

representative sample of the population aged 18 years and more.

The sample was made taking into account the geographical division of the municipality into 10 distinct areas by population density. Depending on the size of each sector, it has been calculated a number of districts to the sample. In each sector 1 to 3 districts were drawn respecting the quota for each area that is to say a total of 30 districts have been identified and defined geographically. Twenty households in each district have been drawn. Two people in each household aged 18 and over were interviewed. A total of 1200 people aged 18 years and more were surveyed.

Data were collected by a trained personal meeting at the home of the respondents, by weighing and measurement. Individuals were interviewed using a questionnaire with questions about sociodemographic information, physical inactivity and dietary habits. At the end of the survey the various items of the questionnaire were reviewed to check the quality of data collection and coding with coding parts. Information on the level of education was recoded as "illiterate, primary" vs. other "middle, secondary or higher." Professional activity was also assessed and recoded as "active" vs. "inactive" (retired, unemployed, housewives). Regarding eating habits, subjects were asked about their eating habits (they skip breakfast, lunch and/or dinner). Subjects were considered ≥ 3 if they had eaten the three main meals every day. The sedentary lifestyle was evaluated by the time spent watching television or surfing the Internet every day.

Weight was measured using electronic bathroom scales (Terraillon, France) with an accuracy of 100 g. Height was measured in standing position without shoes using fathom down (Seca, Germany) mounted on a wooden stand. Reading the measurement was performed at millimeters. The measurement of waist circumference was performed using non-stretchable tape-meter graduated in millimeters. The waist circumference was measured in a standing position on the horizontal plane corresponding to the thinnest part of the torso, between the last rib and the iliac crest. The accuracy of anthropometric equipment was regularly checked. The anthropometric assessment is assessed by waist circumference (WC), the waist circumference/hip circumference ratio (WHR) (is the waist circumference in centimeters divided by hip circumference in centimeters), the waist circumference/size ratio (WC/H corresponds to the waist circumference in centimeters divided by height (size) in centimeters) and calculate the body mass index (BMI) kg/m^2 (weight/height²). Waist circumference, waist circumference/hip circumference ratio and waist circumference/size ratio are more closely associated with morbidity and mortality related to cardiovascular disease (CVD) than is BMI [19], BMI assesses patient's weight and the degree of obesity. The prevalence of overweight and obesity of different types were measured according to the WHO criteria [11].

- Underweight: BMI below $18,5 \text{ kg/m}^2$
- Wide range normal: BMI between $18,5 \text{ kg/m}^2$ $24,9 \text{ Kg/m}^2$
- Overweight: BMI between 25 kg/m^2 $29,9 \text{ Kg/m}^2$
- Obesity (obesity class I and II) BMI between 30 kg/m^2 $39,9 \text{ Kg/m}^2$

- Obesity disease (class III): BMI greater than or equal to 40 kg/m^2

Data analysis was carried out using the following software: SPSS 18 and Microsoft Excel 2007. Descriptive analyzes were presented as means for continuous variables and percentages for qualitative variables. The level of significance p read the Student table can set the level of significance ($P < 0,05$, very significant).

Associations between overweight/obesity and qualitative variables were studied by univariate analysis using the Chi2 test of independence of Pearson comparing percentages and analysis of variance for comparison of means (ANOVA). Associations between overweight, obesity, and other variables and explanatory factors were estimated by odds ratio of prevalence.

A multivariate binary logistic regression was then performed to determine the relationship between each variable and overweight or obesity, independently of other variables. The variables used in the model are the variables associated with overweight and obesity ($\text{BMI} \geq 25$) with $p < 0,2$ in univariate analysis. For an individual to be taken into account in the multivariate analysis, it must have filled the information about all the variables involved in the model construction.

3. Results

From the 600 households initially selected, a total of 1200 subjects would be recruited in this study, but 57 (4,7%) individuals refused to participate or were absent on the day of the survey of which 92,9% were male. In the end the final sample consisted of about 1143 (response rate: 95,2%), with a sex ratio M/F of 0,70. The average age was 41,3 with a range from 18 to 95 years. The average age of male respondents was 38,3 years and for women 43,5 years, Table I summarizes the main anthropometric variables.

Table 1: Summary of main anthropometric variables

	Total	Men	Women	p
average weight (Kg)	73,7	74,9	72,9	0,04
average size (cm)	164,6	170,7	160,2	$<10^{-3}$
average Waist (TT) (cm)	93,93,1	94,2	$<10^{-3}$	
average Hip (TH) (cm)	100,9	97,8	103,1	$<10^{-3}$
average WHR(ratio TT/TH)	0,9	0,95	0,9	$<10^{-3}$
average RTG (ratio TT/T)	0,6	0,5	0,6	$<10^{-3}$
average BMI (Kg/m^2)	27,2	25,6	28,4	$<10^{-3}$
TT ≥ 94 ♂ and ♀ TT ≥ 80 (%)	68,1	46,4	83,4	$<10^{-3}$
TT ≥ 102 ♂ and ♀ TT ≥ 88 (%)	51,9	27,1	69,4	$<10^{-3}$
WHR ≥ 1 ♂ and ♀ WHR $\geq 0,85$ (%)	62,1	28,1	87,6	$<10^{-3}$
RTG $\geq 0,5$ for both sexes (%)	76,6	69,5	81,7	0,001

13,4% of the study population were illiterate, the percentage is higher among women. Thirty one point nine percent (31,9%) of the population was active, the majority of which is represented by men. The unemployed and housewives 45,5% and students accounted for 14,3% of the study subjects (Table II).

The mean BMI was $27,2 \text{ Kg/m}^2$, it is significantly higher among women than men ($28,4$ vs $25,6$ $p < 10^{-3}$). It increases with age (Significant Difference (SD) $p < 10^{-3}$), the highest value was found in the 45-54 age group ($29,2 \text{ kg/m}^2$). The

frequency of each class of BMI is 4,0% for underweight, 32,5% normal range, 32,5% overweight, 27,6% for obesity (common and severe) and 3,3%for morbid obesity (Fig 1).The frequency of thinness and the normal range is higher among men. Being overweight is the same in both sexes (32,2% men vs. 32,5% women OR=1,0[0,7-1,2] p=0,5), obesity is more frequent among women (38,3% women vs. 20,8% men OR=2,4[1,8-3,1]p<10⁻³). The prevalence of different classes of obesity was significantly higher among women (p<10⁻³): common obesity 23,9% vs. 15,1%, severe obesity 9,8% vs 3,6% and morbid obesity 4,5% vs 1,7%. The prevalence of abdominal obesity according to IDF classification is higher among women than men: 83,5% vs 46,4% OR=2,1[1,6-2,5]p<10⁻³.

Overall, the prevalence of overweight increased significantly (p= 0,01) with age, and marital status (38,1% married vs 23,6% unmarried OR=1,6[1,3-1,9]p<10⁻³). There was no significant difference in overweight according to the level of education (P=0,7) and professional activity either before (OR=1,2[0,9-1,6] active vs. inactive p=0,1) or after adjustment.

Table 2: Socio-economic and lifestyle characteristic of adults

Variables	Men	Women%p	Variables	Men	Women%p
Level of education	4,4	19,7	0,01	marital status	50,6	67,8	0,4
illiterate	14,0	14,3	0,4	married	49,4	32,2	0,3
primary	24,8	19,7	<10 ⁻³	unmarried	8,5	7,4	0,5
middle	31,8	22,8	0,03	Television screen (min/day)	24,4	15,8	0,08
secondary	25,0	23,5	0,2	≤60	67,2	76,7	0,5
higher	42,8	21,4	<10 ⁻³	60-120min	85,2	81,1	0,5
active	15,0	3,7	0,001	>120h	14,8	18,9	0,5
retired	17,4	65,1	<10 ⁻³	Number of meals	≥3	≥3	
Unemployed	20,76	9,6	0,001	<3	<3	<3	
Housewife							
Students							

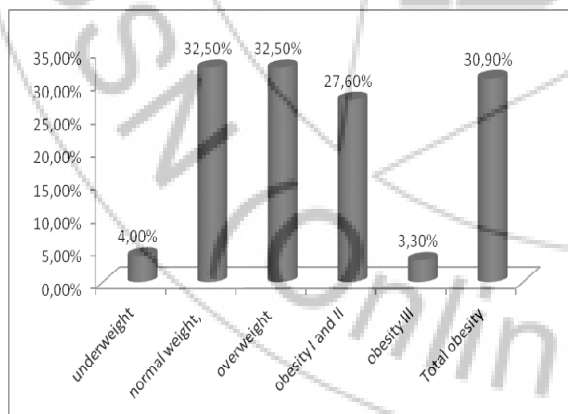


Figure 1: weight status of individuals aged 18 and over

The overall prevalence of obesity was 30,9%. It increased significantly (p<10⁻³) with age and fall in the bracket 65 and over. Total Obesity is significantly different by marital status (37,7% married vs 20,7% unmarried OR=1,8[1,5-2,2] p<10⁻³) and the level of education (49% among illiterate p<10⁻³). The prevalence of obesity was higher by the professional activity (37,1% non active vs. 23,8% active, OR=1,9[1,5-2,4] p<10⁻³), particularly among women (43,9% non active vs. 25,5% active OR=2,3[1,6-3,3], p<10⁻³), but not for men (16,8% non active vs. 22,7% active OR=0,7[0,4-1,1] p=0,1). The person was asked about the lifestyle in particular the time spent watching television and the number of meals per day. Thus, the time spent watching television (screen) is ≤60 minutes for 7,8% of the respondents (8,5% men vs. 7,4% women) between 60min-120min for 19,3% and >120 minutes for 72,8% of them. Sedentary behavior was widespread and significantly more frequent among women, 67,2% men and 76,7% women spend more than 120 minutes of their time sitting (P=0,001). The prevalence of obesity increases with the length of time spent watching television, 10,7% when the duration is ≤60 minutes, 21,7% when the duration is between 60 and 120 minutes and 36,4% when the duration is >120 minutes (p<10⁻³). 82,8% of people eat three meals a day and only 17,2% consume less than 3 meals per day (Tab II). The overall prevalence of obesity was not significantly different depending on the number of meals consumed daily. 27,4% when the number of meals consumed is less than three, 31,8% when the number of meals is greater than or equal to 3: OR=1,1[0,9-1,7] p=0,2.

The results of the logistic regression analysis show that after adjustment for socioeconomic variables and lifestyle, the prevalence of overweight and obesity is higher among women in the older age group than among the younger age group. Rates of overweight and obesity were 2,3 times and 1,6 times higher among married women. Similarly, compared to the reference category, the significantly higher rates of obesity were observed among housewives (OR=1,6) and those who have a primary level of education (OR=1,6). Among the studied lifestyle, physical inactivity is retained as a variable significantly associated with obesity among women (adjusted OR=2,6) (Tab III).

Table 3: Association between BMI and socioeconomic factors and lifestyle (sedentary and number of meals) among adults aged 18 years and over

	Women		Men		Total	
	Overweight OR IC95% P	Obesity OR IC95% P	Overweight OR IC95% P	Obesity OR IC95% P	Overweight OR IC95% P	Obesity OR IC95% P
Sex						
Men					1	1
Women					0,9[0,7-1,5]0,2	1,6[1,1-2,3] 0,01
Age	1,1[1,0-1,3] 0,02	1,2[1,1-1,3] 0,04	1,1[1,0-1,3] 0,03	1,1[1,0-1,3] 0,03	1,1[1,0-1,3]0,01	1,1[1-1,2] 0,04
Marital status						
unmarried	1	1	1	1	1	1
married	2,3[1,5-3,5]<10 ⁻³	1,6[1,2-2,4]0,02	1,7[1,1-2,7] 0,02	1,6[1,1-2,7] 0,01	2,0[1,5-2,7]<10 ⁻³	1,7[1,2-2,3]0,002
Level instruction						
other	1	1	1	1	1	1
illiterate	1,0[0,5-1,7] 0,9	1,0[0,6-1,8] 0,9	0,6[0,2-2,0] 0,4	1,7[0,6-5,3] 0,3	1,0[0,7-1,6] 0,8	1,2[0,7-2,0] 0,5
primary	0,8[0,5-1,4] 0,5	1,6 [1,1-2,6] 0,04	0,5[0,2-1,6] 0,2	3,3[1,9-9,3] 0,02	0,8 [0,6-1,3] 0,3	2,0[1,3-3,1]0,001
Professional activity						
Active	1	1	1	1	1	1
Non active	1,1[0,7-1,6] 0,8	1,6[1,1-2,6] 0,02	1,2[0,8-2,0] 0,3	0,5[0,7-1,7] 0,06	1,1 [0,6-1,7] 0,8	1,0[0,6-1,8] 0,9
Sedentarity						
Non-sedentary	1	1	1	1	1	1
Sedentary	1,2[0,8-1,7] 0,5	2,6[1,6-3,8] <10 ⁻³	1,3 [0,8-2,0] 0,3	2,9 [1,6-5,2]0,001	1,1 [0,9-1,7] 0,1	2,6[1,8-3,7]<10 ⁻³
Numberof meals						
<3	1	1	1	1	1	1
≥ 3	1,1[1,5-2,8] 0,7	0,9[0,6-1,5] 0,7	0,8[0,4-1,3] 0,3	1,1[0,5-2,2] 0,8	1,2[0,8-1,8] 0,3	0,9[0,6-1,3] 0,7

Rates of overweight and obesity were higher among older men age group than those in the younger age group. Overweight is 1,7 times higher in the group of married men. Among men, it was observed that obesity rates varied considerably and were similar to those of women, but only for marital status (OR=1,6), the primary level of education (OR=3,3) and physical inactivity (OR=2,9) (Tab III). For both sexes combined, the rate ratios were significant for age, sex, marital status, level of education and physical inactivity are predictors of varying degrees of obesity observed in adults (Table III).

4. Discussion

This study aims to determine the prevalence and factors associated with overweight and obesity among adults in Constantine. The results of the overall prevalence of overweight and obesity among adults are alarming. Most European countries are also faced with a high prevalence of overweight and obesity, respectively, ranging from 30 to 45% and from 10 to 25%. Greece, Finland and the United Kingdom are particularly affected. France, the Netherlands and Italy have lower prevalence [8]. The present study showed that the prevalence of obesity in Constantine is high compared to the European average (10 to 25%) and to the Maghreb countries. Morocco, 13,3% of the population is obese and 29,9% are overweight. [13] Tunisia obesity affects 15% of the population and 40% live with excess weight [6]. However, these data are difficult to compare because of the heterogeneity of references and their possible evolution. In France, the most recent data of 2009 estimated the prevalence of obese French is 14,1% +/- 0,4% (31,9% are overweight) [5].

The data from this survey are consistent with local reports of the high prevalence of overweight and obesity in Turkey

(36,0% overweight and 30,4% obese) [10]. In Greece 35,2% of adults are overweight and 22,5% obese. [9] In China, the prevalence of obesity was 29,9% [17]. In 2007-2009, the prevalence of obesity in Canada was 24,1%, that is to say, more than 10 percentage points lower than in the United States (34,4%) [12]. Obesity among adults in Constantine remains lower than that recorded in some countries in the Middle East. Kuwait reported a very high prevalence of 71,2% with 37,2% obesity grade 2 and grade 1 31,4% [1].

With reference to the national survey TAHINA [15], underweight among adults of 35-70 years decreased from 5,1% (TAHINA 2005) to 1,7%. During the same period, overweight has increased significantly from 55,9% to 75,7%. Overweight increased from 34,7% to 37,8% and obesity increased from 21,2% to 38% (men 25,6% to 9,1% and 30,1% at 44,5% for women). A similar trend was observed in the developing countries that have undergone rapid socio-economic transition.

The results of the univariate analysis showed that there are two factors that appear to be strongly associated with overweight and obesity and should be considered in the context of a collective preventive approach. The first factor is the rapid and linear increase of the prevalence of overweight and obesity with age and sex. In this study, the prevalence of obesity is always higher among women as compared to men. This association with sex was reported for other countries. In Morocco, 22% of women are affected and 8% of men. [4] In France, the prevalence of obesity is generally higher among women (15,1%, p<0,01) than men (13,9%) [5]. It is highest among those aged 25-34 (19,5%) [5]. For Canadian males, the prevalence of obesity was 8 percentage points lower compared to the United States (24,3% vs. 32,6%) and among Canadian women over 12 percentage points lower (23,9% vs. 36,2%) [12]. A highly significant elevation of BMI values recorded proportionally

with age demonstrates its role in the biological predisposition to weight gain. Women of Constantine aged 45 to 54 and 55 to 64 years are most affected by obesity respectively with a prevalence of 49,5% and 49,5%. This significant association between age and obesity among women illustrates the concept of biological predisposition of women to obesity demonstrated by several studies [2]. This can be partly explained by parity and menopause [2]. The decrease in the prevalence of obesity among young women versus older women may also reflect a change in the perception of obesity was traditionally considered as a sign of beauty and prosperity among women as a symbol of underdevelopment especially among young women with higher level of education.

The second factor, which is strongly linked to obesity, is the social status. The prevalence of obesity and educational attainment are inversely correlated [13]. This study shows that obesity is higher ($p < 10^{-3}$) among illiterate people (49% of adults Constantine) than among those with a higher education level (18,84%). The same trend was observed among men (38,09% vs. 12,71%) and women (50,75% vs. 23,41%). Overall, the prevalence of obesity is significantly higher ($p < 0,001$) among inactive adults (37,13%) than among those who are active (23,80%): MSPs (managers and skilled professionals) 31,6%, unemployed 28%, 25% officials, farmers 50% and traders 36,0% ($p < 10^{-3}$).

The link between obesity and socioeconomic status can be explained by lifestyle factors likely to determine significant weight gain as dietary practices and physical activity. Thus in modern societies, the energy expenditure of individuals have dropped considerably. The causes are the heating and cooling of residential, the development of transport individual or collective and forms of professional activity. Unfortunately, changing our lifestyle leads to a more sedentary daily life. Several prospective studies have shown that the time spent in sedentary occupations, regardless of the usual level of physical activity, is associated with weight gain over time.

The analysis of the relationship between overweight / total obesity and factors associated by a logistic regression analysis allowed us to retain age, marital status and physical inactivity as predictors most significant, either among men or among women. These differences between married/unmarried are frequently reported [16]. These people are older than the others. In addition, women in these categories are often multiparous and/or menopause. All this could explain the high incidence of obesity among these individuals. Thus, adults, especially men, after marriages have less physical activity, change their diet or may be exposed to other environmental factors. Unfortunately, the data used here do not allow an empirical test of these speculations. Further research would be useful to examine the factors that play a role in weight gain of married people in our society. . In addition, the low level of education is a predictor of obesity, which can be explained by the low-income, people with low education earn much less money than those with higher levels of education.

Although this work has many advantages, it has several limitations. The main limitation of this study is its cross-

cutting nature. More methodology calls for some comment. This survey does not include individuals living in institutions or persons in situations of exclusion. However, ordinary households represent about 95% of the population Constantine. The study is based on individuals who agreed to help. This could pose a limit: the tendency of obese people to exclude themselves from any study in which weight would be evaluated. This could have led to an underestimation of the prevalence of obesity. Eating behaviors are considered limiting factors in this study. In fact it has no direct assessment of dietary intake.

5. Conclusion

This study showed a high prevalence of obesity especially among women. Moreover, this study has permitted to understand the relationship between overweight/obesity and socioeconomic factors and lifestyles among Constantine population. It therefore appears that obesity and overweight are very common in Algeria and there are socioeconomic disparities in the emergence of obesity. But with the rapid increase in the prevalence of obesity, one wonders if there are other factors other than demographic that could explain this phenomenon in a country in the throes of demographic and epidemiological transition. But overall, there are serious reasons for considering obesity in adults as a real public health problem in Algeria. Prevention of obesity must fight the contributing factors at all stages of life, but it should certainly pay attention to early childhood.

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7. Conflict of Interest

None.

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