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Overweight School Children in the Urban Community of Niamey According to their Eating Habits, Level of Physical Activity and Social and Economic Characteristics

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Overweight and obesity during adolescence are a worldwide public health concern, due to their potential impact on health and their increasing frequency. Dietary habits such as overconsumption of energy-dense foods combined with low levels of physical activity are the main causes.
Objective: The aim of this study was to assess the impact of adolescents' dietary and lifestyle habits on the prevalence of overweight and obesity.
Methodology: This was a descriptive cross-sectional study of pupils aged 11 to 17 in lower secondary schools in the Niamey Urban Community. Anthropometric parameters were measured for each pupil, and a questionnaire was completed concerning dietary habits, level of physical activity and lifestyle. Results were analyzed using Epi info software version 7.2.5.0.
Results: The prevalence of obesity differed significantly between the sexes. 2.86% in boys versus 5.95% in girls ($p < 0.05$). The three main meals of the day, morning snack and afternoon tea, were respectively provided for 83.24% of pupils for breakfast, 95.06% for lunch, and 91.90% for dinner. Among the pupils, 37.85% travelled to school by car or motorcycle; 60% practised a sport. The prevalence of overweight and obesity was 11.00% and 1.4% respectively. The majority of students had a sleep time of between 5-8 hours (80.24) per day, significantly so ($p<0.05$).
Conclusion: With regard to eating habits, around 10% consumed offal every day, with a significant link ($p<0.05$). These results justify awareness-raising activities among pupils, and the involvement of parents and teachers in strategies focusing on food hygiene and sport.

Keywords: Adolescents; obesity; overweight; commune; prevalence; Niamey.

1. INTRODUCTION

Africa's nutritional situation is currently marked by the triple-burden phenomenon of malnutrition [1]. On the one hand, malnutrition due to deficiency and hidden hunger, which have been present for years and constitute priority areas in the development of nutrition policies, and on the other, malnutrition due to excess, which is becoming increasingly prevalent in low- and middle-income countries.

Indeed, it is not uncommon to observe undernutrition, hidden hunger and obesity simultaneously in the same country, community or even family [2]. In developing countries, non-communicable diseases such as obesity and overweight have become a major public health challenge, following the example of developed countries, particularly in urban areas [3].

Globally, the prevalence of obesity almost tripled between 1975 and 2016. In 2016, more than 1.9 billion adults aged 18 and over were overweight, of whom more than 650 million were obese. Globally, around 13% of the world's adult population (11% of men and 15% of women) were obese in 2016 [4]. The obesity pandemic and its upward trend do not only concern adults; children are also victims [5].

In 2004, an estimated 170 million children under the age of 18 were overweight worldwide [6]. In 2016, more than 340 million children and adolescents aged between 5 and 19 were overweight or obese [2]. Between 1975 and 2016, the prevalence of overweight and obesity in children and adolescents aged 5 to 19 had risen from just 4% to just over 18% [2]. Over 75% of overweight children lived in developing countries and 25% in developed countries.

The determinants of obesity are multiple and their interaction complex [7,8,9]. However, energy imbalance between calories consumed and expended is the fundamental cause [10,11]. Globally, there is an increase in the consumption of energy-rich foods coupled with an increase in the lack of physical activity due to the increasingly sedentary nature of many forms of work, changing modes of transport and increasing urbanization [2]. Adolescence is a critical period for abnormal weight gain [12]. Adolescents are subject to eating behavior problems because they are growing and have increasing nutritional needs [13]. In addition, adolescents enjoy increasing levels of independence and spend more time away from their families, making them highly susceptible to obesogenic behaviors [11] such as higher consumption of energy-dense foods coupled with the promotion of a more sedentary lifestyle [14,15]. Sedentary behaviors are activities with low energy expenditure [16]. These include watching TV, using a computer, sitting during a

transit ride, playing video games, using mobile devices and tablets, etc. [17,18]. Numerous studies have examined sedentary behaviors in adolescents, particularly watching TV and/or spending excessive time in front of a screen, and have shown them to be associated with the consumption of unhealthy foods [15,19,20]. An inverse association has also been identified with the consumption of healthy foods such as fruit and vegetables [21]. Undesirable eating habits such as eating highly processed and calorie-rich foods between meals, drinking sugary drinks, skipping breakfast, increased consumption of sweet and salty snacks and decreased consumption of fruit and vegetables and like were associated with an incidence of obesity in children and adolescents [22,23,24]. Excessive snacking can also lead to excessive calorie consumption, which in turn can lead to obesity [25]. The findings show that the consumption of energy-dense foods with low nutritional value and screen time act synergistically and are directly associated with overweight.

In sub-Saharan Africa (SSA), the combined prevalence of overweight and obesity ranges from 2% to 54% in 20 countries, and is increasing at an alarming rate [26]. The number of overweight or obese children has almost doubled since 1990, from 5.4 million to 10.3 million [27]. This is worrying as adolescents represent the largest population group and 90% of them live in low- and middle-income countries [28]. Overweight and obesity in children are associated with a significant reduction in quality of life [29,30,31,32], and morbidity and mortality risks are increased in subjects who have been overweight in adolescence, even in those who will return to a normal weight in adulthood [33]. Adolescence is a vulnerable period of sensitive transition, when life choices have a lasting influence on health in adulthood [34]. It is increasingly recognized as a crucial period for optimizing the health and well-being of current and future generations [35,36]. This period of adolescence therefore deserves special attention in a policy to prevent nutrition-related health risks [34].

To achieve this, particular attention needs to be paid to identifying risk factors for obesity in adolescents, such as sedentary lifestyles and food consumption. Although obesity is a major public health problem, few studies have been carried out, hence the interest of the present study, which has the following objectives:

1.1 General Objective

To study the eating habits and lifestyles of adolescents.

1.2 Specific Objectives

- Determine the prevalence of overweight and obesity;
- Evaluate the habits and behavior of adolescents;
- Assess adolescents' level of knowledge about obesity.

2. MATERIALS AND METHODS

1. **Type of Study:** This was a descriptive cross-sectional study involving a representative sample of adolescents over a 3-month period from April 1 to June 30, 2021 in Niamey, the capital of Niger. The study was carried out in accordance with the recommendations of the Declaration of Helsinki and received the approval of the regional secondary education authorities and the school councils. Informed consent had been obtained from the students.
2. **Study Population:** The city of Niamey is subdivided into 5 communal districts. The study involved male and female students in public and private secondary schools in these districts. This was a cluster survey. First, the communes were selected at random. In each commune, 10% of the schools were selected. In each selected school, all classes were enrolled. In each selected school, all classes were enrolled. In each class, 10% of pupils were selected. A total of four hundred and twenty (420) pupils were enrolled.

2.1 Data Collection

2.1.1 Description of protocol

All anthropometric measurements and data collection were carried out with the collaboration of supervisors, colleagues and some physical education teachers.

2.1.2 Measurement of anthropometric parameters

Weight (in kg) was measured to the nearest 0.1 kg using a hand-held scale (Seca 709), between 8 a.m. and midday, in lightly clad, barefoot subjects.

Height was measured to an accuracy of 0.5 cm using a wall-mounted height gauge, on subjects with their feet flat on the floor, backs, buttocks and heels pressed against the vertical board of the height gauge, and the head placed in a horizontal position so that the line of vision was perpendicular to the body.

Body mass index (BMI) was calculated by dividing body weight in kilograms by height in meters squared BMI=Weight/Height² (kg/m²) [37]. The body mass index (BMI) was used as a criterion for assessing students' nutritional status. To assess pupils' weight status, the BMI thresholds for age used are those recommended by the WHO for children aged 05 to 19. The overweight threshold is >+1 standard deviation, the obese threshold >+2 standard deviations and the underweight threshold < -1 standard deviation from the median. These z-score thresholds correspond to the 85th, 97th and 15.9th percentiles, respectively [38,4].

Included in the study were all regularly enrolled students in the 2020-2021 school year, aged 11 to 17, who had agreed to participate in the study. Students absent on the day of the survey and those aged <11 or > 17 were excluded from the study. Waist circumference (WC) was measured in cm with a non-elastic tape measure applied at a point intermediate between the questionnaire.

A questionnaire was completed directly by the students.

Data were collected using a pre-tested, anonymous questionnaire. They covered anthropometric measurements, socio-demographic characteristics, physical inactivity, nutritional knowledge and eating habits. The latter covered the frequency with which the main meals (breakfast, snack, lunch, afternoon tea and dinner) were eaten during the day. A sedentary lifestyle was assessed in terms of physically inactive occupations and after-school physical activity, the means of transport used to get to school, and sports participation. Nutritional knowledge was assessed by offering students three meal menus and three breakfast menus. Nutritional knowledge was assessed by offering students three meal menus and three breakfast menus. The three meal menus consisted of: menu 1 = salad + roast chicken + rice + cheese + fruit; menu 2 = egg + mayonnaise + steak + French fries + plain yoghurt + cream cake; menu 3 = merguez + pasta with cheese + fruit yoghurt + chocolate cake. Students should identify the menu that makes them put on the most weight (menu 2).

The breakfast menus consisted of: menu 1 = bowl of chocolate milk + croissants + glass of orange juice; menu 2 = bowl of milk + slice of bread + butter + jam + 1 piece of fruit; menu 3 = bowl of chocolate cereal + cookies or cakes + banana + glass of orange juice. They had to choose the healthiest one (menu 2).

2.2 Statistical Analysis

Word 2010 was used for text input. Data recording and analysis were performed using Excel 2010, Stata 12 and Epi info version 7.2.5.0. Then, a uni- and bi-variate analysis was performed for an in-depth study of the data. The chi-square test will be used to serve and compare variables; the confidence interval will be 95%, p value 0.05 to have a significant test.

3. RESULTS

This was a descriptive cross-sectional study involving 420 pupils from 16 public and private schools in Communal Arrondissements I and II of the Niamey urban community. Demographic and anthropometric data weight (in kg) was assessed to the nearest 0.1 kg using a hand-held scale (Seca 709), between 8 a.m. and midday in lightly clothed, barefoot subjects.

Height was measured to an accuracy of 0.5 cm using a wall-mounted height gauge, on subjects with their feet flat on the floor, backs, buttocks and heels pressed against the vertical board of the height gauge, and the head placed in a horizontal position so that the line of vision was perpendicular to the body.

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Waist circumference (WC) was measured in cm with a non-elastic tape measure applied at a point intermediate between the lower edge of the rib cage and the iliac crest, at the end of a normal exhalation.

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This was a descriptive cross-sectional study involving 420 pupils from 16 public and private schools in Communal Arrondissements I and II of the Niamey urban community.

3.2.1 Demographic and anthropometric data

Table 1 shows the anthropometric characteristics of the study population. Of the 420 pupils enrolled, 45.95% (193) were girls, with a sex ratio (Boys/Girls) of 0.85. The average age of the students was 14.84±1.49 years. It ranged from 11 to 17 years. No significant difference was found between the average age of boys and girls (p = 0.59). Average weight was 47.69±13.71 kg. The mean weight of girls (49.66±13.57) was significantly higher than that of boys (46.01±13.62) (p=0.0063). Average height was fairly consistent between the sexes, at around 152 cm (p=0.94). The shortest height (1.16 m) was measured in girls, and the tallest height (1.87 m) in boys.

The mean BMI-for-age was 20.26 ± 4.59 kg/m2. The mean BMI for girls was 21.20 kg/m2, higher than that for boys, 19.46 kg/m2 (p = 0.0001). It is higher than that of boys19.46 kg/m^2 (p = 0,0001).

Table 2 shows the distribution of body mass index in the study population. The prevalence of obesity is around 9%, overweight 10.5% and underweight 17%.

Table 1. Anthropometric characteristics (expressed as mean-standard deviation) of the study population

Parameters	Total (N = 420)	Girls (N=193)	Boys (N=227)	P
Age (years)	14.84±149	14.79 ± 1.42	14.87±1.54	0.5901
Weight (kg)	47.69±13.71	49,66 ± 13.57	46.01 ±13.62	0.0063
Size (m)	1.52±0.11	1,52 ± 0.91	1.52±0.13	0.9447
IMC (kg/m^2)	20.26±4.59	21,20 ± 5.29	19.46±3.73	0.0001

The number in brackets indicates the number of subjects

Table 2. Percentage distribution of body mass index (BMI) in the study population

Parameters	Under Weight %(N)	p	Normal %(N)	p	Overweight %(N)	p	Obesity %(N)	p	Total
Female	15.02(29)		59.07(114)		12.95(25)		12.95(25)		45.95(193)
Male	18.06(41)	0.40	68.28(155)	0.004	8.37(19)	0.12	5.28(12)	0.005	54.05(227)
Total	16.66(70)		64.04(269)		10.47(44)		8.80(37)		100(420)

The number in brackets indicates the number of subjects

Table 3. Distribution of students' weight status according to physical activity, means of transport used and sleep time

Parameters	Under weight %(N)	Normal %(N)	Overweight %(N)	Total %(N)	Probability
Outdoor sport					
Yes	14.28(39)	65.87(166)	18.65(47)	60.00(252)	
No	18.45(31)	61.30(103)	20.23(34)	40.00(168)	0.60
Means of transport					
On foot					
Yes	16.25(39)	62.08(149)	21.66 (52)	57.14(240)	
No	17.22(31)	66.66(120)	16.11(29)	42.85(180)	0.36
By car/bike/bus					
Yes	17.31(31)	66.48(119)	16.20(29)	42.61(179)	
No	16.18(39)	62.24(150)	21.57(52)	62.14(241)	0.38
Sleeping time					
< 7h	19.48(15)	64.93(50)	15.58(12)	18.33(77)	
≥ 7h	16.03(55)	63.84(219)	20.11(69)	81.66(343)	0.56

The number in brackets indicates the number of subjects

The distribution of weight status by gender shows that there are significantly more boys with adequate weight status than girls (p=0.004), while on the other hand there are around twice as many obese girls as boys (p=0.005). In fact, the prevalence of overweight was 12.95% among girls and 8.37% among boys, and that of obesity 12.95% and 5.28%, respectively.

Table 3 shows the distribution of students' weight status according to sport practice, means of transport used and sleep time. The results show that 60% of the pupils in the study declared that they practised sport outside physical education classes, of whom 18.65% were overweight. In addition, 42.61% of pupils used some form of transport (motorcycle, car or bus), 66.48% of whom were normo-weight, 16.20% overweight and 17.31% underweight. The mode of transport appears to have no significant influence on the child's overweight (p>0.05).

Concerning sleep time, almost 81.66% of pupils slept more than 7 hours a day, while the remainder (18.33%) slept less than 7 hours. Of these, 15.58% of overweight adolescents slept less than 7 hours a day. No significant relationship was found between sport, means of transport, sleep time, overweight and obesity (p>0.05).

Table 4 shows the distribution of weight status weight status of students according to different food intakes. Approximately 83% of students regularly eat breakfast, while over 16% do not.do not eat breakfast. Nearly ¼ of overweight students do not eat breakfast. Lunch and dinner are eaten regularly by 91.90% of students, of whom 20% who eat lunch are overweight, and 18.91% for dinner. They are respectively 60.5% take a snack and 67% a snack. No association was found between BMI distribution and food intake food intake (p>0.05).

Table 5 shows the distribution of students' weight status according to the number of meals consumed. Nearly three-quarters of adolescents (70.95%) ate more than 3 meals a day. Among those who were overweight, 74.07% ate more than 3 meals a day.

Table 6 shows the nutritional knowledge of schoolchildren according to their weight status. Menu 2, the most fattening menu, was identified by a total of 29.28% of students. Of these, 21.13% were overweight. Menus 1 and 3 were cited by 50% and 20.71% of students respectively. Menu 2 is the healthier breakfast menu.

Pupils were asked to identify menu 2 as the most fattening and breakfast 2 as the healthiest. It was identified by 40.47% of students. Of those who chose menu 2, 20.58% were overweight and 15.88% underweight. Menus 1 and 3 were chosen by 29.76%, respectively.

Table 7 shows the distribution of BMI in the study population according to their eating habits. For offal, the results show that 26.19% of the students in the sample eat offal 2 to 3 times a week. Of these, 29.62% were overweight, 23.00% were of normal weight and 34.28% were underweight. Almost 20% of students reported consuming sweetened beverages on a daily basis, including 20.71% once a week and 46.19% 2 to 3 times a week. Over 40% of overweight students consume sweetened beverages 2 to 3 times a week, and 19.75% rarely. With regard to eating at fast food outlets, only 7.14% of teenagers ate daily, 29.76% ate 2-3 times a week and around 31% rarely. Sweets were eaten by 40.47% of teenagers overall, and 24.69% of overweight teenagers ate every day. More than half the students in the study (55.47%) had eaten fried foods 2 to 3 times a week, and of those who ate daily, 22.22% were overweight. Fruit was eaten 2-3 times a week by 44.52% of those surveyed. As for the consumption of Eggs and Meat, 37.85% of adolescents ate every day, the same proportion ate 2-3 times a day, and almost half of overweight students ate daily. In general, more than a quarter of overweight adolescents (28.39%) ate pastries every day of the week, while 38.27% ate 2-3 times a day and 16.04% rarely.

4. DISCUSSION

The results presented in this cross-sectional survey are based on a representative sample of students in public and private secondary schools in the urban community of Niamey (Niger). Prevalences were obtained from anthropometric measurements taken on the day of the survey on all students included in the sample. The other information studied was collected via a standardized individual questionnaire filled in on the basis of the answers given by the adolescents.

Table 4. Distribution of students' weight status according to different food intakes

Parameters	Criterea	Under weight (%N)	Normal BMI (%N)	Weight over Load (%N)	Total (%N)	Probability
Breakfast	Yes	17.47(61)	63.89(223)	18.62(65)	83.09(349)	0.52
	No	12.67(9)	64.78(46)	22.53(16)	16.90(71)	
Snack	Yes	13.77(35)	68.11(173)	18.11(46)	60.47(254)	0.07
	No	21.08(35)	57.83(96)	21.08(35)	39.52(166)	
Lunch	Yes	16.88(65)	89.09(243)	20.00(77)	91.66(385)	0.37
	No	14.28(5)	74.28(26)	11.42(4)	8.33(35)	
Snack	Yes	17.02(48)	63.12(178)	19.85(56)	67.14(282)	0.85
	No	15.94(22)	65.94(91)	18.11(25)	32.85(138)	
Dinner	Yes	16.3263)	64.76(250)	18.91(73)	91.90(386)	0.58
	No	20.58(7)	55.88(19)	23.52(8)	8.09(34)	

The number in brackets indicates number of subjects

Table 5. Distribution of students' weight status by number of meals eaten

	Under weight %(N)	Normal BMI %(N)	Weight overload %(N)	Total %(N)	Probability	$\chi 2$
Number of meals						
≤ 3 meals	32.85(23)	29.00(78)	5.92(21)	29.04(122)	0.67	0.87
> 3 meals	67.14(47)	71.00(191)	74.07(60)	70.95(298)		

The number in brackets indicates the number of subjects

Table 6. Distribution of students' weight status according to nutritional knowledge

	Criterea	Under weight (%N)	Normal BMI (%N)	Weight over Load (%N)	Total (%N)	Probability
Menu that makes you fat	Menu 1	17 .14(36)	62.38(131)	20 ?47(43)	50.00(210)	
	Menu 2	13.82(17)	66.66(80)	21.13(26)	29.28(123)	0.55
	Menu 3	19.54(17)	66.66(58)	13.79(12)	29.71(87)	
Healtheir breakfast	Menu 1	18.40(23)	60.00(75)	21.60(27)	29.76(125)	0,61
	Menu 2	15.88(27)	63.52(108)	20.58(35)	40.47(170)	
	Menu 3	16.20(20)	68.80(86)	15.20(19)	29.6(125)	

The number in brackets indicates the number of subjects

Table 7. Adolescents nutritional status and eating habits

Foods	Nutritional profil				Probability
	Under weight (N=70)	Normal BMI (N=269)	Weight overload (N=44)	Total (N=420)	
Offal intake					
Everyday	2.85(2)	7.43(20)	9.87(8)	7.14(30)	**0.004**
2-3 times /week	34.28(24)	23.04(62)	29.62(24)	26.19(110)	
1 time /week	41.42(29)	34.20(92)	17.28(14)	32.14(135)	
Rarely	21.42(15)	35.31(95)	43.20(35)	34.52(145)	
Drink intake					
Everyday	12.85(9)	20.81(56)	23.45(13)	20.00(84)	**0.045**
2-3 times /week	61.42(43)	43.86(118)	40.74(33)	46.19(194)	
1 time /week	18.57(13)	22.67(61)	16.04(13)	20.71(87)	
Rarely	7.14(5)	12.63(34)	19.75(16)	13.09(55)	
Raw vegetable intake					
Everyday	35.71(25)	34.57(93)	44.44 (36)	36.66(154)	**0.592**
2-3 times/week	34.28(24)	41.63(112)	33.33 (27)	38.80(163)	
1 time a week	21.42(15)	18.21(49)	16.04 (13)	18.33(77)	
Rarely	8.57(6)	5.57(15)	6.17 (5)	6.19(26)	
Fast-food intake					
Everyday	11.42(8)	6.69(18)	4.93 (4)	7.14(30)	**0.396**
2-3 times/week	28.57(20)	30.48 (82)	28.39 (23)	29.76(125)	
1 time a week	38.57 (27)	30.48 (82)	32.09(26)	32.14(135)	
Rarely	21.42(15)	32.34 (87)	34.56 (28)	30.95(130)	
Feeds intake					
Everyday	51.42(36)	56.13(151)	58.02 (47)	55.71(234)	**0.985**
2-3 times/week	34.28(24)	31.59 (85)	29.62 (24)	31.66(133)	
1 time a week	10.00 (7)	8.17(22)	20.98 (6)	8.33(35)	
Rarely	4.28(3)	4.08(11)	23.45 (4)	4.28(18)	
Treats intake					
Everyday	34.28(24)	18.21(49)	24.69(20)	22.14(93)	**0.065**
2-3 times /week	30.0021)	43.12(116)	40.74(33)	40.47(170)	
1 time/week	24.28(17)	21.18(57)	16.04(13)	20.71(87)	
Rarely	11.42(8)	17.47(47)	18.51(15)	16.66(70)	
Fried food intake					
Everyday	20.00(14)	23.42(63)	22.22(18)	22.61(95)	**0.870**
2-3 times /week	52.85(37)	55.01(148)	59.25(48)	55.47(233)	
1 time /week	21.42(15)	15.61(42)	14.81(12)	16.42(69)	
Rarely	5.71(4)	5.94(16)	3.70(3)	5.47(23)	

Foods	Nutritional profil				Probability
	Under weight (N=70)	Normal BMI (N=269)	Weight overload (N=44)	Total (N=420)	
Fruits intake					
Everyday	32.85(23)	36.80(99)	29.62(24)	34.76(146)	**0.509**
2-3 times /week	48.57(34)	40.89(110)	53.08(43)	44.52(187)	
1 time/week	11.42(8)	12.63(34)	12.34(10)	12.38(52)	
Rarely	7.14(5)	9.66(26)	4.93(4)	8.33(35)	
Cooked vegetable intake					
Everyday	22.85(16)	20.44(55)	20.98(17)	20.95(88)	**0.158**
2-3 times /week	48.57(34)	41.26(111)	34.56(28)	41.19(173)	
1 time /week	21.42(15)	20.16(65)	20.98(17)	23.09(97)	
Rarely	7.14(5)	14.12(38)	23.45(19)	14.76(62)	
Dry vegetable intake					
Everyday	10.00(7)	17.47(47)	22.22(18)	17.14(72)	
2-3 times /week	50.00(35)	43.49(117)	30.86(25)	32.14(177)	**0.244**
1 fois /semaine	24.28(17)	23.04(62)	27.16(22)	24.04(101)	
Rarement	15.71(11)	15.98(43)	19.75(12)	16.66(70)	
Egg - Meat intake					
Everyday	22.85(16)	39.77(107)	44.44(36)	37.85(159)	**0.017**
2-3 times /week	45.71(32)	37.17(100)	33.33(27)	37.85(159)	
1 time /week	25.71(18)	15.98(43)	9.87(8)	16.42(69)	
Rarement	5.71(4)	7.06(19)	12.34(10)	7.85(33)	
Pastries intake					
Everyday	17.14(12)	19.70(53)	28.39(23)	20.95(88)	**0.494**
2-3 times /week	41.42(29)	41.26(111)	38.27(31)	40.71(171)	
1 time /week	28.57(20)	23.42(63)	17.28(14)	23.09(97)	
Rarely	12.85(9)	15.61(42)	16.04(13)	15.23(64)	
Egg intake					
Everyday	15.71(11)	11.89(32)	17.28(14)	13.57(57)	**0.465**
2-3 fois /semaine	38.57(27)	45,35(122)	38.27(31)	42.85(180)	
1 time /week	32.85(23)	25.27(68)	23.45(19)	26.19(110)	
Rarely	12.85(9)	17.48(47)	20.98(17)	17.38(73)	

The number in brackets indicates the number of subjects

4.1 Girls' Sex Ratio

Of the 420 pupils enrolled, 193 were girls, with a sex ratio (boys/girls) of 1.17. In a previous study of 10–15-year-olds in the five communes of Niamey, the sex ratio was 0.68, with a female predominance of 59.4% [39], compared with 45.95% in the present study. The present study took place in communes I and III of Niamey and involved schoolchildren aged 11 to 17.

4.2 Prevalence of Overweight and Obesity

The overall prevalence of overweight (including obesity) among schoolchildren was 19.28%, with a significant difference ($p<0.05$). The prevalence of overweight and obesity among girls was identical (12.95%). It is twice as high as for boys, especially for obesity (5.28%).

Other African countries using WHO criteria report the following prevalences.

The overall prevalence of obesity is around 9%, higher than the 5.0% reported in Algeria [39]. The prevalence of overweight and obesity in schools varies widely from country to country. In Ethiopia, the prevalence of overweight and obesity among children aged 5 to 19 in Addis Ababa was 7.6% and 0.9% respectively [40].

In a study carried out in South Africa, 7.8% of school-going adolescents aged 10 to 15 were overweight or obese [41]. Another study in Morocco found a prevalence of 8% for overweight and 3% for obesity [42]. In a study carried out in Lithuania, among adolescents aged 12 to 17, the prevalence of overweight was 12.1% and obesity 2.47% [43]. In Togo, the prevalence of overweight was 2.8% [44] and obesity 1.72% [45]. In Congo, the prevalence of obesity was estimated at 7.1% [46] and for Côte d'Ivoire obesity was 5% while overweight affected 4% of children [47]. Similarly, in India and Bangladesh, the prevalences of overweight

and obesity were 25%, 9.6%, 12-14% and 3.5% respectively [48,49], which is higher than the figures found in this study.

4.3 Sporting Activities

Sport contributes to well-being and guarantees physical and mental health for athletes [50]. Around 60% of pupils surveyed practiced sport outside compulsory physical education classes. In Tunisia, 52% of pupils practiced sport outside school [51]. Authors have reported a significant association between overweight and the practice of sport outside school. Our results do not confirm this observation (p = 0.60). In Dakar, where 50% of high school students reported practicing sports outside school, the authors found no significant association with corpulence (p=0.22). However, practicing sports at school was significantly correlated with normal weight stature [52]. Other factors that can be incriminated in the development of obesity include lack of physical activity and sedentariness. Indeed, the health benefits of regular physical activity have been well documented [53,54] and numerous studies have established the link between physical activity and a reduced risk of overweight [55,56,57,58]. Another study in Tunisia showed that being overweight was not significantly associated with practising sport outside school, and here 7% of obese pupils did not practise sport outside school.

4.4 Sleeping Time

It is generally recommended that teenagers get 8 to 10 hours of sleep each night [59]. Unfortunately, according to various authors, adolescent sleep time has decreased, worldwide, compared to the last century [60,61]. In the present study, around 82% of students sleep more than 7 h per night, but only 20.47% sleep more than 08 h per night. In Morocco, around 48% of students sleep more than 8 h per night, i.e. double our observations [62]. In the United States, around a third of adolescents aged 12 to 14 and over half of those aged 15 to 17 sleeps less than 7 h per school night [60,63]. Only 10% of 15- to 17-year-olds and 29% of 12- to 14-year-olds sleep more than 9 hours per school night [59]. In Sweden, around 90% of adolescents aged 13 to 15 sleeps at least 8 h per night [64]. According to these authors, short sleep duration (<7 hours) was associated with overweight and obesity. Various authors have also reported that short sleep duration is a risk factor for obesity in children and adolescents worldwide [6,65,66,67]. In present study, we found no formal association between sleep duration and BMI distribution in the study population (p>0.05), as was also the case in the USA [68].

It should be remembered that the relationship between sleep duration and body weight is complex and would involve both Biology and behavior [65]. What's more, the definition of short sleep seems highly ambiguous. Nevertheless, some studies seem to establish, in adolescents, an association between sleep of less than 7 h per night and high BMI [69,70,71].

4.5 Nutritional Knowledge

For nutritional knowledge, students were asked to identify menu 2 as being the most fattening (egg + mayonnaise + steak + French fries + plain yoghurt + cream cake).

In total, 29.28% of students chose menu 2 as being the most fattening. Of these, 21.13% were overweight. The healthiest breakfast was also represented by menu 2 (bowl of milk + slice of bread + butter + jam + 1 piece of fruit). There was no significant relationship between students' nutritional knowledge and overweight (p > 0.05). These results are similar to those found in Senegal, where 29.3% of pupils answered that menu 2 (egg/mayonnaise + fried steaks + plain yoghurt + cream cake) was the most fattening. For breakfast, 23.3% identified menu 2 (bowl of milk + bread latrines + butter + jam) as the healthiest. Adolescents (40.47%) identified menu 2, and among them, 20.58% were overweight. There was no significant association between students' nutritional knowledge and their weight status (p > 0.05).

In a study carried out in Dakar, Senegal, 29.3% of students identified the menu that was most fattening, but only 23.3% identified the best breakfast [52]. These authors also found no significant link between students' nutritional knowledge and their corpulence.

4.6 Eating Habits

In the present study, a significant association was found between overweight and the consumption of offal, sweetened beverages and meat and eggs (p<0.05). However, no significant association was recorded with the other food groups studied (p>0.05). The dietary causes of obesity are complex [72]. Despite this

complexity, a healthy diet remains essential to prevent overweight and obesity [73]. It is generally accepted that a diet based on an adequate intake of whole grains, milk and dairy products, fish, fruits and vegetables is beneficial for health promotion, whereas a diet rich in meat, sodas, fried foods, instant noodles, hamburgers and pizza is deleterious and obesogenic [73,74,75]. In Canada, a study showed that young people who ate less fruit and vegetables were more likely to be overweight/obese than those who ate them more often [76]. The recommendation was 5 fruits and vegetables a day. Also 0 to 6 per day for legume-type starchy foods [77,78]. Fresh vegetables have been shown to have a low caloric density and are very rich in antioxidants (vitamin C and carotenoids), with a high nutritional density in vitamin B9, potassium, calcium, magnesium, flavonoids, saponins and alkaloids. They are an excellent source of fiber and have a low glycemic index [77]. Studies in Asian countries have also reported a statistically significant association between high meat consumption and overweight and obesity [79]. Other studies have also established a significant positive association between high red meat consumption and the risk of obesity, abdominal obesity (defined by a high waist circumference) and weight gain [80]. However, in a recent literature review, based on seven records of higher versus lower meat consumption in children and adolescents aged 5 to 18, no association was found between meat consumption and overweight and obesity [75]. Around 70% of schoolchildren visit fast-food restaurants at least once a week. A further 7% frequent them daily. There was no significant difference between fast-food consumption by students of normal build and those of normal build (p=0.396). These results are close to observations reported from Dakar [52] or Nigeria [81], where the authors found no association between fast-food consumption and the occurrence of obesity in the study population. According to the present study, 20% of students, 23.5% of overweight students and 13% of underweight students reported taking sugary drinks every day. High consumption of sugar-sweetened beverages is generally considered an important dietary determinant of overweight and obesity [82,83].

These results concur with this assertion, showing a significant link between sweetened beverage consumption and overweight (p=0.045). Similarly, in Nigeria, daily beverage consumption was found to be significantly associated with overweight and obesity [81]. In Benin, frequent consumption of sugary foods was identified as one of the factors significantly associated with overweight [84].

Recently, systematic reviews of the literature have confirmed the significant association between sweetened beverage intake and overweight and obesity in children and adolescents [80,85,75].

5. CONCLUSION AND OUTLOOK

The figures provided by the various studies raise awareness of the existence of overweight, and illustrate the scale of the problem. We therefore recommend that public authorities at all levels make the school medicine program operational and/or strengthen it, so that overweight children can be systematically screened and cared for in all schools in Niger, in order to promote academic success. All school teachers can play an important role in transmitting information to parents and teenagers on the benefits of adequate sleep and its association with healthy weight, healthy eating and academic success.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

Informed consent had been obtained from the students included in the study. No biological samples of any kind were taken.

ETHICAL APPROVAL

The study was approved by the University's Academic Scientific Council.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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