Prevalence of obesity and its associated factors in Aleppo, Syria

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Summary

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/m².

Results: The prevalence of obesity was 38.2%, higher in women than in men (46.4% and 28.8%, respectively). It increased with age being highest in the 46–65 year-old age group. Obesity was highest among Arabs (40.2%), the unemployed (50.3%), illiterate (50.8%), married (44.5%) especially women with multiparity, low socio-economic status (46.3%), and those with a low physical activity score (40.6%). Obesity was seen among 49% of ex-smokers, 39.7% of non-users of alcohol and 58.3% 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.

KEYWORDS
- Body mass index;
- Obesity;
- Prevalence;
- Associated factors;
- Syria;
- Aleppo

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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.

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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].

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 (2.5 million), the second largest city in Syria, 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 Fig. 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 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 29 as informal. Of these formal and informal zones, 27 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 to 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/m²). Overweight and obesity were defined according to WHO criteria as BMI from 25 to 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 by Single [12].

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

All statistical analyses were performed with SPSS for PC using the complex sample module (version 13.0 for Windows; SPSS. Inc.). A χ² 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). Among men, married participants and ex-smokers had a lower prevalence of obesity. The study did not show a clear relation with socio-economic 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 childbearers 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

| 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)                                  |
| Non-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** |                                   |                                                |                                              |
| Height (cm) | Mean ± SD 168.7 ± 6.8                          | Mean ± SD 155.3 ± 6.5                          | Mean ± SD 161.4 ± 9.4                        |
| Weight (kg) | Mean ± SD 78.1 ± 15.6                         | Mean ± SD 72.3 ± 16.8                         | Mean ± SD 74.9 ± 16.5                        |
| BMI     | 27.4 ± 5.1                                       | 30.0 ± 7.0                                    | 28.8 ± 6.4                                   |

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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

| 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          | %       |
| 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 χ² analysis.
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. Our 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

| Table 3  | Prevalence of obesity by lifestyle, diagnosed depression, and treated depression |
|----------|--------------------------------------------------------------------------------|
|          | Total | Normal | % | Overweight | % | Obesity | % |
| **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 |
| Ex-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 χ² analysis.
Table 4  Odds ratio for obesity in adult females and males by 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        |                 | 1          |                         |     |
| 30–45            | 4.38            | 2.68–7.15  | 0.001                   |
| 46–65            | 14.66           | 8.26–26.01 | 0.001                   |
| **Ethnicity**    |                 |            |                         |     |
| Non-Arab Ref     |                 | 1          |                         |     |
| Arab             | 1.38            | 0.98–1.93  | 0.065                   |
| **Education**    |                 |            |                         |     |
| Illiterate Ref   |                 | 1          |                         |     |
| 0–12 years       | 1.18            | 0.78–1.79  | 0.015                   |
| >12 years        | 0.45            | 0.23–0.88  | 0.015                   |
| **Number of children** |         |            |                         |     |
| 0–1 Ref          |                 | 1          |                         |     |
| 2–4              | 1.32            | 0.89–1.95  | 0.019                   |
| ≥5               | 1.84            | 1.22–2.78  | 0.019                   |
| **Frequency of vegetable intake** |     |            |                         |     |
| ≤2 times weekly  | Ref             | 1          |                         |     |
| ≥3 times weekly  | 1.68            | 1.07–2.62  | 0.024                   |
| **Frequency of olive oil intake** |     |            |                         |     |
| ≤2 times weekly  | Ref             | 1          |                         |     |
| ≥3 times weekly  | 1.39            | 0.96–2.02  | 0.080                   |
| **Frequency of coffee intake** |     |            |                         |     |
| ≤2 times weekly  | Ref             | 1          |                         |     |
| ≥3 times weekly  | 1.36            | 0.96–1.92  | 0.080                   |
| **Male N = 914** |                 |            |                         |     |
| **Age categorized** |                 |            |                         |     |
| 18–29 Ref        |                 | 1          |                         |     |
| 30–45            | 2.05            | 1.22–3.43  | 0.004                   |
| 46–65            | 3.02            | 1.63–5.59  | 0.004                   |
| **Religion**     |                 |            |                         |     |
| Muslim Ref       |                 | 1          |                         |     |
| Non-muslim       | 1.84            | 0.91–3.72  | 0.089                   |
| **Marital status** |                 |            |                         |     |
| Not married Ref  |                 | 1          |                         |     |
| Married          | 2.62            | 1.13–6.10  | 0.026                   |
| **Cigarette smoking status** |     |            |                         |     |
| Never Ref        |                 | 1          |                         |     |
| Ex-smoker        | 1.47            | 0.81–2.64  | 0.084                   |
| Current          | 0.77            | 0.49–1.19  | 0.084                   |
| **Frequency of vegetable intake** |     |            |                         |     |
| ≤2 times weekly  | Ref             | 1          |                         |     |
| ≥3 times weekly  | 1.82            | 1.07–3.09  | 0.027                   |
| **Frequency of fruits intake** |     |            |                         |     |
| ≤2 times weekly  | Ref             | 1          |                         |     |
| ≥3 times weekly  | 1.44            | 0.99–2.10  | 0.057                   |
| **Drank alcohol—last month** |     |            |                         |     |
| No Ref           |                 | 1          |                         |     |
| Yes              | 0.46            | 0.23–0.90  | 0.025                   |

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 χ² analysis).
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 calorific 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

| Score | Low (value 0) | Middle (value 1) | High (value 2) |
|-------|--------------|-----------------|---------------|
| **Socio-economic status score (maximum 12)** | | | |
| 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 |
| Household members with paid job | 0 | 1 | >1 |
| Items ownership<sup>a</sup> | ≤2 | 3–4 | >4, or private car |
| Density index<sup>b</sup> | >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 min walk/past month | None or rarely | 1–2 days/week | 3 or more days/week |

<sup>a</sup> Items include: TV, Satellite receiver, Phone, Cell phone, AC, PC and private car.

<sup>b</sup> Density index = Number of people living in this home/number of rooms.
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