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Prevalence of obesity and its associated factors in Aleppo, Syria

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Abstract

Background— Obesity and its related adverse health effects have become major public health problems in developing countries. It has been increasing more rapidly in low-income and transitional than in industrialized countries. This study aims to provide the first population-based estimates of the prevalence of obesity in Aleppo, Syria, and to examine its association with a number of risk factors in the adult population.

Methods— An interviewer-administered survey of adults 18–65 years of age, residing in Aleppo, Syria was conducted in 2004, involving a representative sample of 2038 participants (54.8% female, mean age 35.3±12.1, age range 18–65 years) with a response rate of 86%. Demographic factors and anthropometric measurements were obtained for all participants. The main outcome was prevalence of obesity which was defined as BMI≥ 30 kg/m^2.

Results— The prevalence of obesity was 38.2%, higher in women than in men (46.3% and 28.4% respectively). It increased with age being highest in the 46–65 year-old age group. Obesity was highest among Arabs (40.1%), the unemployed (49.8%), illiterate (50.4%), married (44%) especially women with multiparity, low socio-economic status(45.4%), and those with a low physical activity score (40.3%). Obesity was seen among 48.2% of ex-smokers, 39.3% of non-users of alcohol and 57.5% of participants treated for depression. An association was observed between obesity and an increasing frequency intake of certain food items. Among women, an association was observed between obesity and the number of births.

Conclusion— Our data show that obesity is a major health problem in Aleppo, Syria especially among women. It is related to age, marital status, and consumption of certain food items and it shows a significant prevalence among women with repeated pregnancies.

Introduction

The prevalence of overweight and obesity in most developed and developing countries has increased markedly over the past two decades(1). According to World Health Organization (WHO), obesity has reached epidemic proportions globally, affecting both rich and poor societies. Obesity has been increasing more rapidly in low-income and transitional countries than in industrialized countries (2–4)

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Although obesity should be considered a disease in its own right, it is also one of the key risk factors for serious chronic diseases, including Type 2 diabetes, cardiovascular disease, hypertension and stroke, and cancer (5–7).

In Syria, a low-middle income country in East Mediterranean Region (EMR), there are still no population-based estimates of obesity and its associated risk factors. Syria has witnessed rapid changes in lifestyle, and is showing a double disease burden whereby non-communicable diseases have already emerged while infectious diseases continue unabated (8). According to a recent estimate from informal zones in Aleppo, the second largest city in Syria (2.5 million), about half of 45–65 year old women have hypertension, and 15% of older men and women have ischemic heart disease (9). Diabetes is also common among women and is mostly confined to an older age group affecting about one fifth of them (9). The lack of information about obesity, as an important CVD risk factor hampers public health planning for intervention and control of these diseases.

Our objective in this study was to provide the first population-based estimates of obesity in Aleppo, and to look at its association with a number of risk factors in the adult population.

Methods and procedures

Setting, population, and sampling

In this study we used data from the first Aleppo Household Survey (AHS), conducted in 2004 in Aleppo by the Syrian Center for Tobacco Study (SCTS) (9). The main objective of AHS was to provide a baseline map of the main health problems and exposures affecting adults (18–65 years) in Aleppo. The design and strategy of the AHS have been described in detail elsewhere (9,10) and illustrated in Figure 1. Briefly, the AHS is a population-based survey of a representative sample of households in Aleppo. Two-stage, stratified, cluster sampling was used, with the target population divided into two strata; formal and informal zones according to Aleppo municipality's records. A list of all residential neighborhoods and the number of residents in each neighborhood, according to the last census, was obtained from the Central Bureau of Statistics (2004). From a total of 114 neighborhoods in Aleppo, 87 are classified as formal and 27 as informal. Of these formal and informal zones, 29 and 18, respectively, were randomly selected based on the probability proportional to size (PPS). From each stratum we aimed to survey about 1000 households. The number of households selected from each neighborhood was proportional to the total number of households in that neighborhood. A random selection of a "starting point" in each neighborhood was done with the help of enlarged aerial maps. Beginning from that point, every fifth household was included in the study. When the working street ended, the surveyors would turn left or right according to an a priori specified plan and continue onto the next street, and so on, until the targeted number of households for that neighborhood was reached. When the selected building was not residential or the household’s head refused to participate, the interviewer proceeded until the next household was located. In each participating household, a list of all adult members of that household was prepared and numbered sequentially according to age. A random number between 1 and the total number of adults in the given household was generated by computer and the corresponding person was interviewed. If the selected person was not available at the time, a second appointment was scheduled and the household was revisited for the interview. The total number of study subjects was 2038 (921 male, 1117 female).

Instruments and procedures

AHS is an interviewer-administered survey involving six, 2-person, mixed gender teams of interviewers equipped with notebook computers to record questionnaire responses and measurements using a custom data entry program (Delphi programming language with an SQL

server DBMS). The survey was performed using a questionnaire and anthropometric measurements. The questionnaire covered demographic information including age, sex, marital status, level of education (illiterate, less than 6 years, 6–12, and > 12 years), occupation (student, employed, unemployed), ethnicity, religion, and mean family income. These were considered individually as well as combined into a socio-economic status (SES) score. (Appendix 1). SES scores were from 0–12, with higher values indicating better SES. Questions on lifestyle included physical exercise, smoking habits, food consumption and alcohol use. The score for physical exercise was derived from multiple inquiries as outlined in Appendix 1. Food frequency consumption was asked for vegetables, fruits, olive oil, coffee, tea, and potato chips. In line with other reports from AHS, age was categorized into 3 groups (younger as 18–29 years, middle as 30–45 years, and older as 46–65 years) to allow for meaningful comparisons, and to reflect, to some extent the age composition of the Syrian population (only 4% of the Syrian population is above 65 years) (11). The SES score was stratified into three tertiles for the purpose of analysis.

Measurements

Anthropometric measurements were taken using standardized techniques. The weight was measured objectively using a digital scale (Camry-China), and recorded to the nearest 100 g.. Height was measured without shoes and recorded to the nearest 0.1 cm using a sliding wall scale (Seca-Germany).

Body mass index (BMI), was calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2). Overweight and obesity were defined according to WHO criteria as BMI from 25–29.9 and ≥ 30 respectively (2). Informed consent was obtained from the participants. The study protocol was approved by a local and an international IRB.

Data analyses

After the survey was completed, the final sample was weighted to account for different neighborhood status (formal/informal zones), multiple neighborhoods, and different numbers of adults living in the household. The sampling weight was calculated similar to the method described by U.N. Statistics Division and Richard M. Single (12)

All proportions and ratios were calculated using sample weights to provide estimates for the population parameters.

All statistical analysis were performed with SPSS for PC using the complex sample module (version 13.0 for Windows; SPSS. Inc). A Chi square test was used to assess bivariate relation between obesity (BMI categorized into three main parts) and the socio-demographic variables (age group, gender, …..).

Backward Wald Logistic regression was used to estimate the odds ratio (OR) and the 95% confidence intervals for the relation between being obese (BMI≥30) and age, SES, marital status, cigarette smoking, and frequency of vegetables and olive oil intake, grouped by gender.

Results

Basic socio-demographic indicators and anthropometric characteristics of the study subjects are presented in Table 1. There were 2038 subjects (54.8% female, mean age 35.3±12.1, age range 18–65 years), with a response rate of 86%. The mean BMI was 27.4±5.1 in men and 30.0±7.0 in women. The overall prevalence of obesity was 38.2%, higher in women than in men (46.4% vs. 28.8%, p <0.001). Table 2. Obesity increased with age, with the highest prevalence in the 46–65 year-old age group.

Tables 2 and 3 show the prevalence of obesity according to measured variables. Overall, the prevalence of obesity was highest among Arabs (40.2%), the unemployed (50.3%), illiterate (50.8%), married (44.5%), low socio-economic status (46.3%), and those with a low physical activity score (40.6%).

The study showed that ex-smokers were more obese than current smokers (49% vs. 32.8%). An association was observed between the prevalence of obesity and increasing frequency intake of some food items (vegetables, fruits, olive oil, and coffee). An association was also noted between obesity and treated depression. On the other hand the data revealed an inverse association between the prevalence of obesity and alcohol use (39.7% of non-users were obese vs. 23.2% of users, $p<0.05$).

Among women, a linear association was observed between parity (the number of births) and the prevalence of obesity ($p< 0.001$). Table 2. Residency, religion, and diagnosed depression in this study were not associated with the prevalence of obesity.

The results of multivariate logistic regression analyses are presented in Table 4. The prevalence of obesity increased with age, and frequency consumption of vegetables in both sexes. It was significantly prevalent among women with repeated pregnancies and low education, as well as married men.

Discussion

This study provides population-based estimates of obesity and associated covariates in Aleppo, Syria. Obesity is predominant in women, increasing sharply by age, and is related to frequency consumption of certain food items. The study also showed a significant association between the prevalence of obesity and the female reproductive history. It also showed that low educated women were more obese that those with high education (over 12 years of study). In men, married participants and ex-smokers were associated with a lower prevalence of obesity. The study did not show a clear relation with socioeconomic status in both sexes.

Although we have no previous estimates of prevalence of obesity for comparison, obesity is highly prevalent in Syria by international comparison. Indeed, the prevalence of obesity in Syria is higher than in many Arab countries as well as most Western European and American countries (4,13–18).

The remarkable finding of this study is the high prevalence of obesity among women. Obesity among women in Syria has reached epidemic levels affecting almost half of those studied, and surpassing levels reported in other Arab countries, including affluent societies with more western influence (19–21). Obesity is more prevalent in Syrian women than in women from other Mediterranean countries, which share many climatic and nutritional patterns with Syria, such as Turkey (29.4%), Greece (15%), and Spain (15.2%) (22–24). Interestingly, obesity is less prevalent among women of Arab origin in the US (25), indicating the importance of local factors. Obesity among women is likely to be rooted in the social norms and gender roles in traditional Arab societies, where women are seen mainly as child bearers and rearers. Confined to their homes, either due to societal traditions or their pressing household duties, women have probably little chance for recreational or sporting activities. In fact gender analysis of physical activity in our population shows that half of women compared to only one fifth of men are in the low activity category (26).

The problem of obesity in women is compounded by the effect of age. In our study, the prevalence of obesity increased with age in both men and women which is consistent with data from other countries (10,27–29). Among women, however, it is alarming that 81% of women in the 46–65 years old age group were obese. In comparison, obesity in the same age group

among US women is 24.4% (30). Although this association is explained, in some references, by physiological factors such as weight gain following menopause and the associated lowering of metabolic consumption (2), the decrease in the level of physical activity with age, especially among women is an important factor. AHS showed that 93% of women aged 46–65 spend more than 14 hours daily indoor compared with 34.8% of men at the same age group (9). These observations reflect social disparities. The adverse health consequences of these disparities such as obesity, are more likely to burden women.

Out data indicate that married adults are more obese than unmarried, and this is true for both men and women, confirming results of other studies (31,32). Two possible explanations for the observed association seem plausible. Married people were more likely to be physically inactive. It is also possible that marriage increases cues and opportunities for eating because married people tend to eat together and thus reinforce each other's increased intake (32).

The association between the prevalence of obesity and the increased consumption of vegetables and fruits and some other food items may reflect the characteristics of nutrition pattern in Syria. Fruits and vegetables are not expensive in Syria and are very available to all social classes. Thus, consumption of these food items likely reflects indulging eating habits rather than health-oriented behavior (26). Obese Syrians eat more than normal-weight Syrians, regardless of what sort of food they eat. For this, detailed food consumption studies with rigorous methodologies are needed

Family size and the number of children have been reported to be related to the prevalence of obesity (9,30,33). In our study we found that the prevalence of obesity among women was positively associated with the number of children. This may be due to age as well as to pregnancy and breast feeding, when women believe that it is healthier for themselves and for their babies to increase their caloric intake (34).

The data revealed that male ex-smokers were more obese than current smokers. Similar findings have been reported in other studies (14,22,35). The smoking-BMI association has been attributed to the effect of smoking on physiological processes that lead to changes in appetite, food preferences, and basal metabolic rates (36)

It seems that a lack of association between obesity and SES in this study is similar to other studies in low-middle income countries (37). One likely explanation for this weak association is that lack of food and/or high energy expenditure patterns become less common in a society after a certain stage of economic development has been reached, even among its poorer social segments (38). Research on the mechanism that link SES to obesity in still scarce in the developing world and this subject certainly deserves more attention from researchers and public health authorities.

Conclusion

This study provides the first population-based estimates of obesity and associated factors in Syria. It shows that the prevalence of obesity among adults is alarmingly high. In the absence of published data on overweight or obesity in Syria, it is difficult to examine any changes in recent years. Nevertheless, the high prevalence of obesity in our study, especially in comparison with those from neighboring or industrialized countries, foreshadows an alarming signal which should be considered one of the major public health problems in Syria. Findings related to gender, age and other factors associated with obesity provide information for further studies and formulation of health policies. The very high prevalence of obesity among women, especially in the older age groups is a matter of great concern. Further studies on other determinants of adult BMI such as nutritional norms and practices, and on the distribution of

BMI in children, are urgently required to obtain a full picture of the burden of overweight and obesity in Syria.

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Appendix 1

Socio-economic status score (maximum 12)

	Score		
	Low (value 0)	**Middle (value 1)**	**High (value2)**
Education Status	Illiterate	<= 9 years	> 9 years
Employment	Unemployed, student	Employed (manual, private, government), retired	Employer, private business (including engineers, lawyers, etc.)
Family income	< 10,000 SL	10,000–20,000 SL	> 20,000 SL

Socio-economic status score (maximum 12)

	Score		
	Low (value 0)	**Middle (value 1)**	**High (value2)**
Household members with paid job	0	1	> 1
Items ownership*	≤2	3–4	> 4, or private car
Density index**	> 2.3	1.5–2.3	< 1.5
Physical activity score (max. 4)			
Regular practice of sports	No	Yes (<3 times/week)	Yes (>3 times/week)
Frequency of >10 minutes walk/past month	None or rarely	1–2 days/week	3 or more days/week

*Items include: TV, Satellite receiver, Phone, Cell phone, AC, PC and private car

Density index = Number of people living in this home/number of rooms

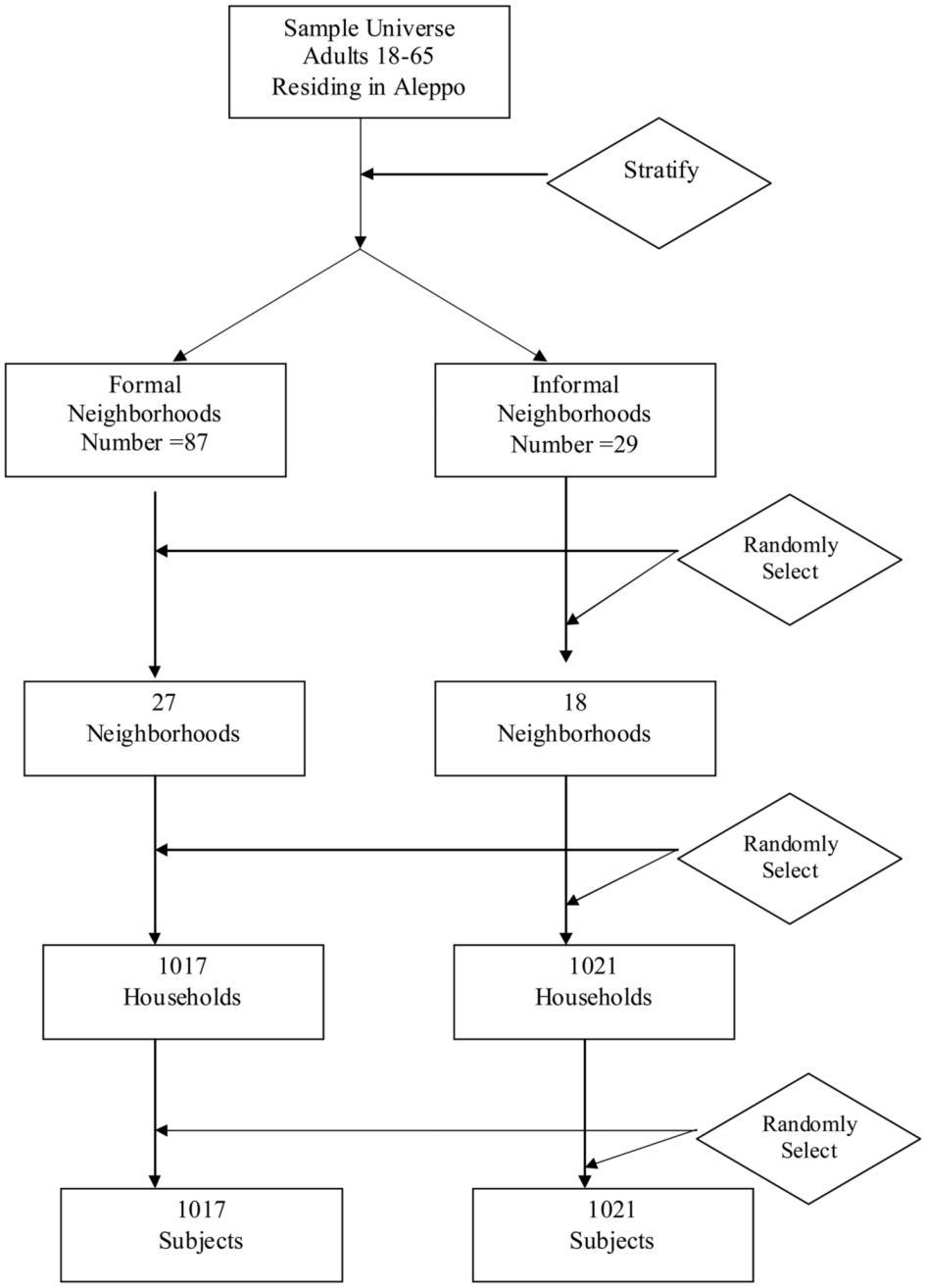

Figure 1. The overall sampling scheme of Aleppo Household Survey

In the 1st step the target population was divided in two strata, forma land informal zones (where residential areas are built illegally or on a land not designated for housing). In the next step residential neighborhood were selected with PPS, and within selected neighborhood household and one adult in were selected with equal probability

Table 1

Basic socio-demographic indicators and anthropometric characteristics of the study participants

	Men	Women	Total
	n (%)	n (%)	n (%)
Age group			
18–29	305 (33.1)	431 (38.6)	736 (36.1)
30–45	398 (43.2)	476 (42.6)	874 (42.9)
46–65	218 (23.7)	210 (18.8)	428 (21.0)
Residency			
Formal	451 (49.0)	566 (50.7)	1017 (49.9)
Non-formal	470 (51.0)	551 (49.3)	1021 (50.1)
Ethnicity			
Arabs	730 (79.3)	895 (80.3)	1625 (79.9)
Non-Arabs	190 (20.7)	219 (19.7)	409 (20.1)
Religion			
Muslim	884 (96.3)	1054 (94.5)	1938 (95.3)
None-Muslims	34 (3.7)	61 (5.5)	95 (4.7)
Education status			
Illiterate	128 (13.9)	297 (26.6)	425 (20.9)
0–12 years	642 (69.7)	699 (62.6)	1341 (65.8)
> 12 years	151 (16.4)	121 (10.8)	272 (13.3)
Occupation			
Student	62 (6.7)	57 (5.1)	119 (5.8)
Employed	792 (86.0)	146 (13.1)	938 (46.0)
Unemployed	67 (7.3)	914 (81.8)	981 (48.1)
Marital status			
Married	710 (77.1)	834 (74.7)	1544 (75.8)
Unmarried	211 (22.9)	283 (25.3)	494 (24.2)
SES score			
(0–3)	180 (19.5)	611 (54.7)	791 (38.8)
(4–5)	390 (42.3)	320 (28.6)	710 (34.8)
(6–12)	351 (38.1)	186 (16.7)	537 (26.3)
Anthropometric measurements			
	Mean±SD	**Mean±SD**	**Mean±SD**
Height (cm)	168.7 ± 6.8	155.3 ± 6.5	161.4±9.4
Weight (kg)	78.1 ± 15.6	72.3 ± 16.8	74.9±16.5
BMI	27.4 ± 5.1	30.0 ± 7.0	28.8±6.4

Table 2

Prevalence of obesity by gender, residency, age group, religion, ethnicity, occupation, level of education, marital status, physical activity, socio-economic status, and number of children.

	Total	Normal		Overweight		Obesity	
	n	n	%	n	%	n	%
Gender **(p<0.001)**							
Male	919	318	34.4	340	36.9	261	28.8
Female	1117	291	25.9	309	27.7	517	46.4
Residency **(p<0.08)**							
Formal	1017	281	27.6	335	32.9	401	39.9
Non-formal	1019	328	32.2	314	30.8	377	37.0
Age group **(p<0.001)**							
18–29	735	386	52.9	230	31.3	119	15.8
30–45	873	168	19.1	313	36.1	392	44.7
46–65	428	55	12.5	106	24.4	267	63.2
Religion **(p<0.5)**							
Muslim	1936	582	29.9	611	31.4	743	38.7
Non-muslim	95	25	26.4	37	39.1	33	34.6
Ethnicity **(p<0.002)**							
Arab	1623	471	29.0	501	30.8	651	40.2
Other	409	137	32.9	147	36.1	125	31.0
Occupation **(p<0.001)**							
Student	119	74	62.8	32	27.0	13	10.2
Employed	937	318	33.3	342	36.5	277	30.2
Unemployed	980	217	21.7	275	27.9	488	50.3
Level of education **(p<0.001)**							
Illiterate	423	81	18.4	129	30.9	213	50.8
0–12 years	1341	435	31.9	417	30.7	498	37.4
> 12 years	272	93	34.2	103	37.8	76	28.0
Marital status **(p<0.001)**							
Not married	494	277	55.3	118	24.1	99	20.5
Married	1542	332	21.0	531	34.4	679	44.5
SES score **(p<0.001)**							
SES (0–3)	789	188	23.3	243	30.5	358	46.3
SES (4–5)	710	236	33.3	234	32.9	240	33.8
SES (6–12)	537	185	33.5	172	32.2	180	34.3
Number of children (female only) **(p<0.001)**							
0	54	12	22.2	17	31.5	25	46.3
1	76	25	32.9	29	38.2	22	28.9
2	132	50	37.9	38	28.8	44	33.3
3	128	17	13.3	41	32.0	70	54.7
4	113	19	16.8	41	36.3	53	46.9
5	126	15	11.9	40	31.7	71	56.3
6–7	147	6	4.1	33	22.4	108	73.5
8	115	5	4.3	24	20.9	86	74.8
Never married	226	142	62.8	46	20.3	38	16.8

$p < 0.05$ according to Chi^2 analysis

Table 3

Prevalence of obesity by lifestyle, diagnosed depression, and treated depression

	Total	Normal		Overweight		Obesity	
	n	n	%	n	%	n	%
Physical activity **(p<0.05)**							
Low (0–1)	759	207	27.4	246	32.0	306	40.6
Middle (2)	1019	310	29.7	317	31.3	392	38.9
High (3–4)	258	92	35.9	86	33.2	80	30.9
Cigarette smoking status **(p<0.001**)							
Never	1076	327	30.4	304	28.1	445	41.5
X-smoker	141	27	17.9	46	33.0	68	49.0
Current	814	252	30.6	298	36.6	264	32.8
Frequency of vegetable intake **(p<0.001**)							
≤2 times weekly	388	123	31.6	150	38.6	115	29.8
≥3 times weekly	1648	486	29.2	499	30.2	663	40.5
Frequency of fruit intake **(p<0.025)**							
≤2 times weekly	1235	386	31.3	406	32.8	443	35.8
≥3 times weekly	801	223	27.6	243	30.5	335	42.0
Frequency of olive oil intake **(p<0.05**)							
≤2 times weekly	451	144	31.3	157	35.4	150	33.3
≥3 times weekly	1585	465	29.3	492	30.8	628	39.9
Frequency of coffee intake **(p<0.001**)							
≤2 times weekly	835	287	34.9	256	30.6	292	34.5
≥3 times weekly	1201	322	26.4	393	32.6	486	41.0
Frequency of tea intake **(p<0.59**)							
≤2 times weekly	345	101	29.3	104	30.2	140	40.6
≥3 times weekly	1691	508	29.8	545	32.2	638	38.0
Frequency of chips intake **(p<0.001**)							
≤2 times weekly	1820	508	27.7	594	32.5	718	39.8
≥3 times weekly	216	101	46.9	55	25.8	60	27.4
Current alcohol use **(p<0.001**)							
no	1902	570	29.7	584	30.6	748	39.7
yes	134	39	29.3	65	47.5	30	23.2
Diagnosed depression **(p<0.5**)							
No	1944	585	29.8	622	32.0	737	38.2
Yes	92	24	27.0	27	28.3	41	44.7
Treated depression **(p<0.05**)							
no	1996	601	29.9	640	32.0	755	38.1
yes	40	8	19.5	9	22.2	23	58.3

$p< 0.05$ according to Chi^2 analysis

Table 4

Odds ratio for obesity in adult female and male for demographic, socio-economic, lifestyle factors, and number of children (logistic regression analysis)

Female N=1108	Odds ratio	95% Confidence interval	*P*
Age Categorized			
18–29	Ref		<0.001
30–45	4.38	2.68–7.15	
46–65	14.66	8.26–26.01	
Ethnicity			
Non-Arab	Ref		0.065
Arab	1.38	0.98–1.93	
Education			
Illiterate	Ref		0.015
0–12 years	1.18	0.78–1.79	
> 12 years	0.45	0.23–0.88	
Number of children			
0–1	Ref		0.019
2–4	1.32	0.89–1.95	
≥5	1.84	1.22–2.78	
Frequency of Vegetable intake			
≤2 times weekly	Ref		0.024
≥ 3 times weekly	1.68	1.07–2.62	
Frequency of olive oil intake			
≤2 times weekly	Ref		0.080
≥ 3 times weekly	1.39	0.96–2.02	
Frequency of Coffee intake			
≤2 times weekly	Ref		0.080
≥ 3 times weekly	1.36	0.96–1.92	
Male N=914			
Age Categorized			
18–29	Ref		0.004
30–45	2.05	1.22–3.43	
46–65	3.02	1.63–5.59	
Religion			
Muslim	Ref		0.089
Non-Muslim	1.84	0.91–3.72	
Marital Status			
not married	Ref		0.026
married	2.62	1.13–6.10	
Cigarette smoking status			
Never	Ref		0.084
x-smoker	1.47	0.81–2.64	
Current	0.77	0.49–1.19	
Frequency of Vegetable intake			
≤2 times weekly	Ref		0.027
≥ 3 times weekly	1.82	1.07–3.09	
Frequency of fruits intake			
≤2 times weekly	Ref		0.057
≥ 3 times weekly	1.44	0.99–2.10	
Drink alcohol–Last month			
No	Ref		0.025
yes	0.46	0.23–0.90	

Variables included in the model are age (categories), religion, ethnicity, occupation, education, marital status, socio-economical scale (categories), physical activities score (categories), cigarette smoking status, frequency of vegetables, fruits, olive oil, coffee, tea and chips intake, alcohol drink, depression and treated depression. ($p < 0.05$ according to Chi^2 analysis)