Factors Associated With Overweight and Obesity Among Adults in Constantine

Dalichaouch-Benchaoui. S[1], Abadi. N[2]

[1]Laboratoire de Génétique et Biologie Moléculaire Université Constantine (3) 25000 Algérie.

[2]Laboratoire de Génétique et Biologie Moléculaire Université Constantine (3) 25000 Algérie.

Abstract: *Objectives: In Algeria, as in all countries of the developing world, obesity has become more common among adults. The present study aims to assess the prevalence of overweight and obesity among adults in Constantine and its relationship with certain determining factors. Study design: A cross-sectional study with cluster sampling allowed us to estimate the prevalence of all categories of body mass index. Methods: The study was conducted in the city of Constantine capital of the district of Constantine. For this purpose, 1143 adults living in Constantine were interviewed. Results: The prevalence of overweight and obesity was respectively 32,5% and 30,9%. Women are more affected by obesity than men. Obesity is more common among people with no professional activity. Similarly, the level of education and the prevalence of obesity are inversely correlated; it only affects 25,5% of the educated subjects. The results of the logistic regression analysis show that the prevalence of overweight and obesity was significantly different according to age and marital status. The prevalence of obesity is significantly different according to sex and the level of education; sedentary people are 2.6 times more obese than those who are physically active. Conclusions: In this study the prevalence of overweight and obesity is high. Preventive measures are to be taken urgently.*

Keywords: Obesity; Overweight; Adults; Socioeconomic factors, Lifestyle factors.

1. Introduction

Obesity, which is simply defined as an abnormal accumulation or excessive fat in adipose tissue, is a factor of risk for the development of several chronic diseases that significantly reduce life expectancy or seriously affect its quality. Obesity is the result of an imbalance between calorie intake and energy expenditure. However, things are not so simple. Indeed, many factors such as heredity, sedentary lifestyle, eating habits, socio-cultural factors, smoking cessation, hormonal phenomena and certain medications may increase this imbalance and promote weight gain.

According to the World Health Organization (WHO), obesity has become a major problem of public health in both developed and developing countries [7]. It reached 10 to 40% in most European countries over the last 10-15 years [3]. In rich countries, despite the efforts and means to stop its progression, it reached dramatic levels. The United States is the head of the table with 34,4% of the population in obesity [12]. Algeria, a country in middle-income developing has undergone significant socio-economic changes, is no exception, as 55,7% of adults 35 to 70 years have been classified as overweight [15]. Algeria must be aware of its third burden that is obesity. The other form of malnutrition, because of chronic diseases such as diabetes, hypertension, cardiovascular disease, cancer ... is increasing. In fact, despite the few studies that have looked at obesity in Algeria, the resulting information allows us to see that the prevalence of overweight and obesity is increasing rapidly in recent decades and are only even more pronounced in women [15]. Currently cosmopolitan, obesity is found more in urban areas of developing countries. Constantine was not spared by the increasing number of obese and the epidemiological situation of obesity is not sufficiently well known due to the lack of structure and monitoring program in Algeria. However a number of factors suggest that the situation is not very different from that prevailing in the countries of the same level of development [14].

Through its prevalence, considered alarming, obesity can represent in the near future a real public health problem. Identifying factors associated with national and regional levels, may help target prevention efforts.

2. Methodology

The study was conducted in the city of Constantine (Qacentina Arabic) capital of Constantine. Constantine is located in northern Algeria and is located 439 km far from the capital Algiers. It is considered as the third largest city of Algeria in terms of population. At the last census of 2009, the resident population of the city of Constantine was 448374 inhabitants. The adult population aged 18 and more is 340428.

The aim of this cross-sectional descriptive study was to assess the nutritional status of adults, based on direct measurements of height and weight to estimate the prevalence of overweight and obesity. The prevalence, according to demographic and socioeconomic factors as well as those related to lifestyle, is described. The study took place from November 2009 to July 2010, with a representative sample of adults aged 18 years and more. The inclusion criteria was subjects of both sexes, Constantine residents, aged 18 and more, and present on the day of the survey. Exclusion criteria was, unwilling subjects, incomplete questionnaire, sick and pregnant women.

This work was done in collaboration with the National Office of Statistics, on the basis of methodological note for sampling. To build up this sample, we initiated a two-stage cluster sampling. First stage, draw districts and second stage, random households in each district in order to draw lots for a

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/height^2). 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 kg/m^2
- Wide range normal: BMI between 18,5 kg/m^2 24,9 Kg/m^2
- Overweight: BMI between 25 kg/m^2 29,9 Kg/m^2
- Obesity (obesity class I and II) BMI between 30 kg/m^2 39,9 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 (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 $\geq$94 ♂ and ♀ TT $\geq$80 (%)	68,1 46,4 83,4 <10^{-3}
TT$\geq$102 ♂ and ♀ TT$\geq$88 (%)	51,9 27,1 69,4 <10^{-3}
WHR $\geq$1 ♂ and ♀ WHR$\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 27,2Kg/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 (29,2kg/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

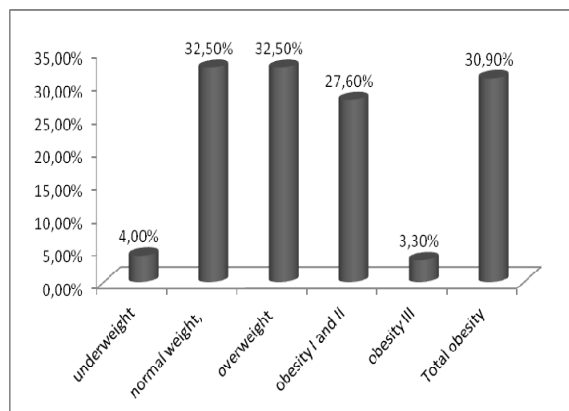| Variables	Men Women%........p	Variables	Men Women%........p
Level of education		marital status	
illiterate	4,4 19,7 0,01	married	50,6 67,8 0,4
primary	14,0 14,3 0,4	unmarried	49,4 32,2 0,3
middle	24,8 19,7 <10^{-3}	Television	
secondary	31,8 22,8 0,03	screen	
higher	25,0 23,5 0,2	(min/day)	8,5 7,4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

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 Women					1 0,9[0,7-1,5]0,2	1 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 married	1 2,3[1,5-3,5]$<10^{-3}$	1 1,6[1,2-2,4]0,02	1 1,7[1,1-2,7] 0,02	1 1,6[1,1-2,7] 0,01	1 2,0[1,5-2,7]$<10^{-3}$	1 1,7[1,2-2,3]0,002
Level instruction other illiterate primary	1 1,0[0,5-1,7] 0,9 0,8[0,5-1,4] 0,5	1,0[0,6-1,8] 0,9 1,6 [1,1-2,6] 0,04 1	0,6[0,2-2,0] 0,4 0,5[0,2-1,6] 0,2 1	1,7[0,6-5,3] 0,3 3,3[1,9-9,3] 0,02 1	1 1,0[0,7-1,6] 0,8 0,8 [0,6-1,3] 0,3	1 1,2[0,7-2,0] 0,5 2,0[1,3-3,1]0,001
Professional activity Active Non active	1 1,1[0,7-1,6] 0,8	1,6[1,1-2,6] 0,02 1 2,6[1,6-3,8] $<10^{-3}$	1,2[0,8-2,0] 0,3 1 1,3 [0,8-2,0] 0,3	0,5[0,7-1,7] 0,06 1 2,9 [1,6-5,2]0,001	1 1,1 [0,6-1,7] 0,8 1 1,1 [0,9-1,7] 0,1	1 1,0[0,6-1,8] 0,9 1 2,6[1,8-3,7]$<10^{-3}$
Sédentarity Non-sedentary Sedentary	1 1,2[0,8-1,7] 0,5	1 0,9[0,6-1,5] 0,7	1 0,8[0,4-1,3] 0,3	1 1,1[0,5-2,2] 0,8	1 1,2[0,8-1,8] 0,3	
Number of meals <3 ≥ 3	1,1[1,5-2,8] 0,7					1 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

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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% 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.

6. Acknowledgements

7. Conflict of Interest

None.

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Author Profile

Souhaila.Dalichaouch, Maître de conférences, Faculty of Medecine university Constantine 3 Algéria . PhD in Molecular and Cellular Biology.

Nourredine. ABADI, Professeur of Biochemistry, Faculty of Medecine university Constantine 3 Algéria.

Corresponding Author: S. Dalichaouch, Maître de conférence, Faculty of Medecine university Constantine 3 Algéria research fields: Molecular and Cellular Biology, Tél: 213555070123, E-mail:dalisouh@yahoo.mail