

Obesity and Associated Nutritional Determinants Among Adolescents Attending The Akwa North Secondary School in Bonamoussadi, Douala, Cameroon

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Abstract

Introduction: Adolescent obesity is a major public health problem due to its global rise and its metabolic and psychosocial consequences. It results from complex interactions between nutritional, and environmental factors, particularly in urban areas where dietary shifts favour the consumption of energy-dense foods. This study aimed to determine the prevalence of obesity and to identify its nutritional determinants among adolescents at the Akwa North Secondary School in Bonamoussadi, Douala. **Methodology:** A descriptive cross-sectional study with an analytical focus was conducted among 200 adolescents aged 10–19 years between May and October 2023. Data were collected using a structured questionnaire and standardised anthropometric measurements in accordance with WHO recommendations. Body mass index (BMI) was calculated and classified according to WHO guidelines. Statistical analyses included chi-squared tests and binary and multivariate logistic regression to identify factors associated with obesity. **Results:** The prevalence of obesity was 13.5%. Factors significantly associated with obesity in the multivariate analysis were frequent consumption of dairy products (>4 times per week) (AOR=3.72; p=0.002), consumption of high-fat foods (>4 times per week) (AOR=3.74; p=0.030), alcohol consumption (AOR=4.43; p=0.013) and having an obese parent (AOR=5.03; p=0.0003). These factors were all statistically significant. **Conclusion:** Obesity amongst adolescents at the secondary school studied is relatively high and strongly associated with unhealthy dietary behaviours as well as family history. Targeted interventions in nutrition education and the promotion of healthy lifestyles are needed in schools.

Keywords: Obesity; adolescents; nutritional determinants; diet; Cameroon

Introduction

Obesity is a chronic, multifactorial condition characterised by an excessive or abnormal accumulation of body fat that may be harmful to health. In children and adolescents, it is assessed using body mass index (BMI) adjusted for age and sex, based on the World Health Organization (WHO) growth charts ¹. Regarded as a major public health challenge of the 21st century, it results from the interaction of genetic, metabolic, environmental, behavioural and nutritional factors ². In adolescence, obesity is associated with an increased risk of non-communicable diseases, notably type 2 diabetes, high blood pressure and cardiovascular disease. It also leads to psychosocial consequences such as stigmatisation, low self-esteem, anxiety and depression ^{3,4}. Its rise is linked to changes in lifestyle and the food environment. The consumption of foods high in sugar and fat, combined with low intake of fruit and vegetables, increases the risk of being overweight and obese ^{5,6}. Furthermore, certain habits such as skipping breakfast, frequent snacking, eating meals in front of screens and a sedentary lifestyle contribute to the energy imbalance responsible for weight gain ^{4,7}.

Over the past few decades, childhood and adolescent obesity has risen significantly worldwide. According to the WHO, more than 390 million children and adolescents aged 5 to 19 were overweight in 2022, of whom around 160 million were obese ¹. Analyses by the NCD Risk Factor Collaboration indicate that the

global prevalence of obesity among young people has increased more than fourfold since 1990⁸. This trend is also affecting low- and middle-income countries due to the nutritional transition and increasing urbanisation⁵. Africa is not immune to this trend. According to the World Health Organization, the prevalence of obesity among children and adolescents ranges from 5% to 16.5% in several African countries, making this condition a growing public health problem⁹. The continent faces a double burden of malnutrition characterised by the coexistence of undernutrition and obesity¹⁰. In Cameroon, obesity amongst adolescents is particularly pronounced in urban areas. A study carried out in Douala reported a prevalence of 12.4% of overweight and 1.9% of obesity amongst young people aged 8 to 15¹¹. More recently, a prevalence of obesity of 30.4% in urban areas compared with 9.8% in semi-urban areas was observed, highlighting the influence of the urban lifestyle on the nutritional status of adolescents¹².

Despite this increase, obesity among adolescents is often underestimated. In some African communities, being overweight is still seen as a sign of prosperity or good health. Obesity among adolescents is associated with numerous adverse effects on physical, psychological and social health. Physically, it increases the risk of developing several non-communicable diseases at an early age, notably type 2 diabetes, high blood pressure, dyslipidaemia and cardiovascular disease^{4,6}. It is also associated with respiratory disorders, musculoskeletal problems and a reduced quality of life. Psychologically, obese adolescents are more likely to experience low self-esteem, anxiety, depression and social stigma, which affect their well-being and academic performance⁹. Furthermore, obesity in adolescence tends to persist into adulthood, increasing the risk of morbidity and premature mortality⁵. Given these consequences, identifying the nutritional determinants of obesity remains essential for guiding prevention and health promotion strategies among adolescents. It is against this backdrop that this study on obesity and associated nutritional factors amongst pupils at Akwa North Secondary School in Bonamoussadi has been conducted. It aims to determine the prevalence of obesity within this school population and to identify the main nutritional factors associated with it. The findings will provide evidence to inform nutrition education programmes, promote healthy eating habits and strengthen strategies for preventing obesity in schools.

Materials and methods

Study framework and period

This study took place over a 12-month period from February 2023 to January 2024, whilst data collection was carried out between 18 May and 28 October 2023. It was carried out at Akwa North Secondary School in Bonamoussadi, located in the Douala V district, Wouri department, Littoral region of Cameroon. Douala V is one of the most densely populated municipalities in the city of Douala and is characterised by rapid urbanisation, high population density and significant exposure of adolescents to unhealthy eating habits and sedentary lifestyles. This

site was chosen due to its high school-age population density, its accessibility, and the lack of local data on obesity in secondary schools.

Study design and population

We conducted a quantitative, descriptive cross-sectional study with an analytical focus amongst adolescents attending Akwa North Secondary School in Bonamoussadi, in the Douala V district of the Littoral region of Cameroon. The study population comprised all pupils regularly enrolled at this school during the study period. The target population comprised adolescents aged 10–19 years attending Akwa North Secondary School in Bonamoussadi.

Included in this study were adolescents aged 10–19 years who were regularly enrolled at the school, present on the day of the survey, and who had submitted a consent form signed by their parents or legal guardians. The pupils' assent was also obtained prior to data collection. Pupils who were absent at the time of data collection, those who refused to take part in the study, and participants whose information was incomplete were not included. Also excluded from the study were pupils suffering from a known chronic condition likely to influence body weight, those following a therapeutic diet, and questionnaires deemed incomplete or unusable.

Sample size and sampling method

The minimum sample size was calculated using Fisher's formula, which is commonly used in cross-sectional studies:

$$n = Z^2 \times p(1 - p) / d^2 \quad (1)$$

Where (n) represents the minimum sample size, (Z) corresponds to the value of the 95% confidence interval, i.e. 1.96, (p) represents the expected prevalence of obesity and (d) the margin of error, set at 5%. The value of p was estimated based on a study conducted in Cameroon by Ebouki et al., published in 2023, which examined the prevalence and factors associated with excess weight and central obesity among Cameroonian children and adolescents. This study reported a prevalence of excess weight of 12.4% among adolescents¹³. Consequently, an expected prevalence of 12.4% was used to calculate the sample size. Taking into account a margin of error of 5% and a confidence level of 95%, the minimum sample size calculated using Fisher's formula was 167 participants. In order to increase the statistical power of the study and to account for incomplete or unusable data, a total of 200 adolescents were ultimately selected for the study.

Participants were selected using a non-probability convenience sampling technique. Pupils meeting the inclusion criteria were recruited progressively until the required sample size was reached.

Data collection techniques and tools

Data were collected using a structured questionnaire administered face-to-face by the principal investigator. The questionnaire comprised three sections covering, respectively, socio-demographic characteristics, dietary habits, and other risk factors such as physical activity, screen time, and family history.

Anthropometric measurements were carried out

in accordance with the standardised procedures recommended by the World Health Organization. Participants' weight was measured using a calibrated electronic scale placed on a flat, stable surface. Participants were lightly dressed, without shoes, and stood in the centre of the scale. Weight was recorded in kilograms to the nearest 0.1 kg. Height was measured using a graduated measuring rod fixed against a vertical surface. Participants stood barefoot with their feet together, arms at their sides, heels, buttocks and shoulders aligned against the measuring rod, and their head positioned in the Frankfurt plane. Height was recorded in centimetres to the nearest 0.1 cm. Body mass index (BMI) was then calculated as the ratio of weight in kilograms to the square of height in metres. To ensure the quality of the data collected, the questionnaire was pre-tested before the survey began and interviewers were trained in the various data collection procedures. The questionnaires were checked daily to identify any errors or missing information.

Definition and operationalisation of variables

The dependent variable in the study was obesity, assessed using body mass index (BMI), calculated as weight in kilograms divided by the square of height in metres. BMI was standardised according to age and sex. Weight status was classified using the WHO growth reference for children and adolescents aged 5–19 years. Overweight was defined as a BMI-for-age $> +1$ SD and obesity as a BMI-for-age $> +2$ SD above the WHO growth reference median¹⁴. The independent variables included sociodemographic characteristics, dietary habits, and other risk factors such as physical activity, screen time and family history.

Data collection procedure

Data collection took place after the necessary administrative and ethical approvals had been obtained from the relevant authorities. Initial contact was made with the school's administrative staff to outline the study's objectives and the practical arrangements for data collection. This step facilitated access to the pupils and the organisation of the survey sessions within the school. Furthermore, an informed consent form intended for parents or legal guardians was provided to the pupils in order to inform families about the objectives and procedure of the study, as well as to obtain parental consent prior to the pupils' participation in the survey. Only participants who returned the consent form signed by their parents or legal guardians were included in the study. The pupils' assent was also obtained before the questionnaires were administered.

At the start of the survey, anthropometric measurements, including weight and height, were taken and recorded on each data sheet. The questionnaires were then administered face-to-face to participants by data collectors trained for this purpose, in an environment that ensured the confidentiality and privacy of the participants. A quality control system was put in place throughout the data collection process. The questionnaires were checked to identify any inconsistencies, data entry errors or missing data.

Statistical analysis

The data collected were entered into Microsoft Excel and then analysed using R software, version 4.2.1. A descriptive analysis was first carried out to describe the participants' sociodemographic characteristics, as well as variables relating to dietary habits, physical activity, screen time and family history of obesity.

The prevalence of obesity was then calculated with a 95% confidence interval. A bivariate analysis was carried out using logistic regression to explore the associations between obesity and the various explanatory variables. A multivariate logistic regression analysis was carried out on all variables with a p-value < 0.05 in the bivariate analysis to identify factors independently associated with obesity. The results were presented as adjusted odds ratios (aOR) with their 95% confidence intervals. The threshold for statistical significance was set at $p < 0.05$.

Results

Description of respondent characteristics

Table 1 presents the participants' socio-demographic characteristics, nutritional status, dietary habits, lifestyle behaviours and family history. The majority of participants were aged 15–19 years (92%), with a slight predominance of females (53%), and resided mainly in Bonamoussadi (71%). With regard to nutritional status, 57% of participants had a normal BMI, whilst 29.5% were overweight or obese. Most participants consumed dairy products (62.5%), fish and meat (50%), high-fat foods (52%) and starchy foods (52.5%) once a week. The majority did not consume alcoholic drinks (91%) and had a low level of physical activity (72%). As regards screen time, 81% watched television for between 1 and 4 hours a day, whilst 75% used their mobile phones for at least 5 hours a day. Finally, 73.5% of participants reported having no obese parents, 51.5% had not been overweight during early childhood, and 56.5% had no close relatives following a diet.

Table 1: General information on participants

Variables	Categories	Frequency n (%)
Sex	Female	106 (53)
	Male	94 (47)
Age (years)	10–14	16 (8)
	15–19	184 (92)
Place of residence	Bonamoussadi	142 (71)
	Other places	58 (29)
BMI status	Obese	27 (13.5)
	Overweight	32 (16)
	Normal	114 (57)
	Underweight	27 (13.5)
Milk and dairy products	Once a week	125 (62.5)
	1–4 times a week	39 (19.5)
	More than 4 times a week	36 (18)
Fish/meat and assimilate	Once a week	100 (50)
	1–4 times a week	78 (39)
	More than 4 times a week	22 (11)
Fruits and vegetables	Once a week	98 (49)
	1–4 times a week	83 (41.5)

Variables	Categories	Frequency n (%)
	More than 4 times a week	19 (9.5)
Foods rich in oil and fat	Once a week	104 (52)
	1–4 times a week	70 (35)
	More than 4 times a week	26 (13)
Starchy foods	Once a week	105 (52.5)
	1–4 times a week	61 (30.5)
	More than 4 times a week	34 (17)
Alcoholic beverages	No	182 (91)
	Yes	18 (9)
Physical activity	Low	144 (72)
	Moderate	44 (22)
	Vigorous	12 (6)
Screen time video game	Never	104 (52)
	1–4 hours/day	61 (30.5)
	≥5 hours/day	35 (17.5)
Screen time TV	Never	7 (3.5)
	1–4 hours/day	162 (81)
	≥5 hours/day	31 (15.5)
Screen time phone	Never	7 (3.5)
	1–4 hours/day	43 (21.5)
	≥5 hours/day	150 (75)
Obese relative	No	147 (73.5)
	Yes	53 (26.5)
Overweight baby	No	103 (51.5)
	Yes	97 (48.5)
Relative on diet	No	113 (56.5)
	Yes	87 (43.5)

Distribution of participants according to nutritional status

Figure 1 shows the distribution of participants according to their obesity status. The figure shows that the majority of participants were not obese (86.5%), whilst 13.5% were obese.

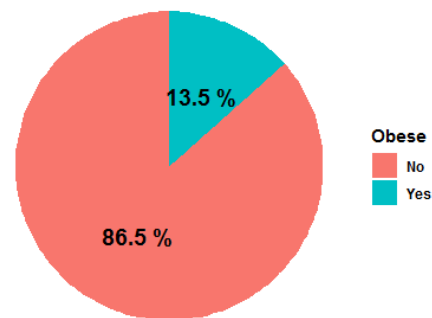


Figure 1: Distribution of participants according to obesity status.

Nutritional determinants associated with obesity among adolescents attending Akwa North Secondary School in Bonamoussadi

Table 2 presents the results of the simple logistic regression analysis of factors associated with obesity among adolescents at Akwa North Secondary School in Bonamoussadi. The results show that consuming dairy products more than four times a week was significantly associated with an increased risk of obesity (OR = 5.26; 95% CI: 1.83–15.84; $p = 0.005$). Similarly, consumption of foods high in oils and fats more than four times a week significantly increased the risk of obesity (OR = 3.88; 95% CI: 1.25–11.77; $p = 0.015$). The consumption of alcoholic drinks was also strongly associated with obesity, with drinkers having a higher odds than non-drinkers (OR = 6.18; 95% CI: 1.72–14.60; $p = 0.002$). Furthermore, adolescents with an obese parent were approximately four times more likely to be obese than those without an obese parent (OR = 4.44; 95% CI: 1.92–10.47; $p = 0.0005$).

Table 2: Results of the simple logistic model for factors influencing obesity among adolescents attending Akwa North Secondary School in Bonamoussadi

Variable	Category	Obese n (%) (n=27)	Non-obese n (%) (n=173)	OR [95% CI]	p-value
Sex	Female	15 (55.56)	91 (52.60)	1	
	Male	12 (44.44)	82 (47.40)	0.88 [0.38–2]	0.775
Age (years)	10–14	2 (7.41)	14 (8.09)	1	
	15–19	25 (92.59)	159 (91.91)	0.90 [0.13–3.51]	0.903
Place of residence	Bonamoussadi	18 (66.67)	124 (71.68)	0.79 [0.33–1.95]	0.594
	Other places	9 (33.33)	49 (28.32)	1	
Milk and dairy products	Once a week	14 (51.85)	111 (64.16)	1	
	1–4 times a week	5 (18.52)	34 (19.65)	1.16 [0.35–3.29]	0.782
	More than 4 times a week	8 (29.63)	28 (16.18)	5.26 [1.83–15.84]	0.005**
Fish/meat and assimilate	Once a week	11 (40.74)	89 (51.45)	1	
	1–4 times a week	12 (44.44)	66 (38.15)	1.47 [0.60–3.58]	0.389
	More than 4 times a week	4 (14.81)	18 (10.40)	1.79 [0.45–5.94]	0.358
Fruits and vegetables	Once a week	11 (40.74)	87 (50.29)	1.07 [0.25–7.34]	0.929
	1–4 times a week	14 (51.85)	69 (39.88)	1.72 [0.42–11.64]	0.497
	More than 4 times a week	2 (7.41)	17 (9.83)	1	
Foods rich in oil and fat	Once a week	9 (33.33)	95 (54.91)	1	
	1–4 times a week	11 (40.74)	59 (34.10)	1.96 [0.76–5.15]	0.157
	More than 4 times a week	7 (25.93)	19 (10.98)	3.88 [1.25–11.77]	0.015*

Variable	Category	Obese n (%) (n=27)	Non-obese n (%) (n=173)	OR [95% CI]	p-value
Starchy foods	Once a week	11 (40.74)	94 (54.34)	1	
	1–4 times a week	9 (33.33)	52 (30.06)	1.47 [0.56–3.80]	0.416
	More than 4 times a week	7 (25.93)	27 (15.61)	2.21 [0.75–6.19]	0.134
Alcoholic beverages	No	20 (74.07)	162 (93.64)	1	
	Yes	7 (25.93)	11 (6.36)	6.18 [1.72–14.6]	0.002**
Physical activity	Low	20 (74.07)	124 (71.68)	0.80 [0.19–5.49]	0.790
	Moderate	5 (18.52)	39 (22.54)	0.64 [0.11–4.93]	0.624
	Vigorous	2 (7.41)	10 (5.78)	1	
Screen time video game	Never	14 (51.85)	90 (52.02)	1	
	1–4 hours/day	7 (25.93)	54 (31.21)	0.83 [0.29–2.13]	0.712
	≥5 hours/day	6 (22.22)	29 (16.76)	1.33 [0.43–3.65]	0.592
Screen time TV	Never	0 (0.0)	7 (4.05)	–	–
	1–4 hours/day	21 (77.78)	141 (81.50)	1	
	≥5 hours/day	6 (22.22)	25 (14.45)	1.76 [0.36–9.16]	0.492
Screen time phone	Never	0 (0.0)	7 (4.05)	–	–
	1–4 hours/day	9 (33.33)	34 (19.65)	1	
	≥5 hours/day	18 (66.67)	132 (76.30)	0.89 [0.23–3.96]	0.880
Obese relative	No	12 (44.44)	135 (78.03)	1	
	Yes	15 (55.56)	38 (21.97)	4.44 [1.92–10.47]	0.0005***
Overweight baby	No	12 (44.44)	91 (52.60)	1	
	Yes	15 (55.56)	82 (47.40)	1.38 [0.61–3.18]	0.432
Relative on diet	No	13 (48.15)	100 (57.80)	1	
	Yes	14 (51.85)	73 (42.20)	1.47 [0.65–3.36]	0.349

OR: Odds Ratio; CI: Confidence Interval. Level of significance: ***p<0.001; **p<0.01; *p<0.05.

Table 3 presents the results of the multivariate logistic regression analysis of factors associated with obesity among adolescents at the Akwa North Secondary School in Bonamoussadi. After adjusting for confounding variables, the consumption of dairy products more than four times a week remained significantly associated with obesity, with the adolescents concerned having an approximately 3.7 times higher odds of being obese than those who consumed them once a week (AOR = 3.72; 95% CI: 1.58–9.74; p = 0.002). Similarly, consumption of foods high in oils and fats more than four times a week significantly increased the risk of obesity (AOR = 3.74; 95% CI: 1.10–12.49; p = 0.030). Furthermore, adolescents who consumed alcoholic drinks were approximately 4.4 times more likely to be obese than non-consumers (AOR = 4.43; 95% CI: 1.32–14.43; p = 0.013). Having an obese parent was the factor most strongly associated with obesity, with a five-fold increased risk among the adolescents concerned (AOR = 5.03; 95% CI: 2.09–12.61; p = 0.0003).

Table 3: Multivariate analysis of factors associated with obesity among adolescents attending Akwa North Secondary School in Bonamoussadi

Variable	Category	AOR [95% CI]	p-value
Milk and dairy products	Once a week	1	
	1–4 times a week	0.79 [0.21–2.49]	0.699
	More than 4 times a week	3.72 [1.58–9.74]	0.002**
Foods rich in oil and fat	Once a week	1	
	1–4 times a week	1.92 [0.72–5.25]	0.192
	More than 4 times a week	3.74 [1.10–12.49]	0.030*

Variable	Category	AOR [95% CI]	p-value
Alcoholic beverages	No	1	
	Yes	4.43 [1.32–14.43]	0.013*
Obese relative	No	1	
	Yes	5.03 [2.09–12.61]	0.0003***

AOR: Adjusted Odds Ratio; CI: Confidence Interval. Level of significance: ***p<0.001; **p<0.01; *p<0.05.

Discussion

This study identified the nutritional determinants associated with obesity among pupils at the Akwa North Secondary School in Bonamoussadi. The results showed that 13.5% of participants were obese. This prevalence was found to be higher than that reported in studies conducted in sub-Saharan Africa by Tunkara-Bah et al. ¹⁵ and Uba et al. ¹⁶, as well as in Greece by Makri et al. ¹⁷, where the observed proportions remained below 10%. This difference could be attributed to the specific characteristics of the urban environment in which the study was conducted. Indeed, Bonamoussadi is a highly urbanised neighbourhood characterised by a marked nutritional transition, with increasing access to processed foods, a gradual decline in physical activity and the adoption of more sedentary lifestyles. Furthermore, secondary school pupils generally have greater autonomy in their food choices and are more exposed to the influence of the commercial environment, which may encourage less healthy eating behaviours. Interestingly, the coexistence of obesity (13.5%) and underweight (13.5%) in this study population also highlights the double burden of malnutrition among adolescents. This finding suggests that, within the same school population, both excessive and insufficient weight

remain important nutritional concerns that should be considered when designing school-based nutrition interventions.

An analysis of dietary habits has shown that the consumption of dairy products is associated with obesity. This finding is consistent with the observations of Tunkara-Bah et al.¹⁵ in The Gambia. Several mechanisms may explain this relationship. On the one hand, certain dairy products consumed by adolescents, notably whole milk and sweetened milk-based drinks, have a high energy density. On the other hand, frequent consumption of these products, when part of an overall high-calorie diet, may contribute to an energy surplus that promotes the storage of body fat. However, this association could also reflect broader dietary patterns characterised by increased consumption of high-calorie foods.

The results also revealed that frequent consumption of foods high in oils and fats significantly increased the risk of obesity. This finding is consistent with the conclusions reported by Niba et al.¹⁸ in Cameroon. Foods high in fat have a high energy density and often provide a shorter-lasting feeling of fullness than foods high in fibre. Regular consumption of fried foods, dishes containing large amounts of oil, or high-fat processed foods can therefore lead to an excessive energy intake. When this excess is not offset by sufficient physical activity, it gradually promotes the accumulation of adipose tissue and the onset of obesity.

Furthermore, the consumption of alcoholic drinks emerged as a factor strongly associated with obesity. Adolescents who consumed alcohol had significantly higher odds of being obese than those who did not, both in the bivariate analysis and in the adjusted model. This finding is consistent with the observations of Zalewska and Maciorkowska¹⁹. This relationship could be explained by the high energy content of alcohol, which provides calories often referred to as 'empty calories' due to their low nutritional value. Furthermore, alcohol consumption is frequently associated with unhealthy eating behaviours, including increased appetite, snacking and the concurrent consumption of foods high in sugar and fat. Among adolescents, this behaviour may also reflect the adoption of risky lifestyles that indirectly promote weight gain.

Finally, a family history of obesity was a significant determinant of obesity among the pupils surveyed. This finding is consistent with those reported by Turi et al.²⁰ in Uganda and Tchoubi et al.²¹ in Cameroon. The influence of family on obesity is complex and results from the interaction between genetic and environmental factors. Children from families where obesity is present may inherit biological predispositions that influence energy metabolism, appetite or fat storage. However, they also share a common environment characterised by similar dietary habits, consumption behaviours and levels of physical activity. These factors contribute to increasing the risk of obesity within the same household, thereby highlighting the importance of involving families in prevention strategies^{22,23}.

Several other variables examined in this study

were not significantly associated with obesity, including physical activity, screen time, fruit and vegetable consumption, sex and age. The absence of statistically significant associations for these factors should be interpreted with caution. Regarding physical activity, 72% of participants were classified as having a low level of physical activity, which may have resulted in limited variability between participants and reduced the ability to detect an association. Similarly, screen-time behaviours were concentrated in specific categories, with 81% of participants reporting 1–4 hours of television viewing per day and 75% reporting at least 5 hours of mobile phone use per day. This limited variability may have reduced the ability to detect differences between obese and non-obese participants. The lack of a significant association with fruit and vegetable consumption may also reflect the distribution of consumption frequencies in the study population. In addition, dietary and lifestyle behaviours were self-reported and may therefore have been subject to recall or reporting bias. Finally, the relatively small number of obese participants (n=27) may have limited the statistical power to detect modest associations. These findings therefore do not necessarily indicate that these factors are unrelated to adolescent obesity, but rather that their associations could not be demonstrated in this particular study population.

Limits of the study

This study has certain limitations. Its cross-sectional design does not allow causal relationships to be established between the factors studied and obesity, but only associations. Furthermore, convenience sampling may limit the representativeness of the results and introduce selection bias. Furthermore, some information relating to dietary habits and lifestyle behaviours is based on participants' self-reports, which may lead to recall or reporting bias. Finally, the failure to account for certain confounding factors, such as socio-economic status or quantified energy intake, could influence the observed results. The small number of obese participants (n=27) resulted in approximately 6.75 events per predictor in the four-predictor multivariate model, which may have reduced estimate precision and contributed to wide confidence intervals. The absence of information on non-responders or unreturned consent forms prevented calculation of a response rate and limited assessment of selection bias. Finally, the marked age imbalance (8% aged 10–14 years versus 92% aged 15–19 years) limits the assessment of age-related patterns in obesity.

Conclusion

This study revealed a significant prevalence of obesity amongst adolescents at the Akwa North Secondary School in Bonamoussadi, estimated at 13.5%. The analyses showed that obesity is significantly associated with certain dietary behaviours, notably the frequent consumption of dairy products and high-fat foods, alcohol consumption, and a family history of obesity. These results reflect the significant influence of dietary habits and the family environment on the development of obesity among adolescents in

urban areas. They highlight the need to strengthen prevention initiatives in schools through nutrition education, the promotion of a balanced diet and raising awareness amongst families, in order to reduce the risk of obesity and its future complications.

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Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee for Human Health Research at the School of Health Sciences, Catholic University of Central Africa (No. 2023/022045/CEIRSH/ESS/MSP).

The administrative authorisations required for data collection were also obtained from the relevant health and education authorities, notably from the Regional Public Health Delegate for the Littoral Region (No. 0277/AAR/MINSANTE/DRSPL/BCASS) and from the Head of the Bangue Health District, authorising the study to be carried out at Akwa North Secondary School (No. 121/L/MINSANTE/DRSP/DSB).

Free and informed consent was obtained from participants aged 18 and over before the survey began. For participants under the age of 18, a consent form signed by parents or legal guardians, as well as the pupils' own assent, was required prior to data collection. The anonymity and confidentiality of the information collected was strictly maintained throughout the study.

Author contributions

S.R.K. Maffouo, G.R.P. Djoko, J.R.M. Tachoum, P.C.M. Sawi, and A. Nkonjock conceived and designed the study. S.R.K. Maffouo coordinated the fieldwork and collected the data. S.R.K. Maffouo, G.R.P. Djoko, V.C.K. Ngodem, J.R.M. Tachoum, and P.C.M. Sawi contributed data management, statistical analysis, and interpretation of the findings. S.R.K.

Maffouo drafted the first version of the manuscript. G.R.P. Djoko, J.R.M. Tachoum, P.C.M. Sawi, V.C.K. Ngodem, and A. Nkonjock critically revised the manuscript for important intellectual content. All authors read, reviewed, and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there are no financial, professional or personal conflicts of interest that could influence the content or interpretation of the results presented.

Data availability

The data used and analysed in this study are available from the corresponding author upon reasonable request.

Consent to publication

All participants and/or their legal guardians have given their consent for the publication of aggregated data from the study. No personally identifiable information has been collected or published.

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