

Review Article

Assessment of the Prevalence and Determinants of Childhood Overweight and Obesity among Public and Private Secondary School Students in the Urban Community of Niamey, Niger

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Abstract

Introduction: An adequate, healthy and balanced diet is essential to maintain health in adults and for the harmonious psychomotor development of children and adolescents. According to the World Health Organization (WHO), the incidence of overweight and obesity is increasing rapidly, particularly in children, and was a major public health problem worldwide. Obesity in children also has a significant risk of persisting into adulthood. These multiple complications of obesity underline the importance of an effective preventive approach that must be initiated in childhood. General objective: To assess the prevalence of childhood overweight and obesity among public and private secondary school students in the Urban Community of Niamey (CUN).

Method: This is a prospective cross-sectional study on a representative and random sample. The interview was conducted by means of a self-administered questionnaire. All regularly enrolled students during the 2020-2021 academic years who agreed to complete the questionnaire and interview guide were included in the study. The analysis is done in Epi info version 20, Stata 12 software.

Result: Four hundred and twenty (420) students were interviewed. One hundred and fifty-one (151) students were underweighted (35.89%). Overweight and obesity were found in 10.5% and 8.8% respectively. Obesity and overweight were seen in female subjects and represented 56.8% and 67.6% respectively. These results are significant ($p=0.05$).

Conclusion: Overweight and obesity are a major public health problem because of their potential impact on health and their increasing frequency in the world.

Keywords: Overweight; Obesity; Adolescent; Commune; Niamey

Introduction

Throughout human history, weight gain and accumulation of fat reserves have been considered signs of health and prosperity [1]. Obesity has become the most common nutritional pathology. Overweight and obesity are a major public health problem because of their potential impact on health and their increasing frequency.

Overweight is an important determinant of health that exposes to cardiovascular, metabolic, articular, cancerous pathologies..., as well as to an increase in mortality. Childhood obesity is not limited to industrialized countries, since a high percentage is already observed

in some developing countries. The social consequences have also been highlighted with the observation of negative attitudes and stigmatization, even discrimination of many obese people. Obesity in children also has a high risk of persistence into adulthood. There are more and more obese children in the world, childhood obesity no longer concerns only American children, today 30% of young people are overweight, of which 17% are obese. There has been an increase of 60% in ten years [2].

Traditionally, it was assumed that populations in developing countries were malnourished due to lack of intake, while those in developed countries were at risk of malnutrition due to excessive intake. This dichotomous view of malnutrition is now being challenged [3,4], at least in developing countries. Indeed, various epidemiological and health surveys conducted in developing countries have revealed the gradual installation of a nutritional transition, the major consequence is the increasing morbidity and mortality due to chronic (non-communicable) diseases caused by excess intake [1]. The prevalence of obesity almost tripled globally between 1975 and 2016.

In 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of this total, more than 650 million were obese. Globally, approximately 13% of the world's adult population (11% of men and 15% of women) was obese in 2016 [5]. According to the World Health Organization (WHO), obesity has become a major public health problem, even more important than malnutrition and infectious diseases, and one of the most serious public health challenges of the

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early 21st century [6,7]. The determinants of obesity are multiple and their interaction complex [8-11]. Among school-aged children, one of the most concerning elements appears to be physical inactivity. In Niger, according to the survey on the surveillance of risk factors for chronic diseases [12], 21.2% of the population has hypertension and 4.3% has diabetes [13]. The proportion of people suffering from obesity was 3.2% in the 15-64 age group and 22.4% for overweight. The weight and height measurements of the respondents were calculated according to the corresponding Body Mass Index (BMI) for each child. Overweight was assessed by comparing BMI to WHO 2007 reference standards and international standards.

The main objective of this study was to determine the prevalence and the environmental and socioeconomic determinants of childhood overweight and obesity among public and private secondary school students in the Urban Community of Niamey (CUN). Given the deleterious effects of overweight and obesity, the long-term objective is to enable the implementation of a prevention and early management program geared towards high-risk population. More specifically, this study should allow to:

- Assess the prevalence of overweight and obesity among adolescents enrolled in public and private secondary schools in the CUN;
- Identify the socio-economic, environmental and behavioral determinants of overweight and obesity among adolescents.

Materials and Methods

Study setting

The Republic of Niger, a country located in Sub-Saharan Africa, is bordered by Algeria and Libya in the north, by Chad in the east, by the Federal Republic of Nigeria and Benin in the south, by Burkina Faso in the west and by Mali in the northwest. Niger is one of the largest countries in West Africa with an area of 1,267,000 km². It is also a landlocked continental country. The nearest port is nearly 1,000 km away. Its climate is tropical Sudanese. It is characterized by two main seasons: a very long dry season of about eight months, from October to May, and a short rainy season of four to five months, from April (or May) to September. The population of Niger lives mainly from agriculture, livestock, fishing and crafts. The region of Niamey, the capital of Niger, is located on the Niger River, in the extreme west of the country. It is located at 13°31 North latitude and 2°6 East longitudes.

With an area of 225 km², it is built on two plateaus overlooking the Niger River at 218 m altitude. The climate is Sahelian with a rainfall ranging from 500 mm to 700 mm per year. The city of Niamey is divided into two parts by the Niger River. The most important part of the city is on the left bank and is composed of 54 districts. The city of Niamey has been constituted as a community since November 24, 1998 and is subdivided into 5 communes: communes I, II, III, and IV which are all on the left bank of the river and commune V which is on the right bank. The population of Niamey was estimated in 2018 at 1,565,056. Education in Niger, or the Nigerien education system, refers to all public and private institutions in Niger whose function is to ensure and develop the education system throughout the country. The Nigerien school system is predominantly public, secular and compulsory from age 6 to 16. It is partly inspired by the French educational model.

This study framework is made up of sixteen (16) public and private

establishments distributed in two communes (I and III) of Niamey.

Type of study

This is a descriptive cross-sectional study on a representative sample, using questionnaires and an interview guide.

Study population

The study population is all adolescents aged of 11 and 17 who are regularly enrolled in secondary schools in the urban community of Niamey I and III.

Sampling technique

A multi-stage sampling was used:

Stage one: Selection of communes

We draft lots in a ballot box with five labels, two labels were randomly selected: commune I and III.

Second step: Selection of schools

All schools in the urban community of Niamey are configured according to two types:

- Francophone schools
- Franco-Arabic schools
- French schools are divided into private and public schools.

All public schools have been taken into account and have been given a serial number. Thus:

- Commune I: 54 private schools and 15 public schools;
- Commune III: 28 private and 11 public schools.

All schools in the urban community of Niamey were numbered.

From the list of all secondary schools, 10% of the francophone schools were selected, including:

- For Commune I: 6 private schools and 1 public school: CSP Union, CSP Intégral du savoir, CSP Faza 1, CSP Bineta, CSP Bakaye, CSP Al Bakhir and CES Zam.
- For Commune III: 3 private and 1 public schools: CSP Rousseau, Complexe Technique Wangari, CSP Alheri, and CES Banifandou.

In the same way, a serial number was assigned to the Franco-Arab schools. A selection of 10% of the Francophone schools leads to the following schools: CES FA Banifandou, CES LFA (Franco-Arab League), CSP Daroul Khairia 2, CSP Djamiatou Salam, CSP Dawatoul Islam.

Third step: Selection of classes

All the classes and all the four levels of each of the selected schools were considered, which gave a total of 420 students from 139 classes.

Sample size

According to the class size lists, 10% of the students were selected, giving us a total sample of 420 students in 139 classes.

Inclusion criteria

Included in the study were all students who were regularly enrolled in the 2020-2021 school year and who agreed to complete the questionnaire and interview guide.

Exclusion criteria

Are excluded from the survey for the following reasons: undetermined date of birth.

Non-inclusion criteria

All students absent on the day of the survey are not included in the study.

Data collection technique and tools

Administration of a questionnaire to the students in the study; A structured interview using a self-administered questionnaire to all students selected for the second survey.

Data collection

Collection was conducted from April 1 to June 30, 2021. Surveys were given to students to complete.

Data processing and analysis

A manual count was conducted to ensure the number of questionnaires, but also the objectivity of the responses. Word 2010 software was used for text entry. Data recording and analysis were performed using Excel 2010, Stata 12 and Epi info 8. Then, uni and bi-variate analysis was done for further study of the data. The chi-square test will be used to serve and compare the variables; the confidence interval will be 95%, P worth 0.05 to have a significant test.

Results

We enrolled four hundred and twenty (420) students from sixteen (16) public and private schools, girls and boys, distributed in two (2) communal districts (commune I and commune III) of the urban community of Niamey. The survey took place from April 1st to June 30, 2021.

I.1 Socio-demographic aspects

I.1.1 Anthropometric characteristics

Table 1 shows the anthropometric characteristics of the students. The mean age of the students was 14.84 ± 2.22 years. The average weight was $47.69 \text{ kg} \pm 13.71 \text{ kg}$. The weight of the girls ranged from 20 kg to 121 kg; with an average of 49.66 ± 13.45 . The weight of the boys ranged from 22 kg to 129.4 kg with a mean of 46.01 ± 13.62 .

The average height is quite homogeneous between the two genders; it is $1.52 \text{ m} \pm 0.013 \text{ m}$. The smallest height (1.16 m) was measured in girls. The highest height (1.87 m) was measured in boys. The average BMI-for-age was $20.26 \text{ kg/m}^2 \pm 4.59 \text{ kg/m}^2$. However, the BMI was relatively higher in girls than in boys, 21.20 ± 5.35 vs. 19.46 ± 3.73 .

Table 2 also shows that the number of students with a normal BMI is identical between the two communes (about 32%). Similarly, the distribution of overweight ($p=0.31$) and obesity ($p=0.75$) in the two communes is not significantly different. However, Commune III had twice as many underweight students as Commune I ($p=0.018$).

The distribution of BMI by gender shows that about 37% of boys have a normal BMI compared to 27% of girls. The difference was highly significant ($p=0.004$). Most of the obese students were female (5.95%

vs. 2.86%). The difference is significant with $p=0.005$, an odds ratio of 0.37 and a confidence interval [0.18-0.76] suggesting the female gender is a risk factor for obesity. On the other hand, there was no significant difference in the distribution of overweight ($p=0.12$) and underweight ($p=0.4$) between the two sexes, even though underweight boys were relatively more numerous than girls, 10% vs. 7%.

We were also interested in the distribution of BMI among students in public schools compared to students in private schools. The results reported in Table 2 show that there is no significant difference ($p>0.05$) between students in the two school groups. However, the trends show that the prevalence of normal BMI is relatively higher (about 36%) in public schools than in private schools (28%). Similarly, underweight students are relatively more numerous in public schools (about 11%) than in private schools (6%).

According to class, students were grouped into two brackets, 6th-7th and 8th-9th. The prevalence of BMI that indicates normal weight status is 32.38% in 6th-7th graders and 26.67% in 8th-9th graders. Despite the apparent disparity, the difference is not significant ($p=0.28$), nor is the distribution of underweight ($p=0.89$), overweight ($p=0.21$), and obese ($p=0.76$).

The age of adolescents could affect their eating behaviour and influence their BMI. Of the 2/3 of students with a normal BMI, about 31% belong to the age group 11-<14 years and slightly more 33% to the age group at 14-17 years. The difference is significant ($p=0.004$). The distribution of underweight, overweight and obesity between the age group 11-<14 years and 14-17 years was 4.8 versus 11.9%, 3.6 vs. 6.9% and 3.8 vs. 5% respectively. Despite the strong trends observed in the 14-17 age groups, the differences were not significant.

Figure 1 compares the weight status of the subjects according to the WHO standards with the weight status defined according to the IOTF criteria. Subjects with a normal BMI according to WHO standards were 64%, increasing to approximately 77% with the IOTF criteria. The prevalence of underweight and obesity decreased by half, from 17% and 9% according to WHO standards to 9% and 4.5% with the IOTF criteria, respectively. On the other hand, the prevalence of overweight remains unchanged regardless of the reference used.

Table 3 shows the percentage distribution of BMI by parents' occupation. Among the 64% of students with a normal BMI, 24.5% were children of civil servants, 18.6% of shopkeepers, 16% of craftsmen and 4.5% of fatherless children. This distribution is significantly different ($p=0.048$).

Thus, children of civil servants were more likely to have a normal BMI, followed by children of shopkeepers and artisans. However, the father's profession was not predictive of underweight ($p=0.13$), overweight ($p=0.37$) or obesity ($p=0.98$). The distribution of BMI by mother's occupation was also not significantly different between students ($p>0.05$). However, underweight, overweight and obesity seemed to be more prevalent among children of housewives but the differences were not significant, $p=0.92$; 0.32 and 0.79 respectively.

Discussion

We recall that this is a cross-sectional study that involved students in 16 public and private secondary schools (CES) in the communal districts (I and III) of the Urban Community of Niamey. The objective was to determine the prevalence, the environmental and socioeconomic determinants of overweight and obesity as well as its causal relationships with the academic performance of the students.

Table 1: Anthropometric characteristics of the study population.

	Total (N=420)	Female (N=193)	Male (N=227)
Age (ans)	14,84 ± 2,22	14,79 ± 2,026	14,87 ± 2,39
Poids (kg)	47,69 ± 13,71	49,66 ± 13,45	46,01 ± 13,62
Taille (m)	1,52 ± 0,013	1,52 ± 0,091	1,52 ± 0,18
IMC (kg/m ²)	20,26 ± 4,59	21,20 ± 5,35	19,46 ± 3,73

Table 2: Distribution (percentage) of Body Mass Index (BMI) according to the parameters studied.

Parameters	Under Weight	OR [IC]	p	Normal Weight	OR [IC]	p	Overweight	OR [IC]	p	Obesity	OR [IC]	p
	18,5 ≤ IMC			18,5 > IMC ≤ 24,9			25,0 ≥ IMC ≤ 29,9			IMC > 30		
Total Commune	16,67 (70)			64,05 (269)			10,5 (44)			8,81 (37)		
Municipality I	5,48 (23)	0,54	0,018	32,38 (136)	1,73	0,007	4,05 (17)	0,72	0,31	3,81 (16)	0,89	0,75
Municipality III	11,19 (47)	[0,30-0,90]		31,67 (133)	[1,15-2,60]		6,45 (27)	[0,38-1,37]		5,00 (21)	[0,45-1,77]	
Sex												
Female	6,90 (29)	1,24	0,40	27,14 (114)	1,49	0,004	5,95 (25)	0,61	0,12	5,95 (25)	0,37	0,005
Male	9,77 (41)	[0,74-2,09]		36,91 (155)	[0,99-2,22]		4,52 (19)	[0,32-1,15]		2,86 (12)	[0,18-0,76]	
School												
Private	5,96 (25)	0,69	0,12	28,10 (118)	0,97	0,92	5,50 (23)	1,66	0,21	4,52 (19)	1,0	0,96
Public	10,71 (45)	[0,38-1,12]		35,95 (151)	[0,65-1,46]		5,00 (21)	[0,34-1,27]		4,29 (18)	[0,51-2,01]	
Classe												
6 th -7 th grade	9,29 (39)	0,96	0,89	37,38 (157)	1,24	0,28	5,00 (21)	0,67	0,21	4,76 (20)	0,90	0,76
8 th -9 th grade	7,38 (31)	[0,57-1,61]		26,67 (112)	[0,83-1,85]		5,50 (23)	[0,36-1,26]		4,05 (17)	[0,45-1,77]	
Tranche d'âge												
11- 13 ans	4,77 (20)	0,47	0,008	30,72 (129)	1,80	0,004	3,58 (15)	0,66	0,21	3,81 (16)	1,01	0,96
14- 17 ans	11,90 (50)	[0,27-0,83]		33,33 (140)	[1,19-2,73]		6,92 (29)	[0,34-1,27]		5,00 (21)	[0,51-2,01]	

The numbers in parentheses indicate the number of subjects.

Table 3: Presents the prevalence of overweight and obesity by parental occupation.

Variables	Underweight 18,5 ≤ IMC	Probability	Normal weight 18,5 > IMC ≤ 24,9	Probability	Overweight 25,0 ≥ IMC ≤ 29,9	Probability	Obesity IMC > 30	Probability
Total sample	16,7 (70)		64,0 (269)		10,47 (44)		8,80 (37)	
Father's occupation								
Craftsman	18,3 (20)	0,13	62,4 (68)	0,048	2,86 (12)	0,37	2,14 (9)	0,98
Shopkeeper	20,7 (28)		57,8 (78)		3,81 (16)		3,09 (13)	
Orphans	8,7 (2)		82,6 (19)		0 (0)		0,48 (2)	
Civil servant	11,8 (18)		69,9 (107)		3,57 (15)		3,09 (13)	
Mother's profession								
Craftswoman	20,7 (1)	0,92	62,5 (5)	0,30	0,23 (1)	0,32	0,23 (1)	0,79
Shopkeeper	20,6 (7)		67,6 (23)		0,71 (3)		0,48 (2)	
Orphans	16,7 (2)		50,0 (6)		0,47 (2)		0,48 (2)	
Civil servant	14,0 (13)		73,1 (68)		1,19 (5)		1,66 (7)	
Housewife	16,7 (70)		64,0 (269)		7,86 (33)		5,95 (25)	

The numbers in parentheses indicate the number of subjects.

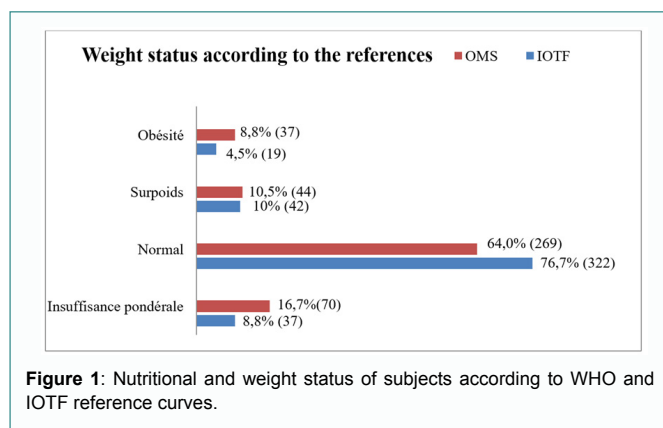


Figure 1: Nutritional and weight status of subjects according to WHO and IOTF reference curves.

Sociodemographic aspects

Niamey region remains the first region in terms of school coverage and access rates. In fact, 79.7% of schools are located in the urban area, which means that access and accessibility are easy. Niamey ensures almost equal access for girls and boys with a fairly well-developed private education system (one pupil in four is in private schools). The regional education system is in line with the national system, which is characterized by a pyramid structure with three levels of education: primary, secondary and higher education.

The study involved 420 students between the ages of 11 and 17, with a mean age of 14.84 ± 2.22 years. This mean value is close to those

previously reported in Niger 14.03 years with age extremes of 10 and 15 years [14]. In Togo, [15] found 14.36 years.

Of the 420 students enrolled, 54.04% were boys, with a sex ratio of 1.17. This is consistent with national data that show that boys are more enrolled than girls as the Gross Enrollment Rate for boys is 82.1% compared to 70.2% for girls, (according to DS/MEP/A/PLN/EC results, 2016). About the same proportions were found in Kenitra, Morocco 53.15% [16]. On the other hand [17], obtained in Lubumbashi, an opposite sex ratio of 0.86. This would be explained by the fact that the schooling rate of boys was higher than that of girls who are rather subject to domestic work and forced or early marriage and are forced to stay at home in our society. Our culture and religion have a great deal to do with this situation, as women are always taken care of by their husbands, fathers or third parties. A female predominance is evident in this study with regard to both excess weights with 67.56% for obesity and 56.81% for overweight. The result is significant with p=0.005, OR=0.37; CI=95% [0.18-0.76]; suggesting that female gender is a risk factor for obesity. The results from this study are in line with those found a female predominance of 59.4% [14].

The results are contrary to those found by [18,19] who respectively have shown a male predominance at 51%, 51.4%.

This study found in Commune III rates of obesity at 56.75% and overweight at 61.36%. While [14] in their study in the five communes of Niamey found in commune I rates of 25.5%.

Nutritional status

Malnutrition is a major public health problem in developing countries. Under nutrition alone is responsible for one-third of deaths worldwide [20]. The current trend is towards overweight and obesity. All this is the consequence of a poor diet characterized either by overfeeding or on the contrary by undernourishment. In the present, the nutritional status of students showed a prevalence of overweight of 10.50% and that of obesity 8.80%; 64% of students had a normal weight while 16.67% have thinness.

In Niger, in 2017, children under 5 years of age have an underweight rate of 34.6% [21]. The data is in line with those from WHO that considers that the weight/age ratio is not a reliable indicator of nutritional status for children beyond 10 years of age since those children could have already started their growth spurt which could make them overweight for simply getting taller.

The rate of underweight was low compared to the 43.1% found in Rabat in Morocco [22] and higher than that of 7% of students in Cotonou [23], as well as those of Lahore, 7% [24] and Tananarive (Madagascar), 5.5% [25] and finally close to the rate of Marrakech, 10% [26].

Regarding overweight, the results found in this study are also significantly higher than those found in the literature. Thus, in Côte d'Ivoire, [27]; in Marrakech, Morocco, [17]; in Ouagadougou in (Burkina Faso), [28]; and finally, in Sfax (Tunisia), [19] reported 5%, 8%, 5.3%, and 6.3% for overweight and 4%, 3%, 2.3%, and 2.4% for obese, respectively. However, Faye and all in his 2010, 2011 study in Senegal reported an obesity rate of 9.34% in Senegal. Some authors have also reported cumulative rates of obesity and overweight similar to our observations notably in Tamale, Ghana, 17.3% [29] and in Rabat, Morocco 18.3% [30]. On the other hand, other authors report higher cumulative prevalence's of overweight/obesity up to 23.2% in Lagos, Nigeria [31].

Favoring factors

In our study, an association was noted between age and the nutritional status of the students, and overweight (obesity/overweight) is more important in the 14-17 years age group, with 5% and 6.92% respectively. This could be explained by the fact that adolescence is characterized by an acceleration of growth that is about two years earlier in girls (9-13 years) than in boys (11-15 years). Fat mass increases physiologically in young girls from the pre-pubertal period, which makes this period a critical phase with regard to the risk of obesity [32]. However, this is not the case in boys because the changes in body composition are mainly related to lean body mass and bone mass which increase considerably. It has been well documented that the risk of obesity is increased in girls and boys who mature sexually earlier [33].

In a similar study done in Dakar, Senegal, Faye and all, 2010 reported that overweight is higher among 11 year old students. This is comparable to the study done in Togo, [15] where the majority of overweight/obese students are between 15 and 16 years old.

The socioeconomic level of the parents as well as their level of education has a significant impact on the nutritional status of the students. Among the obese students, 35.13% have fathers who are civil servants and traders, and 67.56% have mothers who are housewives.

These results confirm those of [34] in Dakar obtained from a study in which 87.2% of obese subjects came from families with a

high socioeconomic level. They also corroborate the assertion of some authors in China [35,36] that a high socioeconomic level is a risk factor for obesity in poor or developing countries. Marrakech stated that the educational level of both the father and the mother influenced the nutritional status of children [37].

Social and economic factors, parental education and occupation influenced the nutritional status of children. The higher the level of education, the more likely children were to be undernourished, overweight and obese. The same was true for occupation, with children from households with parents in the private sector being more obese and those with parents in the public sector and traders being more prone to overweight. This has been demonstrated in Northwest Morocco [20] and in California except in the United States overweight is mostly found among the poor [38].

A positive correlation was found between the type of school students attended and their nutritional status. Students in private schools had a higher risk of being obese than those in public schools (51.4%). This finding is similar to the one made by which shows that there are significantly ($p < 0.05$) more obese students in private schools than in so-called public schools [39].

The social economic factors, education level and parental occupation influenced the nutritional status of children.

In the present study, the highest frequency of obesity was observed among students of civil servant and merchant fathers with 8.9 and 9.6% respectively, while overweight was common among students of merchant fathers (11.9%). The higher the education level, the more the students were at risk of malnutrition. The same was true for occupation, with students from households with parents in the private sector being more obese and those with parents in the public sector and traders being more subject to overweight. This has been demonstrated in Northwest Morocco [20] and California [38] except in the United States overweight is mostly found among the poor.

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