Public Health Nutrition: 21(6), 1048–1056 doi:10.1017/S1368980017003664

Prevalence and factors associated with overweight and obesity among children from primary schools in urban areas of Lomé, Togo

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Submitted 6 January 2017: Final revision received 18 October 2017: Accepted 6 November 2017: First published online 24 January 2018

Abstract

Objective: Overweight and obesity in childhood are serious public health issues, both in developing and developed countries. The present study aimed to ascertain overweight and obesity prevalence rates among Togolese schoolchildren in Lomé, Togo, and their correlation with physical activity, socio-economic conditions and eating habits.

Design: Cross-sectional survey conducted in December 2015. Overweight and obesity were defined using age- and sex-specific BMI cut-off points of the International Obesity Task Force. Physical activity, socio-economic conditions and eating habits were assessed with a standardized questionnaire. Specially trained medical students interviewed children and collected the data. After bivariate regression analyses, factors associated with overweight/obesity were identified by multivariate logistic regression. Statistical significance was two-sided $P<0·05$.

Setting: Lomé, Togo.

Subjects: Representative sample of 634 children (288 boys, 346 girls), aged 8–17 years, who were studying in primary schools.

Results: Overweight and obesity respectively affected 5·2 and 1·9 % of children surveyed. Watching television (>4 h) on weekends (OR; 95 % CI: 3·8; 1·2, 12·0, $P=0·02$) and medium dietary diversity score (3·0; 1·1, 8·1, $P=0·03$) were independently associated with overweight/obesity in a multivariate regression model. Eating breakfast in the school cafeteria (0·2; 0·1, 0·8, $P=0·03$) and eating fruits (0·4; 0·1, 0·9, $P=0·03$) significantly reduced the risk of overweight/obesity.

Conclusions: Overweight and obesity prevalence were linked with sedentary behaviour and non-optimal food diversity. Promoting physical activity and fruit consumption should be explored as interventions to reduce and prevent overweight and obesity in Lomé schoolchildren. In addition, preventive approaches in the social environment of children should be considered.

Keywords
Children
Dietary diversity
Obesity
Overweight
Prevalence
Physical activity
School
Togo

Existing evidence shows that the prevalence of obesity and overweight is increasing worldwide, with significant health and economic implications[1]. Between 1980 and 2013, combined prevalence rose by 27·5 % in adults and 47·1 % in children[2]. Malnutrition with rapid overweight and obesity emergence has been recognized as a major public health problem in developing countries[3].

With rapid industrialization, these countries are facing a growing epidemic of overweight/obesity in children and adolescents[4]. However, in sub-Saharan Africa, most nutrition efforts still concentrate on undernutrition in children[5]. Studies in developing countries have shown that this increased prevalence of overweight/obesity among children varies from 20·1 % in Kenya, 21·1 % in

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urban Vietnam, 23·6 % in Nigeria to 9 % in the Recife metropolitan region, Brazil, and 8·42 % in Punjab, India[5]. In South Africa, the prevalence of obesity among children aged 3–16 years was found to be 3·2 % for boys and 4·9 % for girls. In the same study, the prevalence of overweight was also higher in girls (17·9 *v.* 14·0 % in boys)[6]. In Togo, according to the last Demographic and Health Survey, the prevalence of overweight among children under 5 years of age was 2 %[7]. In a single-centre study in Togo, Djadou *et al.* showed obesity and overweight prevalence of 1·72 and 2·86 %, respectively. The prevalence of overweight (obesity included) was significantly higher among girls and among pupils aged 15 and 16 years old[8].

The increasing prevalence of childhood overweight/obesity is a likely consequence of behavioural changes in transitional countries[4]. Urbanization can improve children's diets but can also bring a number of unhealthy dietary changes, such as increased consumption of saturated fats, sugars and processed foods containing excessive amounts of these components[9]. Coupled with sedentary behaviour, they seem to have contributed to the dramatic rise in overweight and obesity prevalence in low-income countries[10].

Childhood obesity has been linked to various adverse physical, psychological and social outcomes, including type 2 diabetes, CVD, cancer, depression, low self-esteem and diminished quality of life[11].

Information on the nutritional status of schoolchildren in Togo is incomplete and the factors associated with overweight/obesity development in this context need to be identified. Therefore, the aims of the present study were to estimate overweight and obesity prevalence rates in children from primary schools in the city of Lomé, Togo, and to identify potential risk factors.

Methods

Study population

A cross-sectional study was conducted during 1–16 December 2015 among children aged 8–17 years attending public and private primary schools in Lomé, Togo. A multistage, random cluster sampling method was performed to choose the class to be included. The first stage included a simple random sample to identify schools to be surveyed. Among the 363 schools in Lomé, nineteen were randomly selected in the five districts of Lomé, taking account of the number of schools by district. The second stage of sampling randomly selected one class of each selected primary school. All children in the selected class, whatever their age, were invited to participate through a letter to their parents.

Since overweight and obesity prevalence in Lomé was not well known, it was assumed to be 25 % in the study population. Hence, the minimum number of students necessary for the investigation was 288 students (number of students $= (t^2 \times p \times q)/i^2$ where $t = 1{\cdot}96$, $p =$ children supposed to have the outcome overweight/obesity, $q = 1 - p$ and $i = 0{\cdot}05$). This number was doubled and then increased by 10 % to reduce fluctuations related to sampling. In view of the sampling method considered, 576 was the minimum number of students necessary for investigation.

Data collection

A standardized questionnaire was used to collect data by trained medical students[12,13] and was administered face-to-face to each participating child. Dietary intake was estimated by the 24 h recall questionnaire. Children were asked to report consumed food in the last 24 h for breakfast, morning snack, lunch, afternoon snack and dinner, as well as any other snacking that had occurred during the day. Data on snacking and water and soft drink consumption were also recorded. The questions on dietary diversity, developed and validated by the FAO, were used as the basis for the questionnaire. Each of the twelve food groups defined by the FAO was scored either as 1 or 0, as an indication of respectively consumption or non-consumption of these foods in the past 24 h. We therefore constructed a score by summing each food group recorded (minimum score = 0, maximum score = 12). Other variables that were collected included age, gender, family conditions (including parental income and living space), food habits, anthropometric measurements, physical activity (sport in and outside school, means of commuting to and from school) and sedentary behaviour (including time spent watching television or playing video games).

Anthropometric measurements

Weight and height were recorded by specially trained medical students. Standardized methods and techniques were used to measure weight and height as described by the WHO[14]. Weight was measured to the nearest 100 g with an electronic scale with children wearing only light clothing and without shoes. Height was measured with a wooden stadiometer to the nearest 0·1 cm, placed on a flat surface, the children stood on the basal part of the device with feet together (without shoes) and standing with their eyes in the horizontal plane. BMI was calculated as weight in kilograms divided by the square of height in metres. Overweight and obesity thresholds were categorized as proposed by the International Obesity Task Force[15]. Therefore, thinness was classified as the equivalent to BMI $< 18{\cdot}5\ kg/m^2$ in adults and overweight and obesity were classified as corresponding to BMI $\geq 23\ kg/m^2$ and BMI $\geq 27\ kg/m^2$ in adults, respectively.

Socio-economic conditions

Data were collected on household type and size, number of rooms and bedding conditions, as well as on the availability of comfort items such as air conditioning,

https://doi.org/10.1017/S1368980017003664 Published online by Cambridge University Press

electricity and tap water. They served to compute socio-economic status (SES) scores[16]. SES was considered as low (score = 0–3) in households with no access to tap water or electricity and with residents sleeping on the floor. However, high SES (score = 4–6) was attributed to children living in brick houses, having access to tap water and electricity, and sleeping on beds.

Dietary diversity assessment

Food diversity was defined by the recognition of twelve food groups (candies, cereals, condiments, dairy products, eggs, fats, fish, fruits, legumes, meats, tubers and vegetables) consumed in the last 24 h[17]. Food items that did not belong to one of the mentioned groups were excluded. Three levels of dietary diversity were defined: low (≤3 food groups), medium (4–5 food groups) and high (≥6 food groups)[17].

Statistical analysis

Continuous variables were expressed as mean values and compared by Student's *t* test. Categorical variables were presented as proportions and compared by Fisher's exact test. Bivariate analysis identified factors associated with overweight/obesity. All potential risk factors, with $P \leq 0{\cdot}30$ in bivariate analysis, were entered in a step-wise logistic multivariate regression model. The study objectives were to ascertain overweight and obesity prevalence rates among Togolese schoolchildren and their correlation with physical activity, socio-economic conditions and eating habits. Therefore, we decided to force variables concerning dietary habits into the multivariate model, even if *P* values were higher than 0·30. Model data fit was assessed by the Hosmer–Lemeshow goodness-of-fit test. In all tests performed, two-tailed $P < 0{\cdot}05$ values were regarded as denoting statistical significance. Statistical data were analysed with the statistical software package IBM SPSS Statistics for Windows, version 24.0.

Ethical considerations

The Ministry of Primary Schools granted permission and provided a list of primary schools in the municipality of Lomé. The directors of the schools selected were contacted and approved their participation. Clear printed information was sent to the parents of all participating children. The objectives and type of data to be collected were explained. We reassured parents that there was no safety issue to be raised about the participation of their children; on the contrary, their cooperation would be helpful to improve children's health care. The National Ethics Committee and the Ministry of Health in Togo approved the study.

Results

A total of 634 students from public (41·8 %) and private (58·2 %) primary schools in Lomé were included in the study. Median age was 11 years, and 81·8 % of the students were under 13 years old. Girls outnumbered boys (54·6 % and 45·4 %, respectively), with most of the included children (80 %) having at least six siblings. Household income was mostly low (94·7 %), despite high percentages of working parents (98·7 % of fathers and 92·6 % of mothers).

Mean weight of the participating children was 33·7 kg (range 18–84 kg). BMI ranged from 10·2 to 36·7 kg/m^2 with a mean of 16·25 kg/m^2. Values of anthropometric parameters were much higher in girls than in boys (Table 1).

The overall prevalence of thinness, overweight and obesity among the included children was 18·5, 5·2 and 1·9 %, respectively. Overweight prevalence in girls was two times higher than in boys (6·4 and 3·8 %, respectively, $P = 0{\cdot}21$). Thinness prevalence was, however, similar in both genders. Table 2 reports the anthropometric data by gender.

Results showed that 68·4 % of children ate three principal meals, usually at home. Dairy products, fruits and vegetables were consumed daily by 5·3, 25·8 and 84·1 %, respectively. The daily ingestion of other foods was 99·7 % for cereals, 51·1 % for fish, 38·1 % for meats, 25·5 % for vegetables, 14·5 % for eggs and 7·9 % for tubers. We noticed that 35·3 and 13·1 % of students, respectively, consumed sweets and fats daily.

A total of 77·7 % of children participated in physical activity; 51·6 % during weekends and 48·4 % at school. In addition, 88·2 % of included children went to school by foot. For 78·8 % of them, it took at least 30 min to reach

Table 1 Height, weight and BMI of boys and girls included in the random sample of children from primary schools in Lomé, Togo, December 2015

	Girls				Boys			
	≤11 years (*n* 223)		>11 years (*n* 123)		≤11 years (*n* 210)		>11 years (*n* 78)	
	Mean	Min–max	Mean	Min–max	Mean	Min–max	Mean	Min–max
Weight (kg)	31·0	19–54	43·4	26–84	29·7	18–59	37·3	23–60
Height (cm)	140·0	120–163	153·2	129–172	138·0	114·4–160	149·5	105–172
BMI (kg/m^2)	15·7	10·2–25·7	18·4	11·5–36·7	15·5	10·7–26·7	16·6	11·1–31·8

Min–max, minimum–maximum.

https://doi.org/10.1017/S1368980017003664 Published online by Cambridge University Press

Table 2 Normal weight, thinness, overweight and obesity prevalence, according to International Obesity Task Force cut-offs, in boys and girls included in the random sample of children from primary schools in Lomé, Togo, December 2015

	Normal		Thinness		Overweight		Obese	
	n	%	*n*	%	*n*	%	*n*	%
Boys (*n* 288)	217	75·4	54	18·8	11	3·8	6	2·1
Girls (*n* 346)	255	73·7	63	18·2	22	6·4	6	1·7
Total (*n* 634)	472	74·4	117	18·5	33	5·2	12	1·9

Table 3 Description of sociodemographic and lifestyle characteristics in the random sample of children from primary schools in Lomé, Togo, December 2015

	Total (*n* 634)		Girls (*n* 346)		Boys (*n* 288)	
	Mean or *n*	Min–max or %	Mean or *n*	Min–max or %	Mean or *n*	Min–max or %
Age (years), mean and min–max	11·0	8–17	11·1	8–17	10·9	8–16
Gender, *n* and %						
Girls	346	54·6	–		–	
Boys	288	45·4	–		–	
Weight (kg), mean and min–max	33·7	18–84	35·4	19–84	31·8	18–60
Height (cm), mean and min–max	143·0	105–172	144·6	120–172	141·1	105–172
BMI (kg/m^2), mean and min–max	16·25	10·2–36·4	16·6	10·2–36·4	15·8	10·7–31·8
Siblings (*n* 431), *n* and %						
Only child	26	6·0	15	6·6	11	5·4
2–5	235	54·3	117	51·1	118	58·4
6–10	130	30·0	74	32·3	55	27·2
> 10	42	9·7	23	10·0	18	8·9
Professional category* of father (*n* 526), *n* and %						
Group 1	122	19·2	59	21·2	63	25·4
Group 2	397	62·6	213	76·6	184	74·2
Group 3	7	1·1	6	2·2	1	0·4
Professional category* of mother (*n* 581), *n* and %						
Group 1	32	5·0	15	4·8	17	6·3
Group 2	506	79·8	276	88·2	230	85·8
Group 3	43	66·8	22	7·0	21	7·8
Type of school, *n* and %						
Private	369	58·2	159	46·0	106	36·8
Public	265	41·8	187	54·0	182	63·2
Physical activities and sedentary behaviour, *n* and %						
Sport at school and/or outside	492	77·6	246	71·1	246	85·4
Means of transportation, *n* and %						
Walk or bicycle	571	90·1	316	91·3	255	88·5
Car	63	9·9	30	8·7	33	11·5
Watching television, *n* and %						
During school days						
No	392	61·8	230	66·5	162	56·3
≤ 2 h	224	35·3	105	30·3	119	41·3
> 2 h	18	2·8	11	3·2	7	2·4
During weekends						
No	180	28·4	105	30·3	75	26·0
≤ 4 h	316	49·8	180	52·0	136	47·2
> 4 h	136	21·5	60	17·3	76	26·4
Playing video games during school days, *n* and %						
No	524	82·6	322	93·1	202	70·1
≤ 2 h	97	15·3	22	6·4	75	26·0
> 2 h	13	2·1	2	0·6	11	3·8

Min–max, minimum–maximum.
*Professional category: Group 1 = executive, professor; Group 2 = self-employed, farmer, artisan, storekeeper, employee, worker; Group 3 = unemployed.

school. Tables 3 and 4 enumerate the data on physical activities, dietary habits and dietary diversity.

Bivariate analysis indicated that watching television for more than 4 h on weekends, going to school by car and consuming dairy products were significantly associated with overweight/obesity (Table 5). Candy consumption was identified as a risk factor of overweight/obesity, but the association was not significant. Having six to ten siblings or eating breakfast in the school cafeteria was linked to a lower risk of high BMI.

Multivariate logistic regression analysis (Table 6) showed that watching television for more than 4 h on

https://doi.org/10.1017/S1368980017003664 Published online by Cambridge University Press

Table 4 Eating habits, place of meals and dietary diversity score in the random sample of children from primary schools in Lomé, Togo, December 2015

	Total (*n* 634)		Girls (*n* 346)		Boys (*n* 288)	
	n	%	*n*	%	*n*	%
Eating habits and place (principal meals)						
Breakfast	452	71·3	230	66·5	222	77·1
Place of breakfast						
Home	319	70·6	168	73·0	151	68·0
Cafeteria or restaurant	121	26·8	56	24·3	65	29·3
Street food	11	2·4	5	2·2	6	2·7
Snack in the morning	576	90·9	313	90·5	263	91·3
Place of morning snack						
Home	12	2·1	9	2·9	3	1·1
Cafeteria	490	85·1	261	83·4	227	86·3
Street food	76	13·2	43	13·7	33	12·5
Lunch	620	97·8	337	97·4	283	98·3
Place of lunch						
Home	575	92·8	315	93·5	259	91·5
Cafeteria	23	3·8	11	3·3	12	4·2
Street food	23	3·8	11	3·3	11	3·9
Dinner	611	96·4	330	95·4	281	97·6
Place of dinner						
Home	600	98·2	326	98·8	274	97·5
Cafeteria	4	0·7	2	0·6	2	0·7
Street food	7	1·1	2	0·6	5	1·8
Dietary diversity score						
High	8	1·3	115	33·2	84	29·2
Medium	427	67·4	227	65·6	200	69·4
Low	199	31·4	4	1·2	4	1·4

weekends and having a medium dietary diversity score were independently associated with overweight and obesity. Children consuming fruits and breakfast in the school cafeteria were significantly less likely to be overweight or obese.

Discussion

Obesity and overweight are major public health problems among children, with significant health, demographic and socio-economic implications[2]. Food environments have changed in past decades and obesity and overweight rates have increased dramatically in both developing and developed countries[2]. The present study assessed nutritional status in a random sample representative of schoolchildren attending primary schools in urban areas of Lomé, the capital city of Togo. It also investigated the factors associated with overweight/obesity. The study established that overweight and obesity prevalence is less than 8 % and linked with sedentary behaviour, poor eating habits and limited dietary diversity.

Overweight and obesity prevalence was lower than what has been reported in the literature[18,19]. Although this prevalence was similar to that in other studies[20,21], it was higher than the rate among pre-school Togolese children participating in a cross-sectional study conducted in twenty-six African countries[22]. Several others have shown that urban children, because of favourable environmental and socio-economic conditions, generally manifest better nutritional status than their rural counterparts[18]. A similar study among rural children will be necessary to confirm or refute this hypothesis in Togo.

The present survey found higher prevalence rates of overweight and obesity in girls than in boys, which concurs with other reports from low- and middle-income countries, but the opposite held true in high-income countries where overweight and obesity rates were higher in boys than in girls[6,23,24]. This observation might be related to cultural behaviours[25,26]. Differences in physical activity and energy expenditure between boys and girls may also have contributed to the lower prevalence of overweight and obesity among boys.

Differences in published data on prevalence may be explained by study design, population included and cut-offs defining overweight and obesity[27]. Indeed, many cut-off values have been published; each method has its advantages and limitations, and should be used cautiously[27].

While overweight and obesity in children have definitely become a worldwide public health concern, malnutrition remains the greatest problem in developing countries[28,29]. In the present study, thinness prevalence was 18·5 % and was similar in both genders. Given the fact that severe underweight is almost always a sign of malnutrition we can assume that malnutrition persists in Togo, even in urban areas. In addition, some overweight/obese children may be malnourished as well.

Obesity prevention campaigns are considered to be successful through changes in environments such as

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Table 5 Bivariate analysis of factors associated with overweight and obesity in the random sample of children from primary schools in Lomé, Togo, December 2015

Variable	OR	95 % CI	*P*
Female gender (reference: male)	1·5	0·6, 3·6	0·28
Age (years)	1·0	0·8, 1·2	0·67
Socio-economic level (reference: low)			
High	1·8	0·6, 5·4	0·28
Siblings of included children (reference: none)			
2–5	0·5	0·1, 1·5	0·18
6–10	0·3	0·1, 1·2	0·08
> 10	1·3	0·3, 5·0	0·67
Type of school (reference: public)			
Private	1·3	0·7, 2·5	0·38
Eating habits (daily meals)			
Breakfast (reference: no)	0·9	0·5, 1·7	0·71
Morning snack (reference: no)	4·7	0·6, 34·9	0·12
Lunch (reference: no)	NC	–	0·99
Afternoon snack (reference: no)	0·4	0·1, 1·7	0·22
Dinner (reference: no)	0·8	0·2, 3·5	0·76
Eating habits (place of meals)			
Breakfast (reference: home)			
Cafeteria	0·4	0·1, 1·2	0·09
Street food	2·6	0·5, 12·8	0·23
Morning snack (reference: home)			
Cafeteria	0·4	0·1, 1·8	0·23
Street food	0·5	0·1, 2·8	0·43
Lunch (reference: home)			
Cafeteria	2·0	0·6, 7·0	0·27
Street food	0·6	0·1, 4·8	0·66
Afternoon snack (reference: home)			
Cafeteria	0·6	0·1, 5·0	0·63
Street food	1·4	0·3, 5·6	0·65
Dietary diversity score (reference: low)			
Medium (4–5)	1·4	0·7, 2·9	0·31
High (≥6)	2·4	0·3, 21·6	0·42
Practice of sport (reference: no)			
Yes	1·0	0·5, 2·1	0·97
Means of transportation (reference: on foot or by bicycle)			
By car	2·5	1·1, 5·4	0·02
Time to reach school (reference: <30 min)			
≥ 30 min	1·2	0·5, 2·6	0·72
Watching television			
During school days (reference: no)			
≤ 2 h	0·8	0·4, 1·6	0·59
> 2 h	1·6	0·3, 7·1	0·56
On weekends (reference: no)			
≤ 4 h	1·8	0·8, 4·4	0·16
> 4 h	3·3	1·3, 8·3	0·01
Playing video games (reference: no)			
≤ 2 h	0·7	0·3, 1·8	0·42
> 2 h	1·0	0·1, 8·2	0·97

NC, not calculable.

schools, especially if they occur early in life[19]. Thus, it is particularly relevant to identify the factors associated with overweight and obesity in primary-school populations in the specific context of urban settings in a country in transition, such as Togo.

Findings on dietary diversity in the present study indicated that many schoolchildren had diets with little variety, as disclosed by the fact that one-third of them consumed fewer than four food groups daily[30]. The most neglected food groups were dairy products, tubers, eggs, fruits, meats and vegetables, as reported in other investigations[31,32]. Numerous studies have shown that skipping breakfast or reducing the number of meals consumed per day is a significant independent predictor of overweight in schoolchildren[33,34]. Significant relationships with these eating habits were not observed here, as reported in other works[19], but it should be noted that more than two-thirds of children in the present sample ate breakfast.

Increased obesity has been attributed to a growing trend of snacking[35]. In the current study, snacking in the morning was associated with a high risk of overweight/obesity but the relationship was not significant. Snacking may contribute to excess energy intake and weight gain[36]. Harmonizing definitions of snacks is crucial, as is adopting a validated research strategy to evaluate their real impact on weight gain[36].

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Table 6 Multivariate logistic regression of factors independently associated with overweight and obesity in the random sample of children from primary schools in Lomé, Togo, December 2015

Variable	OR	95 % CI	*P*
Watching television on weekends (reference: no)			
≤4 h	2·0	0·7, 5·8	0·20
>4 h	3·8	1·2, 12·0	0·02
Place of breakfast (reference: street food)			
Home	0·4	0·1, 1·2	0·23
Cafeteria	0·2	0·1, 0·8	0·03
Dietary diversity score (reference: low)			
Medium	3·0	1·1, 8·1	0·03
High	NC	–	–
Daily consumption of fruits (reference: no)	0·4	0·1, 0·9	0·03

NC, not calculable.

SES affects access to culturally appropriate and affordable foods, affecting dietary quality[22]. In developing countries, it is assumed that overweight is relatively common in urban settings and in socio-economically privileged households[22]. In the present study, the risk of overweight/obesity was higher with upper SES compared with low or medium SES. This is not surprising because of the higher purchasing power for gadgets such as televisions and video games that goes with upper SES. Therefore, decreased physical activities are expected in these children because of sedentary behaviour, altered eating patterns and increased consumption of unhealthy foods[37]. However, the absence of a significant association may be partly explained by possible rapid nutrition transition and the methodological weaknesses of wealth indices as measures of household economic status[22].

Multivariate analysis showed that sedentary lifestyles related to watching television and poor dietary habits, including low dietary diversity scores and place of breakfast consumption, were significantly coupled with overweight and obesity in the present sample of Togolese schoolchildren, whereas the risk was 64 % less in children who consumed fruits.

Television viewing for over 4 h on weekends was associated with increased overweight and obesity prevalence. This risk might be explained by several mechanisms, including reduction of time spent on intense activities, lower metabolic rate and frequent snacking[37,38].

The present results showed that practising sport was not associated with decreased risk of overweight/obesity, given the unpredictable temporality of the relationship between physical activity and overweight with a cross-sectional study design. Moreover, activities such as outdoor games, family events and daily travel means (walking and biking) should also be considered to evaluate the impact of physical activity. This is highlighted by the significant impact of walking in reducing the risk of overweight/obesity in our bivariate analysis.

Dietary patterns have changed in many countries in past decades. Increased intakes of soft drinks and candy and decreased consumption of fruits and vegetables have been associated with amplified childhood obesity[39]. This observation is in agreement with other studies that showed a negative association between fruit consumption and overweight[40,41].

Dietary diversity represents the extent to which foods of the different food groups are consumed in the last 24 h. The current cross-sectional results, which indicated an association between dietary diversity score and BMI, were consistent with those of several other cross-sectional studies, but were also inconsistent with some presenting no significant positive associations[42,43].

The lack of consistency in the literature concerning dietary diversity may be partly attributed to different cut-off points used to determine if the consumption of particular foods counts in diversity scores[44]. Despite the importance of dietary quality in the assessment of nutritional profile, increasing the variety of healthy foods in children's diets requires careful consideration for obesity control and prevention[32]. In some studies (as in the current one), simple counting of foods consumed within food groups is a measure of diversity[43]. However, the lack of precision in determining portion sizes makes accurate assessment very difficult.

To our knowledge, the present study is the first multicentre one to assess the prevalence of overweight/obesity in Togolese schoolchildren. It is noteworthy that the identification of factors determining overweight/obesity in schoolchildren has several limitations. Conclusions for true individual change cannot be derived from this cross-sectional design which precludes inferences of causal associations. In addition, the study was restricted to schoolchildren in the urban setting of Lomé and the findings may not be extrapolated to rural populations, despite the fact that attending school is mandatory in Togo. However, we have used a random multistage cluster sampling to identify the study population that probably represents the general schoolchild population of Lomé. Another limitation was that other factors such as maternal pre-pregnancy weight, birth weight, sleep quality and parental anthropometric measurements, education level,

income and lifestyle (to assess genetic and family influences), which may strongly impact the presence of overweight/obesity in schoolchildren[29], were not recorded. Yet another study limitation was the methodology implemented, namely a single 24 h recall, which relied on children to remember what they had eaten the day before[44]. The results may have been biased in terms of food items that were left out. Furthermore, this method did not distinguish children who ate small or large portions of food items since food sizes eaten were not recorded. In addition, a recall bias and a measurement error should be mentioned due to the use of self-reported rather than objectively measured physical activity and sedentary behaviour.

Despite these limitations, the current study analysed a large sample to estimate overweight and obesity patterns in urban primary-school children in Lomé, Togo. Body weight of children should be assessed in schools and communities as part of an overall public health strategy. Early detection of weight problems would allow decision makers to implement interventions to reduce associated morbidity and mortality. Health education should be inculcated into school programmes to banish unhealthy behaviours, such as lack of physical activity, food overconsumption and long-term sedentary lifestyles, among school-aged children. Also, children from some areas have very little influence on their food choices, so it appears necessary to educate parents about dietary quality and healthy eating[45].

Acknowledgements

Acknowledgements: Medical editing services were provided by Mr Ovid M. Da Silva, a native English speaker. The authors thank the directors of schools participating in this study and the Ministry of Primary Schools for approving and contributing to performance of the survey. *Financial support:* This research received no specific grant from any funding agency, commercial or not-for-profit sectors. *Conflict of interest:* N.K. received a PhD grant from Sanofi Pasteur, personal fees from Astellas and non-financial support (travel expenses) from Alere and Sanofi Pasteur. P.V. received scientific grants from Sanofi Pasteur, Sanofi MSD and Anios, and personal fees from Sanofi Pasteur, BioMérieux, GlaxoSmithKline and Sanofi MSD. The financial and non-financial support for N.K and P.V. were not related to this work. The other authors have no conflicts of interest to declare. *Authorship:* H.S. contributed to data analysis and interpretation as well as manuscript drafting. D.K.E., S.N. and Y.K. conceived the study and were involved in data acquistion, manuscript revision and final approval. D.T.R. collected and entered data on all participating schools. S.D. constructed the digital database. F.B., A.A. and P.V. partook in data interpretation and final manuscript approval. N.K. contributed to data analysis and interpretation, and wrote the manuscript. All authors have approved the final manuscript version. *Ethics of human subject participation:* The National Ethics Comittee and the Ministry of Health in Togo approved the study. The Ministry of Primary Schools granted permission to conduct the study in primary schools in the municipality of Lomé; and the selected school directors and parents of all participating children consent provided their consent.

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