PREVALENCE AND SOCIO-DEMOGRAPHIC DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG ADULT POPULATION OF ALGERIA.

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Abstract: ***Background:*** *Obesity is considered to be one of the major risk factor for emerging non-communicable diseases. The objective of this study was to estimate the prevalence of overweight and obesity among Algerian population, and to investigate socio-demographic behavioural and clinical factors, related with these conditions.* ***Methods:*** *This is a descriptive cross-sectional study involving individuals aged 18 years old and above. Analysis based on data from the national survey to chronic disease risk factor surveillance conducted in Algeria between 2016 and 2017 according to the World Health Organization STEPwise approach. Continuous variables were compared between groups using the Student's t test, while differences in prevalence between underweight, normal weight, overweight and obesity were assessed using the chi-square test. We also looked at the potential associations between independent factors and the prevalence of overweight and obesity using a logistic regression model.* ***Results:*** *The prevalence rates of overweight and obesity were 35.3% (95% CI: 34.1–36.6%) and 24.7% (95% CI: 23.7–25.7%) respectively. Overweight was more common in males than to females while obesity was significantly higher among females compared to males. According to multivariate logistic regression analysis, age, separated or divorced category of marital status, raised blood Pressure and raised total cholesterol were the strongest risk factors of overweight and obesity.* ***Conclusions:*** *Overweight and obesity are highly prevalent and epidemic in the whole Algerian population. Quantification and monitoring of their risk factors is urgently needed to plan effective public health intervention measures, in order to reduce this burden and prevent other non-communicable diseases, especially cardiovascular disorders.*

Keywords: Overweight and obesity, Risk factors, Non-communicable diseases, World Health Organization (WHO) - STEPS approach, Algeria.

1. Introduction

Overweight and Obesity have become a major public health issue affecting both developed and developing countries (Reilly, 2006). They are generally defined as an excessive and abnormal fat accumulation in human body that presents a health risks (substantial morbidity and disability, impaired quality of life, and increased mortality) as well as economic costs (WHO, 2021). Body mass index (BMI) has recommended by The World Health Organization (WHO) as the most common measure of overall overweight and obesity (WHO, 1998) used for population and clinical screening. A person with a BMI equal to or more than 25 kg/m2 is considered overweight. A person with a BMI of 30 kg/m2or more is typically regarded as obese.

According to the WHO, the global epidemic of overweight and obesity is still increasing. In 2014, 1.9 billion adults (18 years and over) were overweight, and over 600 millions of these people being obese (WHO, 2021). By 2030, 2.16 billion people are expected to be overweight, and 1.12 billion obese (Kelly et al., 2005). Aside from being a potentially modifiable risk factors for the emerging pandemic of chronic non-communicable Diseases

(NCDs), including cardiovascular diseases (CVD), diabetes mellitus, high cholesterol, high blood pressure, metabolic syndrome, osteoarthritis, different types of cancer, stroke asthma, and respiratory issues (World Medical Association declaration of Helsinki, 1997; Must et al., 1999; WHO, 2003; Dalal et al., 2011).

The majority of deaths worldwide are now caused by NCDs. In 2012, Of the 56 million people global deaths, 68% (38 million) were attributed to these conditions, with 74% of deaths occurring in low and middle income countries (WHO, 2014).

Several epidemiological studies indicated that the etiology of overweight and obesity in children and adolescents is multifactorial, involving genetic predispositions, environmental influences, and complex interactions between them. Examples of these factors include socio-economic transition characteristics, rapid urbanisation, increasing incomes, and access to calorie-dense foods, extensive use of technology, as well as a rapid shift from an active to a sedentary lifestyle (Alaba and Chola, 2013; Han et al., 2010).

These determinants weight heavily on patients' health care costs, particularly given that managing chronic diseases is time-consuming and expensive. All these considerations prompt us to think about the early screen and control overweight and obesity which have become a requirement for reducing the risk of common health problems. It is crucial to note that overweight and obesity, along with their related NCDs, are mostly preventable (WHO, 2021).

In the recent decades, excess weight prevalence has increased significantly, with currently more than half of the population in Organization for Economic Co-operation and Development nations -OECD- (52.6%) being overweight or obese (OCDE, 2013). The African continent has seen also a rapid rise in overweight and obesity prevalence as well as associated comorbidities (Abubakari et al., 2008).

Furthermore, Algeria, as an emerging country, has experienced rapid demographic, nutritional transition as a result of urbanisation process, adoption of western lifestyles, and epidemiological transition which has resulted in an increased in the overall prevalence of overweight and obesity, as well as the prevalence rate of non-communicable diseases (TAHINA, 2005; WHO, 2018).

To our knowledge, only a rare or even less studies investigated the epidemiology and the etiology affecting excess weight in the adult population of Algeria. Therefore, using descriptive data from Algerian national Cross-sectional survey (STEPwise reports), the present study aims to assess and estimate the prevalence of overweight and obesity, as well as also identify significant factors associated with it among individuals aged between 18-69 years old. The characterisation of these factors is indispensable to help health professionals and policymakers to address overweight and obesity by developing behavioural modification strategies that would promote a healthy lifestyle and appropriate planning to target preventive public health interventions in Algeria.

2. Methods

2.1. Study design and data source

We performed secondary analyses of data available from Algerian national survey according to the WHO STEPwise approach to chronic disease risk factor surveillance. A detail methodology of The STEPS and the sampling procedures were presented elsewhere (WHO, 2005; Riley et al., 2016; STEPwise Algeria 2016-2017 survey, 2018). The survey database was obtained from the STEPwise official website (NCD Microdata Repository).

In brief, the STEPS is a descriptive cross-sectional study conducted in 2016-2017, and was a collaboration between Ministry of Health, Population and Hospital Reform - General Directorate of Prevention and Health Promotion, National Institute of Public Health with the support of WHO HQ-Geneva and WHO- Algeria representation office.

Based on STEPS approach, in the main survey data on a representative Algerian sample of 7450 participants, aged 18 and above, drawn at random from households

throughout the country, collection consisted of three steps: 1) Collecting socio- demographic information and behavioural measurements by pairs of investigators (doctor and health worker) through interview with selected participants; 2) Measuring anthropometric features including measuring height, weight, waist circumference, hip circumference and blood pressure (BP); 3) performing biochemical investigations including measuring blood sugar, and blood lipid … (Riley et al., 2016; STEPwise Algeria 2016-2017 survey, 2018).

The risk variables studied (STEPS core modules) were tobacco and alcohol use, low fruit and vegetable consumption, physical inactivity, overweight and obesity, high blood pressure, diabetes and dyslipidemia. Optional modules on oral health, mental health, trauma, violence and anti-tobacco policy were also included.

2.2. Anthropometric measurements and definitions

Weight and height were measured in each subject with a portable electronic weighing scale and a portable height/length measuring board. The eligible participants were measured in standardised conditions, wearing underwear, no head gear, no shoes and no socks. Weight was measured in kilograms, while height was estimated in centimetres (WHO, 2005). Body mass index (BMI) was then calculated as weight in (kg) divided by squared height in (m). Using the WHO thresholds (WHO, 2000), BMI categories were defined as follows: underweight (BMI < 18.5 kg/m2), normal weight (18.5 kg/m2 ≤ BMI ≤ 24.9 kg/m2), overweight (25 kg/m2 ≤ BMI ≤ 29.9 kg/m2), and obesity (BMI ≥ 30 kg/m2).We further categorized obesity in 3 levels, according to its severity (I class obesity: 30 kg/m2 ≤ BMI ≤ 34.9 kg/m2; II class obesity: 35 kg/m2 ≤ BMI ≤ 39.9 kg/m22; III class obesity: BMI ≥ 40 kg/m2).

2.3. Study variables

The explanatory variables were selected a-priori based on prior studies; reviews of the relevant published studies and were extracted from available information in the STEEPS datasets.

Socio-demographic-level factors, such as sex (male and female), age (18–29, 30–44, 45–59, and ≥ 60 years), marital status, education level, work status, wealth index, area of residence (rural or urban) and geographical zone. Behavioural-level factors, such as cigarette smoking and physical activity. As for the frequency of alcohol consumption, it was not included among the risk factors because of the low response rate of respondents in the database, especially females. Clinical-level factors such as raised BP, Diabetes and raised (TC). They were defined by self-report, based on the questions: "Have you ever been told by a doctor or other health worker that you have raised blood Pressure? "Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes? And "Have you ever been told by a doctor or other health worker that you have raised cholesterol?". On this basis, a dummy variable was created and categorized as "yes" or "no", which takes the value "yes" depending on the respondent's answer.

Moreover, with regard education level, marital status, geographical zone, work status, cigarette smoking and physical activity, were reclassified and recalculated into original data for analysis convenience and results interpretation. Education level was classified into five groups (no formal education, primary, middle, secondary and university). Marital status was restructured into three categories: married, divorced/separated and widowed. The 48 departments surveyed were divided into five geographical zones according to the government division of 1995; Central, East, West, Southern East and Southern West regions (Brahamia, 2010). Wealth index was estimated according to the monthly income declared by the respondent. Its categories were constructed on the basis of the national guaranteed minimum wage. This allowed us to categorize the individuals into four groups from the least wealthy to the richest. Physical activity was assessed in three different domains: work, transport and leisure. Activities were classified as vigorous, moderate. "Vigorous-intensity activities" were activities that require significant physical effort and cause large increases in breathing or

heart rate. "Moderate intensity activities" were activities that require moderate physical effort and cause slight increases in breathing or heart rate. On this basis, an adult should perform at least 150 minutes of moderate intensity work or 75 minutes of vigorous intensity work or 60 minutes of combined vigorous and moderate intensity work per week. If the reported physical activity did not meet the WHO recommendation, participants were classified as physically inactive (WHO, 2010). Cigarette smoking status was self-reported and classified as current daily smoker, ex-daily smoker or non-smoker.

2.4. Statistical analysis

All analyses were performed using Statistical Package for Social Science (SPSS) version 25 (IBM Statistics, USA). In the descriptive statistics, means and standard deviations (SD) were obtained for relevant anthropometric variables while frequency tables were also generated.

Continuous variables were compared between groups using the Student's t test, while association of each of the categorical variables (explanatory variables) with underweight, normal weight, overweight and obesity was tested with the Chi-square test ($\chi 2$). Normality of continuous variables was verified through the Kolmogorov–Smirnov test ($p < 0.05$).

Risk factors of overall overweight and obesity were examined using a univariate binary logistic regression model. Variables showing statistically significant association with the overweight and obesity ($P<0.05$) were considered as potential risk factors.

Subsequently, these variables were simultaneously subjected to the multivariate logistic regression model to eliminate potential confounders, and to determine the significant explanatory risk factors of overweight and obesity. The results of regression analysis (crude and adjusted prevalence's) were reported as odds ratios (cORs and aORs) with their respective 95% confidence intervals (CIs). Statistical significance was set at p-value < 0.05.

The final multivariate binary logistic regression model was found to be consistent with the results of the Hosmer- Lemeshow fit test.

3. Results

3.1. Socio-demographic and clinical characteristics of the Respondents

The study was carried out with 7450 adults, of whom only 6989 were interviewed; i.e., a response rate of 93.8% (3082 males and 3907 females, aged 18–69 years). Out of these 6989 participants, 360 were excluded from our study due to missing or outlier data for anthropometric measurements.

As depicts in Table 1, of the total 6,629 study participants included in this study, 54.9% were female. The majority of participants were currently married (68.3%), had a better level of education (67.4 %), ranging between moyen or secondary school and higher education, and lived in urban area (67.7%) with a predominance of demographic density especially in the northern geographical zone of the country compared to those in the south. Regarding to the work status, homemaker (28.5%) was the most common occupation, followed by the unemployed (24.0%), government employees (17.5%), non-government employees (10.7%), self-employed (12.0%), and retirees (7.4%). In terms of wealth index, 67.7% of respondents earned more the minimum wage or less than or equal two times the minimum wage (lowest and second lowest), Cigarette smoking was distributed between 76.3% of non-smokers versus 11.4% and 12.3% of ex-daily and current daily smokers respectively. The proportion of participants who exercised physical activity was 74.4%. Moreover, 24.9% had raised BP, 21.2% had diabetes, and 27.3% had raised TC.

Table 1 Participant characteristics, by BMI category

Variables	Overall		Underweight		Normal weight		Overweight		obesity		Cramer's V and p-values
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	
Sex											
Male	2991	45.1	114	3.8	1326	44.3	1095	36.6	456	15.2	0.210 ; p<0.001
Female	3638	54.9	106	2.9	1102	30.3	1248	34.3	1182	32.5	
Age group (years)											
18-29	1413	21.3	115	8.1	776	54.9	352	24.9	170	12.0	0.156 ; P<0.001
30-44	2566	38.7	60	2.1	878	34.2	946	36.9	682	26.6	
45-59	1867	28.2	29	1.6	540	28.9	729	39.0	569	30.5	
60-69	783	11.8	16	2.0	234	29.9	316	40.4	217	27.7	
Marital status											
Never married	1655	25.0	128	7.7	895	54.1	434	26.2	199	12.0	0.161; <0.001
Current married/Cohabiting	4521	68.3	85	1.9	1405	31.1	1741	38.5	1290	28.5	
Separated/Divorced	204	3.1	3	1.5	58	28.4	83	40.7	60	29.4	
Widowed	241	3.6	5	2.1	68	28.2	81	33.6	87	36.1	
Education level											
No formal school	1123	17.0	24	2.1	331	29.5	420	37.4	348	31.0	0.056 ; <0.001
Primary school	1034	15.6	26	2.5	376	36.4	357	34.5	275	26.6	
Moyen school	1561	23.6	57	3.7	601	38.5	533	34.1	370	23.7	
Secondary school	1534	23.2	61	4.0	567	37.0	554	36.1	352	22.9	
Higher education	1362	20.6	52	3.8	546	40.1	474	34.8	290	21.3	
Area of residence											
Urban	4484	67.6	149	3.3	1582	35.3	1619	36.1	1134	25.3	0.041 ; 0.012
Rural	2145	32.4	71	3.3	846	39.4	724	33.8	504	23.5	
Geographical zone											
North-Centre	2388	36.0	92	3.9	873	36.6	853	35.7	570	23.9	0.051; <0.001
North -West	1439	21.7	45	3.1	592	41.1	482	33.5	320	22.2	
North -East	2068	31.2	50	2.4	675	32.6	754	36.5	589	28.5	
South West	210	3.2	11	5.2	89	42.4	72	34.3	38	18.1	
South East	524	7.9	22	4.2	199	38.0	182	34.7	121	23.1	
Work status											
Unemployed (able and not able to work) /Student/No paid	1588	24.0	95	6.0	714	45.0	438	27.6	341	21.5	0.145; <0.001
government employee	1155	17.5	24	2.1	415	35.9	458	39.7	258	22.3	
Non-government employee	708	10.7	24	3.4	328	46.3	255	36.0	101	14.3	
Selt employed	792	12.0	32	4.0	325	41.0	302	38.1	133	16.8	
Homemaker	1882	28.5	33	1.8	464	24.7	676	35.9	709	37.7	
Retired	490	7.4	12	2.4	176	35.9	209	42.7	93	19.0	

Table 1 Participant characteristics, by BMI category (Continued)

Variables	Overall		Underweight		Normal weight		Overweight		obesity		Cramer's V and p-values
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)		
Wealth index (Family monthly income quintile)											
Lowest (less than or equal to SMIG)	1154	28.5	34	2.9	467	40.5	406	35.2	247	21.4	0.044; 0.020
Second lowest (More than to SMIG, less than or equal to 2x SMIG	1588	39.2	49	3.1	565	35.6	559	35.2	415	26.1	
Midle (More than to 2x SMIG, less than or equal to 3x SMIG	676	16.7	29	4.3	225	33.3	267	39.5	155	22.9	
Second highest (More than to 3xSMIG, less than or equal to 4x SMIG)	266	6.6	8	3.0	94	35.3	100	37.6	64	24.1	
Highest (More than to4xSMIG)	362	8.9	7	1.9	121	33.4	136	37.6	98	27.1	
Cigarette smoking											
Never smoked	5058	76.3	152	3.0	1672	33.1	1818	35.9	1416	28.0	0.138; <0.001
Past Daily smoked	756	11.4	14	1.9	304	40.2	299	39.6	139	18.4	
Current Daily smoked	815	12.3	54	6.6	452	55.5	226	27.7	83	10.2	
Physical activity											
Low (< 150 Min/week)	1455	25.6	56	3.8	491	33.7	482	33.1	426	29.3	0.079; <0.001
High (More 150 Min/week)	4227	74.4	139	3.3	1671	39.5	1487	35.2	930	22.0	
History of Raised Blood Pressure											
Yes	1205	24.9	6	0.5	243	20.2	439	36.4	517	42.9	0.217; <0.001
No	3643	75.1	113	2.5	1359	37.3	1320	36.2	851	23.4	
History of Diabetes											
Yes	413	21.2	7	1.7	82	19.9	160	38.7	164	39.7	0.098; <0.001
No	1536	78.8	21	1.4	445	29.0	594	38.7	476	31.0	
History of Raised Total Cholesterol											
Yes	533	27.3	6	1.1	90	16.9	209	39.2	228	42.8	0.163 ; <0.001
No	1416	72.7	22	1.6	437	30.9	545	38.5	412	29.1	

3.2. Prevalence of overweight and obesity

Table 2 describes the main anthropometric characteristics and the distribution of BMI categories by sex. Mean age (± SD) was 41.45 ± 13.25 years, with males 41.63 ± 13.10 and females 41.31 ± 13.37 years. Mean height was 165.81 cm, mean weight was 73.76 kg, and mean BMI was 26.93 kg/m2 (25.61 in males, 28.02 in females).

There was no difference between males and females regarding mean age and mean height. Conversely, there was a significant association in terms of sex by mean weight (<0.05) and mean BMI (<0.001).

Overall, 3.3 % of the Algerian adults were underweight, 36.6 % were normal weight, 35.3 % were overweight, likewise, and 24.7 % were obese. Additionally, 17.0 % of the Algerian adult population had a I class obesity, 5.4 % a II class, and 2.3 % a III class obesity.

The prevalence of overweight was more common in males compared to female participants (36.6 % vs 34.3 %, $p < 0.001$); while obesity was significantly higher among females compared to male participants (32.5% vs 15.2 %, $p < 0.001$). All classes of obesity were also more frequent in female participants.

Furthermore, as shown in table 1, prevalence of obesity observed in correlation, with the highest prevalence rates found among participants who were aged ≤ 45 years, currently married, no formal educated, living urban area especially north east geographical zone, not married, being homemaker, earned more the minimum wage or less than or equal two times the minimum wage (lowest and second lowest), never smoked, not exercised physical activity, and who had raised BP, diabetes and raised TC. Findings were similar regarding highest prevalence rates of overweight, except for participants who were aged ≤30 years, retired and having government employee, earned more than two times the minimum wage or less than or equal three times the minimum wage (Middle), never and past daily smoked.

Bivariate statistical analyses indicated a high significant difference (P < 0.001) between almost all socio-demographic, behavioural, clinical independent variables and BMI categories.

Table 2 Mean values for age, height, weight, and body mass index (BMI) for 6,629 Algerian adults aged 18 years or over, and sex prevalence according to categories of BMI

	Overall (n=6629)	**Sex**		**Statistic**	p value
		Male (n=2991)	**Female (n=3638)**	***student t-test/chi square-test***	
Age [years]; mean ± SD	41.45 ± 13.25	41.63 ± 13.10	41.31 ± 13.37	2.719 [a]	NS
Height [cm]; mean ± SD	165.81 ± 9.93	172.79 ± 7.68	160.08 ± 7.64	1.922[a]	NS
Weight [kg]; mean ± SD	73.76 ± 14.95	76.44 ± 14.38	71.55 ± 15.05	5.914[a]	<0.05
BMI [kg/m^2]; mean ± SD	26.93 ± 5.74	25.61 ± 4.66	28.02 ± 6.29	161.317[a]	<0.001
BMI [kg/m^2]; % (95 % CI)					
Underweight	3.3 (2.9-3.8)	3.8 (3.1-4.5)	2.9 (2.4-3.4)		NS
Normal weight	36.6 (35.5-37.8)	44.3 (42.6-46.1)	30.3 (28.8-31.9)	0.635[b]	
Overweight	35.3 (34.1-36.6)	36.6 (34.9-38.3)	34.3 (32.8-35.8)	29.607[b]	<0.001
Obesity	24.7 (23.7-25.7)	15.2 (14.0-16.5)	32.5 (31.0-34.1)	284.809[b]	<0.001
Class I	17.0 (16.1-17.8)	12.1 (10.9-13.3)	21.0 (19.6-22.2)	155.167[b]	<0.001
Class II	5.4 (4.9-6.0)	2.6 (2.0-3.1)	7.8 (6.9-8.7)	139.262[b]	<0.001
Class III	2.3 (2.0-2.7)	0.6 (0.3-0.9)	3.7 (3.1-4.3)	108.098[b]	<0.001
				324.122[b]	<0.001

SD standard deviation, CI confidence interval

[a] Continuous variables were presented as mean ± SD and compared using the *student t-test*

[b] Categorical variable was expressed as percentage (95 % CI) and analyzed by the *chi square-test*

3.3. Factors associated with overweight and obesity

According to the results of crude logistic regression analysis, the explanatory factors significantly associated with overweight or obese were female sex, age groups :(30-44 years), (45-59 years) and (60-69 years) , marital status, no formal education level, urban residence, north-east geographical zone, work status (government employee, self-employed, homemaker and retired), wealth index (Second lowest, middle and highest), low physical activity, raised BP, diabetes and raised TC. However, past and current daily smoked appeared to have a protective effect.

After adjustment, when all these significant factors were entered into a multivariate logistic regression model (table 3), the analysis revealed that age was significantly related to an increase in the probability to be either overweight or obese. When compared to the younger age group (18–29 years), this risk was more than two and a half times higher in the (30–44 years) age group (aOR = 2.651; [1.580–4.450]; P < 0.001), more than two times higher in the (45–59years) and (60–69 years) age groups , respectively, (aOR = 2.344; [1.339–4.103]; P < 0.01) ; (aOR = 2.200; [1.105–4.380]; P < 0.05). Separated or divorced category of marital status had a higher risk to having either overweight or obese compared to those never married (aOR = 6.237; [1.704–22.823]; P < 0.05). Similarly, being overweight was substanlly associated with adults who had raised BP (aOR = 1.719; [1.209–2.443]; P < 0.01) and raised TC (aOR = 1.564; [1.087–2.251]; P < 0.05). In contrast, the adults who past daily smoked were

less likely to have overweight or obesity and even seemed to have a protective effect (aOR = 0.595; [0.370–0.958]; P < 0.05). Interestingly, no difference was found in terms of overweight or obesity patterns by sex, education level, area of residence, geographical zone, work status, wealth index, physical activity and diabetes.

Table 3 Risk factors associated with overweight and obesity

Variables	normal weight		Overweight / obesity		cOR (95%CI)		P value	aOR (95%CI)		P value
	(n)	(%)	(n)	(%)						
Sex										
Male	1326	46.1	1551	53.9	1			1		
Female	1102	31.2	2430	68.8	1.885 (1.702, 2.088)		<0.001	0.855 (0.534, 1.369)		NS
Age group (years)										
18-29	776	59.8	522	40.2	1			1		
30-44	878	35.0	1628	65.0	2.756 (2.401, 3.164)		<0.001	2.651 (1.580, 4.450)		<0.001
45-59	540	29.4	1298	70.6	3.573 (3.077, 4.150)		<0.001	2.344 (1.339, 4.103)		<0.05
60-69	234	30.5	533	69.5	3.386 (2.801, 4.093)		<0.001	2.200 (1.105, 4.380)		<0.01
Marital status										
Never married	895	58.6	633	41.4	1			1		
Current married/Cohabitating	1405	31.7	3031	68.3	3.050 (2.706, 3.439)		<0.001	1.393 (0.887, 2.187)		NS
Separated/Divorced	58	28.9	143	71.1	3.486 (2.527, 4.809)		<0.001	6.237 (1.704, 22.823)		<0.01
Widowed	68	28.8	168	71.2	3.493 (2.589, 4.713)		<0.001	1.327 (0.578, 3.046)		NS
Education level										
No formal school	331	30.1	768	69.9	1.658 (1.400, 1.964)		<0.001	1.221 (0.698, 2.136)		NS
Primary school	376	37.3	632	62.7	1.201 (1.015, 1.422)		<0.05	1.318 (0.745, 2.332)		NS
Moyen school	601	40.0	903	60.0	1.074 (0.924, 1.248)		NS	1.386 (0.861, 2.229)		NS
Secondary school	567	38.5	906	61.5	1.142 (0.981, 1.329)		NS	1.121 (0.728, 1.729)		NS
Higher education	546	41.7	764	58.3	1			1		
Area of residence										
Urban	1582	36.5	2753	63.5	1.199 (1.077, 1.335)		<0.01	1.122 (0.795, 1.584)		NS
Rural	846	40.8	1228	59.2	1			1		
Geographical zone										
North-Centre	873	38.0	1423	62.0	1.071 (0.879, 1.305)		NS	1.398 (0.768, 2.544)		NS
North -West	592	42.5	802	57.5	0.890 (0.723, 1.095)		NS	0.917 (0.483, 1.740)		NS
North -East	675	33.4	1343	66.6	1.307 (1.068, 1.598)		<0.01	1.411 (0.762, 2.612)		NS
South West	89	44.7	110	55.3	0.812 (0.583, 1.131)		NS	0.684 (0.256, 1.827)		NS
South East	199	39.6	303	60.4	1			1		
Work status										
Unemployed (able and not able to work) /Student/No paid	714	47.8	779	52.2	1			1		
Government employee	415	36.7	716	63.3	1.581 (1.350, 1.852)		<0.001	0.938 (0.548, 1.606)		NS
Non-government employee	328	48.0	356	52.0	0.995 (0.830, 1.192)		NS	0.678 (0.342, 1.344)		NS

Selt employed	325	42.8	435	57.2	1.227	(1.029, 1.463)	<0.05	0.561	(0.282, 1.118)	NS
Home marker	464	25.1	1385	74.9	2.736	(2.364, 3.166)	<0.001	1.308	(0.787, 2.173)	NS
Retired	176	36.8	302	63.2	1.573	(1.273, 1.944)	<0.001	0.667	(0.352, 1.262)	NS
Wealth index (Family monthly income quintile)										
Lowest (less than or equal to SMIG)	467	41.7	653	58.3	1			1		
Second lowest (More than to SMIG, less than or equal to 2x SMIG	565	36.7	974	63.3	1.233	(1.053, 1.443)	<0.01	1.163	(0.785, 1.722)	NS
Midle (More than to 2x SMIG, less than or equal to 3x SMIG	225	34.8	422	65.2	1.341	(1.097, 1.639)	<0.01	1.178	(0.740, 1.876)	NS
Second highest (More than to 3xSMIG, less than or equal to 4x SMIG)	94	36.4	164	63.6	1.248	(0.943, 1.651)	NS	1.549	(0.853, 2.813)	NS
Highest (More than to4xSMIG)	121	34.1	234	65.9	1.383	(1.078, 1.775)	<0.05	1.300	(0.758, 2.229)	NS
Cigarette smoking										
Never smoked	1672	34.1	3234	65.9	1			1		
Past Daily smoked	304	41.0	438	59.0	0.745	(0.636, 0.872)	<0.001	0.595	(0.370, 0.958)	<0.05
Current Daily smoked	452	59.4	309	40.6	0.353	(0.302, 0.413	<0.001	0.559	(0.307, 1.015)	NS
Physical activity										
Low (< 150 Min/week)	491	35.1	908	64.9	1.279	(1.127, 1.451)	<0.001	0.921	(0.671, 1.264)	NS
High (More 150 Min/week)	1671	40.9	2417	59.1	1			1		
History of Raised Blood Pressure										
Yes	243	20.3	956	79.7	2.463	(2.106, 2.879)	<0.001	1.719	(1.209, 2.443)	<0.01
No	1359	38.5	2171	61.5	1			1		
History of Diabetes										
Yes	129	22.2	453	77.8	1.729	(1.399, 2.136)	<0.001	1.404	(0.935, 2.107)	NS
No	886	33.0	1800	67.0	1			1		
History of Raised Total Cholesterol										
Yes	114	17.5	537	82.5	2.116	(1.682, 2.662)	<0.001	1.564	(1.087, 2.251)	<0.05
No	468	31.0	1042	69.0	1			1		

4. Discussion

Several studies have suggested that we are facing a worldwide epidemic of overweight and obesity. In order to assess the prevalence and determinants of key NCD risk variables (socio-demographic, behavioural, and biological risk factors), the current study was performed on a representative sample of 6629 adults using data from the Algeria national survey according to the WHO STEPwise approach.

The results showed that Algeria has a particularly high prevalence of overweight 35.3 %. Compared with females, males are slightly more likely to be overweight (36.6 % vs 34.3 %). Findings regarding increased percentage of overweight in males were in line with the literature (Ahmad Kiadaliri et al., 2015; Maruf and Udoji, 2015). In addition, this BMI category distribution matched that of developed countries, where male and female ratio to overweight is almost the same (Santos and Barros, 2003). However, the proportion of overweight obtained in this study was lower than the 53.3% reported in adult Northern Nigerian population, with a statistically higher prevalence among females compared to males (62.0% vs 41.9% 8 imp 2), and was higher than reported in in Bangladesh (13%), and in Pakistan (25%) (Janjua et al., 2015; Rawal et al., 2018).

This slight decrease of overweight among females likely reflects a reduced social acceptability of overweight and obesity.

For obesity, the overall prevalence was 24.7 %, with a significantly higher prevalence among females compared to males (32.5% vs 15.2 %). These findings were in agreement with data from industrialised, and many developing countries, like some populations of Europe, Latin America, South-east Asia and Africa indicating that all face the same striking increase in the prevalence of obesity, with the average prevalence in males lower than that in females (Millar, 1987; Kruger et al., 2012; Janjua et al., 2015). Moreover, the same result has been reveled in many other parts of sub-Saharan Africa, for example Botswana and Nigeria (Letamo, 2011; Olatunbosun et al., 2011). Our overall prevalence of obesity was almost close to the value of 21% reported in Nigerian populations (Ojofeitimi et al., 2007), and was higher than found in Canada (14.8%) (Katzmarzyk, 2002). This is however lower than that reported in the United States where the prevalence of obesity increased from 22.9% in the late 1980s to early 1990s to 30.5% between 1999 and 2000 (Flegal et al., 2002).

Despite there are many causes contributing to the increased prevalence rates of overweight and, the possible explanation could be that Algeria is just undergoing a rapid epidemiological transition (as confirmed by the increasing overweight and obesity rates among both females and males). It probably reflects profound changes in lifestyle, particularly dietary and behavioural patterns over the last few decades. These had a significant impact on risk factors as well as on the incidence of obesity, cardiovascular morbidities, and diabetes. There is also undoubtedly the genetics which plays an important role of the increase in percentage of overweight and obese people. Human being carry a number of genes associated to body size, but environmental influences the phenotype expression of these genes (Barsh et al., 2000).

4.1. Risk factors

Different prevalence rates of overweight and obesity may be explained by many variables, including sex, age, income levels, educational opportunities, ethnicity, and globalization. Such results have implications for socially or geographically targeted interventions addressing this condition.

Although our bivariate statistical analysis showed a high significant correlation between almost all socio-demographic, behavioural, clinical explanatory variables, and the prevalence of overweight and obesity, only a few significant influences were retained in the multivariate analysis using logistic regression.

The odds of overweight and obesity was still significantly associated with age. Adults (30 to 69 years) were more than twice as likely to be either overweight or obese compared to younger age group (18 to 29 years). These findings are in line to what has been documented in most previous publications on African and around the world that revealed that increased age was significantly related with overweight or obesity but that weight seemed to drop again after the older age (Al-Mannai et al., 1996; Badr et al., 2013). The scientists speculate that this is due to a process of demographic transition that has occurred in the Arab countries with an increase in numbers of old age population leading increase in percentage of overweight or obese people (Saxena, 2008). Also, this might be connected to metabolic changes, aging-related physical inactivity and other health impairments.

Similarly, with reference to marital status, the results of our study indicate that divorced or separated as compared to either single or married adults are associated with a high prevalence of overweight and obesity. This finding was inconsistent with many studies conducted around the world and other Mediterranean regions (Wilson, 2012; Shah et al., 2015), which showed that getting married was correlates with weight gain because couples together eat more food, spend more time watching TV (which is sedentary), and exercise less (Pearson and Biddle, 2011), while leaving marriage was associated with weight loss (Jeffery and Rick, 2002; Sobal et al., 2003). Hence, the relationship between marital status and

overweight or obesity underline how Socio-cultural characteristics can have a great influence on healthy habits, diet, physical activity, and consequently body weight (Sobal et al., 2003).

Furthermore, as in many previous studies, it was discovered that overweight or obesity in Algeria's population was strongly correlated with raised BP and raised TC. These results are in broad agreement with the existing literature on the metabolic syndrome; dyslipidemia and risk factors for cardiovascular disease (Galassi et al., 2006; Mahjoub et al., 2010). Urbanisation and the nutritional transition associated to the risk of metabolic syndrome are the direct reasons of this affinity (Li et al., 2016). Moreover, other research, suggest that the correlation may be explained by a number of additional processes, such as impaired insulin sensitivity, liver fat accumulation and dysfunction of adipose tissue (Klöting et al., 2011).

The high rate of risk factors that define the metabolic syndrome and cardiovascular morbidity underscores the need to create early preventive action against overweight and obesity and improve levels of physical activity could lead to better and mortality figures in the near future.

In terms to diabetes, the present study showed no relationship with overweight or obesity, contrary to what was pointed out in several research that demonstrated a strong link between the levels of insulin secreted and weight gain (Hanson et al., 1995; Mahjoub et al., 2010).

Furthermore, we found no significant difference between the prevalence overweight or obesity and cigarette smoking, and there was even a protective effect of past daily smokers versus never smokers. It could be explained by a number of factors, on top of which is Algerian population with low proportion of smokers and ex-smokers. However, this finding is in disagreement with other data suggesting that ex-smokers were more frequently overweight or obese than never smokers, confirming the overall evidence of substantial weight gain after smoking cessation (Flegal et al., 1995).

Interestingly, no association was observed among female compared with male sex in terms of overweight or obesity. This finding contrasts with those found by some studies which revealed that females had a significantly higher prevalence of overweight or obesity compared with males mainly caused by pregnancy, which may contribute to weight gain through decreasing the ability of participation in vigorous activity, and postpartum depression (Al-Mannai et al., 1996).

Moreover, our results did not show a significant correlation between geographical zone, area of residence and overweight or obesity. Several studies (Al-Mannai et al., 1996; Wilson, 2012; Pradeepa et al., 2015) have noted that people living in urban areas had a higher risk of overweight and obesity; however its trend is increasing at rapid pace in rural residence (Aitsi-Selmi et al., 2012). This could be interpreted as a change of lifestyle in these urban areas, including dietary habits, like consumption of carbonated drink, having access to fast food, high-fat, and energy-dense frozen food, (WHO, 2003) and the availability of transport, all of which contributed to increase in physical inactivity. Adoption of a more westernized, sedentary lifestyle with urbanisation has also been shown to be major driving factor for the increasing obesity epidemic in urban areas in Africa (Sodjinou et al., 2008).

The rates of overweight and obesity were also unaffected by education level, work status and wealth index. This pattern is inconsistent to the findings presented in the literature. Many research have found that overweight or obesity is more prevalent in less educated, low-income, unemployed individuals, notably housewives (Monteiro et al., 2004; Roskam et al., 2010), while others studies stated the opposite (Katulanda et al., 2010; Pradeepa et al., 2015). However, this should be interpreted cautiously as residual confounding between these socio-economic factors may have influenced findings. Many factors may be connected to these observations. It is assumed that illiterate or less educated people with disadvantaged economic status, because of their lower earning capacity and reduced knowledge of healthy

diet, were more exposed to high-calorie foods and simple carbohydrates, which are cheaper and easier to access (Lahti-Koski et al., 2000).

Additionally, it's likely that homemakers and retirees have a greater impact on overweight and obesity than other occupations due to a growing sedentary lifestyle, lower levels of physical activity, mechanised and automated work, motorised transportation, and passive leisure activities, which are particularly related to urbanisation and globalisation (Monda et al., 2008; Pan et al., 2021). Despite the fact that numerous researches indicated that physically active individuals had lower levels of BMI than inactive individuals our findings ran counter to these (Ramadan and Barac-Nieto, 2003). The plausible explanation could be an upsurge in physical activity among North Africans in recent years (Nejjari et al., 2013; Eman et al., 2018), that caused an energy imbalance between calories intake and expenditure. According to the WHO, persons between the ages of 18 and 64 should engage in at least 150 minutes of aerobic exercise each week to maintain a healthy weight (WHO, 2010). Finally, the above important mentioned findings highlight the necessity to plan and implement prevention programmes against the risk factors for overweight or obesity in our country.

4.1. Limitations

Though the STEPS methodology is designed to provide standardized data on important, modifiable risk factors for NCDs that may be identified in population-based surveys without the need for high-technology instruments, some limitations should be considered in this study.

First, given that the main study is a national cross sectional epidemiological study, we cannot discount the possibility of reverse causation bias and recall bias as well as we also cannot allow for the generalization of findings to the entire population.

Second, even though a survey implementation guide had been created and the anthropometric and biomedical measures tools had been periodically calibrated, it is still possible that certain measurement errors could have introduced bias. Also, the study excluded participants who were under the age of 18 or older than 69, which may have distorted the study's findings regarding the overall prevalence of overweight and obesity in the population.

Third, the variables examined in this study can only partially account for the risk factors associated with overweight and obesity. Also, no research was done on the relationship between genetic variables and the high prevalence of overweight and obesity.

5. Conclusion

The present study revealed a significantly higher prevalence of overweight and obesity among Algerian adults aged 18 years and above. This increase is potentially related to some key explanatory factors in this study. These results postulated that there is an urgent need to help curb or reduce this proportion by effectively managed on their modifiable risk factors with the aim to prevent the development of NCDs. However, interventions on modifiable risk factors will require cooperation from numerous sectors and disciplines as well as individual and population-level prevention, especially those that are environmentally focused. In order to inform the public about this preventable epidemic, it is also vital to develop health awareness efforts, particularly those that encourage healthier lifestyles including healthy eating, regular physical activity and smoking cessation.

Finally, considering these variables can help the nation's health policy makers create and implement national preventive and control action plans of a world-class healthcare system and policies to reduce the prevalence of overweight and obesity and its associated chronic diseases as well as to prevent the increase in health expenditures concerning in the coming years.

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