. Those who scored less than 46 percent were classified as having poor nutritional knowledge, those who scored 46–69 percent as having good nutritional knowledge, and those who scored more than 70 percent as having excellent nutritional knowledge, as determined prior to the study. The same assessment method but different questions were used for physical activity knowledge level. Participants were asked whether exercise makes the body healthy, how many minutes of physical activity is recommended every day for school children; it is important for school children to be physically fit, whether taking part in physical activity improves memory and many other questions. Responses were ranked and scored for both nutritional and physical activity awareness. The level of knowledge was poor, good and excellent.

2.5. Assessment of practice and attitude

In order to assess practice and attitude, ten (10) questions were administered to children in the fields of nutrition and physical activity, such as fruit and vegetable consumption, food and nutrient consumption, breakfast, lunch, dinner, and snack consumption, quantity, time, and location of food purchase. Similarly, the types and intensity of physical activity, the length of time spent watching television/playing computer games, and reading. The children were asked if they were concerned

about what they ate in order to assess their attitude toward good dietary practices.

2.6. Data analysis

The Statistical Package for Social Sciences (SPSS) software (IBM Inc.) version 25 was used to analyze the data. Information for categorical data was expressed as n (number) and percentage. The Chi-square cross-tabulation method was used to examine the relationship between nutrition, knowledge of physical activity, and the participants' BMI-for-age. Fisher's analyses were used to examine the relationships between nutrition knowledge, physical activity knowledge, and NutPA, as well as gender, age, and school type. All statistical analyses were two-tailed and had statistically significant p-values of .05.

3. Results

3.1. Socio-demographic characteristics of the sample

Table 1 presents the socio-demographic characteristics of the participants. There were more female school children (55.0%) than male school children (45.0%) in this study, whereas most of the children (49.1%) were within ages 11–13 years. The study had more public schools (66.2%) than private schools (33.8%).

3.2. Nutrition and physical activity knowledge of participants

Table 2 presents the level of nutrition and physical activity knowledge among school-aged children. This category was computed by categorizing the participants' scores on nutrition knowledge and physical activity tests. Results showed that most of the participants had poor nutrition knowledge (46.6%) and nearly half (49.8%) of the participants also had poor physical activity knowledge. Overall, 43.5% of the participants lacked adequate knowledge of nutrition and physical activity. Even though the final sample size was 591, there were questions that required participants to answer if they chose a specific option. This resulted in some variance in the total number of responses.

3.3. Socio-demographic and nutrition and physical activity knowledge of participants

Table 3 presents the relationship between sociodemographic and level of nutrition and physical activity knowledge. There was a significant relationship between nutrition knowledge and type of school ($p = 0.002$). There was a significant relationship between participants' physical activity knowledge and age group ($p = 0.040$). Proportions of nutrition and physical activity knowledge also varied by gender ($p = 0.035$) and type of school ($p = 0.002$).

Table 1. Socio-demographic characteristics of school-aged children.

Sociodemographic, n = 591	Frequency (n)	Percentage (%)
Gender		
Boys	266	45.0
Girls	325	55.0
Age (Years)		
8–9 years	114	19.3
10 years	187	31.6
11–13 years	290	49.1
School Type		
Public school	391	66.2
Private school	200	33.8

Table 2. Level of nutrition and physical activity knowledge among school-aged children.

Variable	Frequency, n = 586	Percentage (%)
Nutrition knowledge		
Poor, less than 46.7%	273	46.6
Good, 46.7%–69.9%	230	39.2
Excellent, ≥70.0%	83	14.2
Physical activity knowledge		
Poor, less than 65%	292	49.8
Good, ≥65%	294	50.2
NutPA knowledge		
Poor, less than 54%	255	43.5
Good, 54%–69.9%	223	38.1
Excellent, ≥70.0%	108	18.4

NutPA- Nutrition and Physical Activity.

3.4. Perception, attitude, and practices of nutrition

Table 4 presents the perception, attitude, and practice of nutrition. The majority of the school-aged children had a good perception of having breakfast and snack (81.0%), different meals in the day (69.8%), whereas 57.0% were not able to perceive signs of vitamin A deficiency. The majority of the participants did not find it challenging to take breakfast (78.1%), eat three meals in a day (75.6%), and take different meals (73.3%). Also, 82.5%, 89.9%, and 97.2% of the school-aged children took breakfast, lunch, and dinner, respectively.

3.5. Nutrition and physical activity knowledge and BMI-for-age

Table 5 presents the relationship between nutrition and physical activity knowledge and BMI-for-age. Physical activity knowledge was significantly related to BMI-for-age of participants ($p = 0.024$). However, no significant relationship exists between nutrition knowledge ($p = 0.577$), total nutrition and physical activity knowledge ($p = 0.766$) and BMI-for-age (Table 5).

3.6. Nutrition, physical activity knowledge, and BMI-for-age

Table 6 presents the Association between nutrition, physical activity knowledge and BMI-for-age. There was a weak, positive correlation between nutrition knowledge ($r = 0.095$, $p = 0.026$), total nutrition and physical activity knowledge ($r = 0.151$, $p < 0.001$) and BMI-for-age.

Table 3. Relationship between socio-demographic and level of nutrition and physical activity knowledge.

Variable	Gender		p value	Age (Years)			p value	School Type		p value
	Male	Female		8–9	10	11–13		Public	Private	
Nutrition knowledge			0.694[†]				0.924[†]			0.002[†]
Poor	128 (48.5)	145 (45.2)		56 (49.6)	81 (46.8)	124 (44.9)		199 (51.8)	74 (36.6)	
Good	101 (38.3)	128 (39.9)		43 (38.1)	67 (38.7)	110 (39.9)		139 (36.2)	91 (45.0)	
Excellent	35 (13.3)	48 (15.0)		14 (12.4)	25 (14.5)	42 (15.2)		46 (12.0)	37 (18.3)	
Physical activity knowledge			0.245[‡]				0.040[†]			0.140[‡]
Poor	124 (47.0)	167 (52.0)		64 (56.6)	96 (55.5)	125 (45.3)		200 (52.1)	92 (45.5)	
Good	140 (53.0)	154 (48.0)		49 (43.4)	77 (44.5)	151 (54.7)		184 (47.9)	110 (54.5)	
NutPA knowledge			0.035[†]				0.265[†]			0.002[†]
Poor	107 (40.5)	148 (46.1)		53 (46.9)	84 (48.6)	108 (39.1)		187 (48.7)	68 (33.7)	
Good	115 (43.6)	107 (33.3)		43 (38.1)	60 (34.7)	110 (39.9)		132 (34.4)	91 (45.0)	
Excellent	42 (15.9)	66 (20.6)		17 (15.0)	29 (16.8)	58 (21.0)		65 (16.9)	43 (21.3)	

NutPA- Nutrition and Physical Activity. Data are presented as frequency (percentage). Bold p-values are significant.

[‡] Fischer's exact p-value.[†] Chi-square p-value, P value is significant at $p < 0.05$.

4. Discussion

This current study highlights the relationship between nutrition and physical activity knowledge, attitude and practices, and body mass index-for-age of school-aged children who were the subjects of this study. Demographic information showed that most of the participants were between the ages of 11–13 years and more females took part in the study than males. This demographic information implies that the status quo of gender disparity that used to exist in the educational system that saw more male enrollment has probably been disrupted and currently, more females are getting enrolled in schools, as observed by Annan et al. (2019) in a similar study.

Generally, participant children had poor knowledge of nutrition. Even though gender and age did not have a significant relationship with nutrition knowledge, a significant relationship existed between nutrition knowledge and the type of school attended. A significant number of students with poor nutrition knowledge were from public schools. In contrast, more students from private schools had good and excellent nutritional knowledge scores implying that private school children had better nutrition knowledge than their public-school counterparts. Public schools are known to be underfunded and have a perceived lower standard of teaching, fueling the assertions that they have a lower quality of education than their private counterparts (Alderman et al., 2001). This could be true in this situation, as more private school students had slightly greater nutrition awareness and performed better on the NutPA exams. On the other hand, knowledge of physical activity was generally good, with many of the participants having adequate knowledge, which was significantly related to their age, suggesting that their knowledge of physical activity improved with age. It is expected that, as children age, they will gain more knowledge and exposure on different facets of issues, including physical activity.

The participants also had generally low knowledge of the joint NutPa test with gender and school type having a significant relationship with their knowledge. These results are consistent with studies by Uys et al. (2016), Triches and Giugliani (2005) and Lee et al. (2013) in South Africa, Brazil, and South Korea respectively, who discovered that several children in elementary schools had poor nutritional knowledge. Their inadequate nutritional knowledge can be attributed to the absence of an education system or program that is solely dedicated to improving healthy eating and lifestyle choices (Lee et al., 2013). Another factor that contributes to the children's insufficient nutritional knowledge is the possibility that parents, schools and the media not having enough engagements with children on healthy eating (Triches and Giugliani, 2005).

The majority of the school-aged children perceived having breakfast, snack, and different meals during the day as a good thing with most of the

Table 4. Perception, attitude, and practices of nutrition.

Nutrition	Frequency, n	Percentage (%)
Perception		
Good to have breakfast and snack, n = 580		
Not good	38	6.6
Not sure	72	12.4
Good	470	81.0
Good to have different meals a day, n = 572		
Not good	75	13.1
Not sure	98	17.1
Good	399	69.8
Signs of Anaemia, n = 271		
Weakness	66	24.4
Paleness	23	8.5
Spoon nails	4	1.5
Likely to become sick	8	3.0
Others	170	62.7
Signs of vitamin A deficiency, n = 305		
Weakness	50	16.4
Likely to become sick	24	7.9
Night blindness	37	12.1
Others	20	6.6
Do not know	174	57.0
Attitude		
Difficult to have breakfast		
Not difficult	452	78.1
So-so	49	8.5
Difficult	78	13.5
Difficult taking three meals a day		
Not difficult	424	75.6
So-so	46	8.2
Difficult	91	16.2
Difficult taking different meals a day		
Not difficult	409	73.3
So-so	54	9.7
Difficult	95	17.0
Practices		
Took breakfast		
Yes	484	82.5
No	103	17.5
Took Snack		
Yes	292	51.2
No	272	47.7
Do not know	6	1.1
Took Lunch		
Yes	523	89.9
No	59	10.1
Took dinner		
Yes	565	97.2
No	16	2.8

participants not having difficulty accessing breakfast, three daily meals, and eating a variety of meals. A vast majority of the participants had adequate knowledge on exercise and its importance and also exercised daily. The participants' perception and attitude of physical activity had an association with physical activity knowledge and NutPA knowledge. Participants who had a positive perception and attitude of the importance of physical activity had a generally better knowledge of the physical activity and NutPA as compared to their counterparts who thought otherwise. Although participants' attitude towards physical activity was not related to their physical activity knowledge, it was related to the participants' on NutPA knowledge. This finding is consistent with the

Table 5. Relationship between nutrition and physical activity knowledge and BMI-for-age.

Variable	BMI-for-age				X ²	p-value
	Wasted	Normal	Overweight	Obese		
Nutrition knowledge					4.747	0.577
Poor	8 (3.0)	208 (79.1)	31 (11.8)	16 (6.1)		
Good	8 (3.7)	180 (82.2)	20 (9.1)	11 (5.0)		
Excellent	4 (4.8)	70 (84.3)	8 (9.6)	1 (1.2)		
Physical activity knowledge					9.46	0.024
Poor	4 (1.4)	239 (85.1)	26 (9.3)	12 (4.3)		
Good	16 (5.6)	219 (77.1)	33 (11.6)	16 (5.6)		
NutPA knowledge					3.336	0.766
Poor	6 (2.5)	202 (83.1)	25 (10.3)	10 (4.1)		
Good	9 (4.1)	171 (78.8)	23 (10.6)	14 (6.5)		
Excellent	5 (4.8)	85 (81.0)	11 (10.5)	4 (3.8)		

Data is presented as frequency (percentage), Chi-square p value is significant at p < 0.05. Bold p-values are significant.

Table 6. Association between nutrition, physical activity knowledge, and BMI-for-age.

Variable	BMI-for-age	Nut	PA	Total NutPA
BMI-for-age	1	0.095 (0.026) *	0.080 (0.062)	0.151 (<0.001) **
Total NutPA	0.115 (0.007) *	0.853 (<0.001) **	0.722 (<0.001) **	1

They are adjusting for age, gender, and school. Nut- Nutrition knowledge, PA- Physical activity knowledge, Total NutPA- Nutrition and Physical activity knowledge, Data presented as correlation coefficient, r (p-value). P-value is significant at p < 0.05*, p < 0.01**.

assertion that individuals with knowledge of the benefits conferred by physical activity are more likely to be active (Fredriksson et al., 2018).

Although the participants' BMI-for-age was not related to their nutrition knowledge and combined NutPA, there was a significant relationship between BMI-for-age and knowledge of the physical activity. BMI-for-age of the participants positively correlated with nutrition knowledge and the combined NutPA of participants, indicating that an increase in the nutrition knowledge of participants could result in ideal BMI-for age. This possibility exists because an increase in nutrition knowledge could translate to making better food choices and regular daily food intake. However, nutrition knowledge alone may not account for ideal BMI-for age since other confounders such as income, socio-economic status, and so on impact participants' dietary intake, which would translate into BMI changes. Correspondingly, findings in a study by Başkale and Bahar (2011), which sought to study the effects of a nutrition intervention on children's nutrition knowledge, nutrition behaviours, and anthropometric measurements, discovered an increase in the experimental group's nutritional knowledge scores as well as a positive change in their food preferences positively. However, the investigators did not observe any significant differences in the experimental and control groups' anthropometric measurements.

Although the study has some interesting findings in the Ghanaian context to the school community, some limitations could influence the findings. It is worth noting that a KAP survey essentially records what has been said, but there might be significant gaps in what has been said and what has been accomplished. Also, due to the study's cross-sectional nature, a significant limitation of this study is the inability to make a causal inference adequately. Hence, difficulties were observed with explicitly identifying the causes of some of the observed outcomes. It implies that the relationship between the factors identified to be associated with the outcome variables may be challenging to explain. Again, using a

questionnaire to collect information from participants meant that there was a possibility of recall bias, which occurs when participants recall information that differs from the actual situation for a variety of reasons. Because children are not the primary decision-makers in school or at home, many of their nutritional practices are not influenced by their choices. Furthermore, information on practices was based on self-reporting rather than observation. Furthermore, knowledge on activities was based on self-reporting rather than observation. However, this study fills a gap in literature by providing information on this subject area in the Volta Region of Ghana. To the best of the authors' knowledge, no such studies have been conducted in this region and thus, this study is essential in providing information to understand this phenomenon in this dispensation.

This research has important implications for nutrition education, nutrition-related school practice, and nutrition research. First, nutrition knowledge and attitudes among schoolchildren are important factors influencing appropriate nutrition practices, which are required to address malnutrition in schools and communities. The findings of this study have further emphasized the importance of school as a learning environment for students to learn about nutrition. Pupils play an important role in disseminating knowledge and ideas learned in school to the wider community.

5. Conclusion

Children in private schools had better (excellent) nutrition knowledge than children in public schools, while older children (11–13 years) appeared to have 'good' physical activity knowledge rather than younger children. Males and children in private schools also outperformed their female and public-school counterparts in combined nutrition and physical activity knowledge. While there were significant correlations between physical activity knowledge and BMI-for-age categories (wasted, average, overweight, obese), nutrition knowledge and overall nutrition and physical activity were weakly but positively correlated with BMI-for-age. They were implying that improvements in such knowledge could have a positive impact on BMI-for-age. Interventional research aimed at improving school-aged children's nutritional awareness should also be implemented; policies to improve the school environment and encourage students to make healthy food choices should be enforced.

Declarations

Author contribution statement

Priscilla Cecilia Akpene Ameyia: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Reginald Adjetej Annan: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Charles Apprey: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Elvis Nutifafa Agbley: Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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