

# Prevalence and risk factors of overweight and obesity among schoolchildren and adolescents in Algiers

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## Abstract.

**BACKGROUND:** Adolescence is a period characterized by important psychological and physical appearance changes.

**OBJECTIVE:** The aim of our study is the assessment of the frequency of different nutritional status grades of Algerian schoolchildren and adolescents.

**METHODS:** We conducted a survey among 2 278 schoolchildren and adolescents of 8–18 years-old in the period 2013–2014. For each child the height and weight were measured and body mass index (BMI) was calculated. The prevalence of, overweight and obesity was assessed using the World Health Organization (WHO-2007) and the International Obesity Task Force (IOTF) criteria. Pearson's chi-square test was used to assess significant differences in prevalence. All analyses were completed using the SPSS statistical package, version 20.

**RESULTS:** The prevalence of overweight and obesity were respectively 28.8% (95% CI, 26–31.6); 10.5% (95% CI, 8.6–12.4) for the boys and 25.5% (95% CI, 23–28); 5.8% (95% CI, 4.4–7.1) for the girls. Sex as a risk factor for obesity in Algerian schoolchildren and adolescents; the odds ratio of obesity was 2.50 times (95% CI, 1.40–3.20;  $P < 0.017$ ) higher in boys compared to girls.

**CONCLUSION:** The results revealed the high prevalence of obesity and overweight. The absence of a national database on the nutritional status of children and adolescent needs the establishment of a monitoring program of their nutritional status to avoid any complications in the adult age.

Keywords: Overweight, obesity, adolescents, Algiers

## 1. Introduction

For a long time people related their health status to the quality and quantity of food they consumed. They tried to establish a balance between the different kinds of food in order to eat healthy.

For this reason each population built its own food culture based on the available alimentation in their countries, but because of the technologic evolution in different areas, especially food processing and media, countries changed their alimentations habits.

In Arabic countries, nutrition and epidemiological changes during the last decades affected the socio-psychological status of people. The confusion of the young person between conserving their alimentation customs

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or following the new western models was described [1]. And this is more evident in Arabic countries considering the fact that about 54% of the people are under 25 years old [2].

The assessment of the nutritional status of adolescents and young people is very difficult. Recently the phenomena of overweight and obesity in children and adolescents have been dramatic [3, 4]. About a third of children are overweight [5].

Generally high nutritional value food is not the preference of adolescent, who are attracted by an unhealthy lifestyles, because of psychological and physiological transition in this age [6–9]. This nutritional transition is observed in developing countries by the increasing of overweight and obesity [10]. Moreover, this transition increased the risk for adolescent for many health problems (diabetes, cardiovascular risk factors and some cancers) in comparison to the previous generations [7, 11–13].

The World Health Organization is warning about the risk of development of non-communicable diseases in the countries with high levels of obesity (which represent 50% of the total causes of death in some Eastern Mediterranean countries) [14, 15].

Some studies revealed the alarming situation of obesity and overweight prevalence among Arabic adolescent (18% to 44%) [16]. In Algeria, only few articles investigated the prevalence of obesity and overweight of adolescents in the capital Algiers (24.8%, and 8.6% respectively) [17]. The aim of this research is the assessment of the prevalence of overweight and obesity among adolescents, according to the criteria of WHO and IOTF, in greater Algiers (east, center, west).

## **2. Materials and methods**

### *2.1. Study area*

Algeria is a Mediterranean North African country, situated between Morocco and Tunisia. It is one of the power economies in Africa and it is a major producer and exporter of oil and natural gas.

### *2.2. Design and sampling*

We conducted a cross-sectional, observational study in a healthy population-based probability sample in which the study population was composed of adolescents of both sexes aged from 8 to 18 years old. Data collection was carried out between January and June 2013 and 2014. A 3-stage selection procedure was used to obtain a representative sample of students in Algerian middle public school. A total of 2690 school children were eligible for this study with a final number of 2278 subjects.

### *2.3. Anthropometric measurements*

All anthropometric measurements were performed by trained personnel according to the standard procedures:

Weight: One suitable weight balance measuring to nearest 100 g was used. Pupils were weighed while wearing light clothes. Participants were asked to remove their shoes, and heavy clothes.

Height: Suitable metallic meter scale measuring to the nearest millimeter, fixed on the scale was used.

BMI: the body mass index was calculated according to the following formula [18]:  $BMI = \text{weight (kg)} / \text{height (m)}^2$ .

To assess the nutritional status, the BMI/age index was used to diagnose excess weight. The WHO 2007 and IOTF criteria were used as reference [19, 20].

### *2.4. Socioeconomic status*

Data on adolescents' socioeconomic status (SES) according to their father and mother occupation were collected using a classroom-administered survey, and parents completed a survey at home. Three categories of

occupation were retained as defined by the National Algerian Institute of Statistics: (1 = lower, 2 = middle and 3 = high).

### 2.5. *Data processing and analysis*

Data analysis included the following variables: weight, age, gender, and socio-demographic characteristics. Age was calculated in months and was obtained by the difference between the date of data collection and date of birth. For the analysis, children and adolescents were categorized into five age groups: 8–10, 11–12, 13–14, 15–16, and 17–18 years old.

In this study, we used the 2 criteria and populations references that are most widely adopted by the international community (WHO and IOTF). The classification of children and adolescents, according to BMI/age, was also expressed as z-score, by adopting the following cutoffs for the categorization of the results: adequate weight, z-scores  $>-2$  to  $<1$ ; overweight, z-scores  $>+1$ ; and obesity, with z-scores  $>+2$ .

AnthroPlus-2007 software (WHO AnthroPlus for personal computers: software for assessing growth of world's children and adolescents. Geneva, Switzerland) was used in the assessment of nutritional status.

The IOTF cut-off values represent cut-offs of a Body Mass Index of 25 and 30 at the age of 18 year for overweight and obesity respectively. The participants were grouped into two categories: overweight ( $C \geq 25$ ) and obese ( $C \geq 30$  which included overweight and obese students).

For the risk factor analysis, an initial exploratory analysis of the data (univariate) was conducted for the selection of variables with  $P \leq 0.2$  by the chi-square test or Fisher's exact test; subsequently, the variables that passed this cut-off were used for logistic regression [21]. The fit of the final model was verified with the Hosmer and Lemeshow test, and co-linearity between independent variables was verified by a correlation analysis. The calculations were performed using Statistical Package for the Social Sciences (SPSS) software Version 20.0 (SPSS Inc., Chicago, IL, USA). The variables were considered as risk factors when the odds ratio is greater than 1 and the  $P$  value is less or equal to 0,05.

Confidence Interval (CI) at 95% =  $P \pm Pa$ , where  $P$  is the obtained Prevalence and  $Pa$  is the Absolute Precision was calculated using the following formula:  $Pa = 1, 96 * [21]$ . Confidence Interval (CI) at 95% =  $P \pm Pa$ , where  $P$  is the obtained Prevalence and  $Pa$  is the Absolute Precision was calculated using the following formula:  $Pa = 1, 96 * [21]$ .

## 3. Results

### 3.1. *Characteristics of the sample*

The response rate was 84.68%, a total of 2278 children and adolescents were evaluated from 2690 eligible participants; 62 (2.3%) were absent on the day of the medical visit. We excluded 104 children and adolescent who did not complete data survey, and 246 (9.14%) did not participate because their parents did not agree to participate to the survey. There was no significant difference between the participants and the one who refuse.

They were 1228 girls (53.90%) and 1050 boys (46.09%). The mean age was  $12.58 \pm 1.59$  years. The average weight was  $46.63 \pm 11.81$  (range 20 to 110 kg), and the average height was  $1.68 \pm 0.37$  m (range 1.00 to 1.90 m). Table 1 contains the characteristics of the population.

### 3.2. *Prevalence study*

The classification of the nutritional status of children and adolescents according to their age, gender, and socioeconomic status by BMI/age index is presented in Table 2.

Table 1  
Socio-demographic characteristics of schoolchildren and adolescents in Algiers, Algeria ( $n = 2\ 278$ )

Characteristics		%
No. persons/household	2	1.7
	3	7.5
	4	23
	5	30.6
	6	19.8
	$\geq 7$	17.4
Parental educational level	Mother's education	
	Primary or less	68
	Secondary	15.3
Father's education	University or more	15.8
	Primary or less	39.7
	Secondary	38.3
Employment Status	University or more	22
	Father employed	86.1
	Mother employed	27.9
Family SES	Low	35.6
	Mid	38
	High	26.4

Table 2  
Prevalence of overweight and obesity according to the World Health Organization (WHO) and International Obesity Task Force (IOTF), Algiers, Algeria

Variables	WHO			IOTF		
	Overweight, % (no.)	Obesity, % (no.)	<i>P</i>	Overweight, % (no.)	Obesity, % (no.)	<i>P</i>
Total	27 (615)	8 (182)	0.013	6.9 (160)	2.1 (48)	0.075
<i>Age (no.)</i>						
8–10 (128)	38.7 (50)	20.2 (26)	<0.001	13.26 (13)	2.04 (2)	<0.001
11–12 (1058)	62.8 (664)	13.9 (147)		6.78 (59)	2.53 (22)	
13–14 (845)	45.3 (383)	12.2 (103)		9.33 (63)	2.81 (19)	
15–16 (209)	37.3 (78)	5.6 (12)		14.28 (24)	2.97 (5)	
17–18 (38)	3.4 (2)	0 (0)		2.63 (1)	0 (0)	
<i>Sex (no.)</i>						
Boys (1050)	28.8 (302)	10.6 (111)	0.310	10.2 (86)	2.25 (19)	0.537
Girls (1228)	25.4 (312)	5.9 (72)		7.36 (74)	2.88 (29)	
<i>Socio-economic status (no.)</i>						
Lower (810)	7.23 (59)	19.24 (157)	0.021	9.37 (62)	3.02 (20)	0.039
Middle (866)	9.51 (83)	17.66 (154)		8.84 (63)	2.66 (19)	
High (602)	7.27 (44)	20.49 (124)		7.36 (35)	1.89 (9)	

Table 3

Risk factor (logistic regression final model) associated with overweight and obesity among Algerian schoolchildren and adolescents according to the World Health Organization (*WHO*) and the International Obesity Task Force (*IOTF*)

Risk factor	<i>WHO</i>			<i>IOTF</i>		
	Odds ratio	95% CI	<i>P</i>	Odds ratio	95% CI	<i>P</i>
Overweight (total)	3.11	1.02–5.20	0.017	3.31	1.20–5.41	0.015
<i>Obesity</i>						
Age (8–10)	1.66	0.45–2.87	0.039	<i>No risk factors found</i>		
Boys	2.50	1.40–3.20	0.017			
<i>Overweight</i>						
Age (11–12)	1.95	0.78–3.12	0.032	<i>No risk factors found</i>		
Hosmer and Lemeshow test: Chi-square = 4.176; df = 8; <i>P</i> = 0.027						

Table 2 contains estimates prevalence of overweight and obesity of Algerian children and adolescents of both sexes according to the WHO and IOTF standards.

When the WHO criteria were applied, the prevalence of overweight and obesity was very similar to that found using the IOTF criteria, although the percentages were systematically higher than those provided by the IOTF. However, when the IOTF criteria were applied in socioeconomic status, the data pattern was inverted and the prevalence of overweight tended to be similar to or even higher than those of the WHO standards.

When the WHO criteria were used, the prevalence of overweight was 27% (95% CI, 25.1–28.8) for the Algerian population aged from 8 to 18 years old; the prevalence of obesity was 8% (95% CI, 6.9–9.2). A higher prevalence of obesity was found in the group aged from 8 to 10 years old than in those other groups 20.2% (95% CI, 12.7–27.6). Overweight was common in the second group (11–12 years old) 62.8% (95% CI, 54.7–70.8).

By sex, 28.8% of childhood and adolescent boys were overweight and 10.6% were obese compared with 25.4% and 5.9% of childhood and adolescent girls, respectively. Statistic significant differences were observed between overweight and obesity according to the sex.

The socio-economic status was not statistically associated with the prevalence of obesity or overweight. In particular, the highest percentage of child obesity was seen in the higher and lower social classes with WHO standards. However, the prevalence of overweight was higher in the lower social classes when IOTF standards were applied.

### 3.3. Risk factors study

Cross sectional studies helps to evaluate both the presence and the risk factors associated with the variables at the same time. Therefore, cross sectional studies take a snapshot of the situation at a specific moment [21]. The use of cross sectional study as a tool for the evaluation of risk factors is adequate mainly for constant factors. However, in this study all the investigated factors were constant.

In this present study, the risk factor analysis using multivariable logistic regression shows (Tables 2 and 3) that the risk of overweight among Algerian schoolchildren and adolescents is 3.11 (according to the WHO standards) and 3.31 (according to the IOTF standards) times higher than obesity.

The risk factor analysis using the univariate analysis (Table 2) followed by multivariable logistic regression (Table 3) confirms that age and sex are risk factors for overweight and obesity among Algerian schoolchildren and adolescents according to the WHO. However, the use of the IOTF doesn't reveal any risk factors.

## 4. Discussion

### 4.1. Prevalence study

The problem of obesity and overweight among adolescents took more attention [22]. Low prevalence of obesity among adolescents in seven Arab countries was shown [23]. Epidemiologically, the prevalence of overweight and obesity was 18% and 6.6% respectively in three northwest African countries (Morocco, Algeria, and Tunisia) [24].

Other studies in Arabic countries focused on disordered eating attitudes of adolescent girls [25–27] and university girls [28, 29] only, because of the highest eating disorders of the female gender [30–32]. The prevalence differences between countries should be due to several factors such as the cultural background, family environment, parents' education, exposure to Western media, ethnicity, lifestyle habits and socio-economic status [23, 33].

These explanations need further investigation. However, during this age, adolescents become more influenced by their environment, especially girls, which may lead to a negative body image [34, 35].

Some researchers reported that childhood overweight and obesity have pronounced impact on physical and psychological health; they are associated with hyperlipidemia, hypertension, abnormal glucose tolerance, infertility and depression [36].

### 4.2. Risk factor study

In the present study, the risk factor analysis showed that Algerian schoolchildren and adolescents are 3 times more likely to be overweight than obese.

Our result showed that the risk for overweight is 1.95 times (95% CI, 0.78–3.12;  $P < 0.032$ ) higher in 11–12 years old age group of schoolchildren compared to other age categories. Meanwhile, our data suggested that the risk for obesity in Algerian schoolchildren and adolescents is 1.66 times (95% CI, 0.45–2.87;  $P < 0.039$ ) higher in 8–10 years old age group of schoolchildren compared to other age categories.

Our findings also identified sex as a risk factor for obesity in Algerian schoolchildren and adolescents (Table 3); the odds ratio of obesity was 2.50 times (95% CI, 1.40–3.20;  $P < 0.017$ ) higher in boys compared to girls.

Surprisingly, the risk factor analysis using the multivariable logistic regression (Table 3) doesn't confirm the socioeconomic status as risk factors for overweight and obesity. However, the univariate analysis shows significant differences between the three socioeconomic categories.

### 4.3. Strengths and limitations

In our study we don't take under consideration the private schools, which contain generally more students from high socio-economic classes than the public ones, because of difficulties of obtaining permission from some of these schools.

The strength of the current research is that it included adolescent boys and girls, as most studies in developing countries. Another strength of this study is its provision of a large population of schoolchildren and adolescents (2 278), also this study contributes to the evaluation of the nutritional status in the capital of Algeria.

According to the results of our study we have identified a need for monitoring and health intervention related to overweight and obesity in middle schools in Algiers. Earlier identification of overweight and obesity could help person treatment at a younger age and improve their psychological status. Training of the school health workers about eating disorders is very important to prevent and control these disorders.

School health programs may contain plans to combat overweight. Further researches on the several factors affecting the obesity and overweight in Arabic countries should be given more attention. We hope that this study will provide more data for those interested in nutritional status among schoolchildren adolescents in Algeria and the Arabic countries.

## 5. Conclusion

To our knowledge this is the first risk factor study of overweight and obesity among the Algerian population. The phenomenon described in our study gives a clear explanation of the strong link between sex and age. The prevalence of obesity in the Algerian population is slightly higher among boys than girls, and is higher for the age range of 11 to 12 years old. The study used two criteria (WHO and IOTF) to assess nutritional status problems. Finally, given the multiple factors involved in childhood status, we recommend to promote nutrition education in schools, promoting programs to prevent under nutrition include: nutrition interventions at the national level in Algeria.

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## Conflict of interests

There was no conflict of interests with respect to all authors.

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