

## Overweight and obesity among adults in Iraq: Prevalence and correlates from a national survey in 2015

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### Abstract

The study aimed to estimate the prevalence and correlates of overweight and obesity among adults in Iraq. Data from a 2015 nationally representative cross-sectional survey of 3,916 persons 18 years and older were analysed that responded to a questionnaire, physical and biochemical measures. Multinomial logistic regression was utilized to predict determinants of overweight and obesity relative to under or normal weight. Results indicate that 3.6% of the participants were underweight (BMI <18.5 kg/m<sup>2</sup>), 30.8% had normal weight (BMI 18.5-24.9 kg/m<sup>2</sup>), 31.8% were overweight (25.0-29.9 kg/m<sup>2</sup>), and 33.9% had obesity (BMI ≥ 30.0 kg/m<sup>2</sup>). In adjusted multinomial logistic regression, aged 40-49 years (Adjusted Relative Risk Ratio-ARRR: 4.47, Confidence Interval-CI: 3.39-5.91), urban residence (ARRR: 1.28, CI: 1.14-2.18), hypertension (ARRR: 3.13, CI: 2.36-4.17) were positively, and male sex (ARRR: 0.47, CI: 0.33-0.68), having more than primary education (ARRR: 0.69, CI: 0.50-

0.94), and larger household size ( $\geq 5$  members) (ARRR: 0.45, CI: 0.33-0.60) were negatively associated with obesity.

**Conclusion:** About two in three adult participants were overweight/obese, and sociodemographic and health risk factors were found that can be utilized in targeting interventions.

**Key words:** overweight, obesity, health behaviour, health status, adulthood

## Introduction

More than half (55%) of all mortality in Iraq was attributable to non-communicable diseases (NCDs) in 2016 [1]. Most NCDs are resulting from poor diet, physical inactivity, tobacco use, and harmful alcohol use leading to metabolic/physical changes including hypertension, diabetes, and overweight and obesity [2]. Worldwide, among adults, the prevalence of obesity ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) was 10.8% among men and 14.9% among women [3]. In several local surveys in sub-regions and clinical populations in Iraq, high proportions of obesity have been reported. For example, in a community-based survey ( $N=1480$  adults in 2017) in Erbil city, Iraq, the prevalence of overweight was 33.4% and obesity 40.9% [4] and in Basrah (Southern Iraq) (2003-2010) 55.1% overweight and obesity [5]. Among non-pregnant women ( $N=200$ ,  $\geq 18$  years) attending out-patient clinics in Baghdad, 39% were overweight and 37% had obesity [6], and among female relatives of primary care-attendees ( $N=440$ ) in Baghdad, Iraq, the prevalence of obesity was 35.2% [7]. In a national STEPS survey in 2005-2006 in Iraq (25-65 years), the prevalence of overweight/obesity was 66.9% [8]. To our knowledge, there are no recent national adult data on the prevalence and correlates of overweight and obesity in Iraq.

In the Eastern Mediterranean region, the prevalence of overweight/obesity among adults ranged from 25% to 81.9% [9]. In Kuwait, the adult (18-69 years, 2014) prevalence of overweight was 37% and obesity 40.3% [10], in Iran the prevalence of overweight/obesity ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) was 59.3% (2016) [11], in Jordan overweight or obesity ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) was 77.2% among men and 74.5% among women ( $\geq 18$  years; 2017) [12] and in Morocco overweight was 35.5% and obesity 20.6% ( $\geq 18$  years; 2017) [13].

Possible risk factors for obesity in the Eastern Mediterranean region may include: “nutrition transition, inactivity, urbanization, marital status, shorter duration of breastfeeding, frequent snacking, skipping breakfast, high intake of sugary beverages, an increase in the incidence of eating outside the home, long periods of time spent viewing television, massive marketing promotion of high fat foods, stunting, perceived body image, cultural elements and food subsidize policy.” [9]. Moreover, middle aged persons [14,15], women [4,15,16], higher socio-economic status [14,15,17], and urban residence [15-18] may increase the odds for overweight/obesity. Some studies showed that tobacco use was inversely associated with overweight/obesity [16,19,20], poor dietary behaviour, such as intake of foods high in fat and sugars, and insufficient fruit and vegetable intake, and physical inactivity were positively associated with overweight/obesity [19-23]. Other studies showed an association between overweight/obesity and NCDs, such as hypertension and diabetes [24,25]. The study

aimed to estimate the national prevalence and correlates of overweight and obesity among adults in Iraq.

## Methods

This is a secondary analysis conducted using nationally representative population-based and cross-sectional data from the “2015 Iraq STEPS survey” [26]. The 2015 Iraq STEPS survey data and more detailed sampling methods can be accessed [26]; the study response rate was more than 93% [26,27]. Briefly, a “multistage cluster sampling was used with stratification to urban and rural areas. Primary sampling units (PSUs) (N=412) were the blocks, which consisted of 70 households or more before selection. One person from each household was randomly selected.” In total, 4,071 persons 18 years or older were potentially eligible in this study. However, 155 individuals were excluded (124 were pregnant and 31 did not have complete anthropometric measurements) so that 3,916 participants were included in the final data analysis. Ethical approval for the study was obtained from the “Republic of Iraq Ministry of Health/Environment Public Health Directorate” and written informed consent was obtained from the participants [27].

## Measures

The standardized anthropometric measuring devices (UNISCALE weighing scale and SICA height measuring tape, and measuring tape for waist circumference measurement) available at the Nutrition Research Institute in Baghdad and the related nutrition units in the governorates were utilized [27]. Body Mass Index (BMI) was classified as “ $<18.5\text{kg/m}^2$  underweight,  $18.5\text{--}24.4\text{kg/m}^2$  normal weight,  $25\text{--}29.9\text{kg/m}^2$  overweight and  $\geq 30\text{ kg/m}^2$  obesity” [27]. Central or abdominal obesity was defined as “waist circumference  $\geq 102\text{ cm}$  for males and  $\geq 88\text{ cm}$  for females” [28,29].

*Hypertension or raised blood pressure (BP)* was defined as “systolic BP  $\geq 140\text{ mm Hg}$  and/or diastolic BP  $\geq 90\text{ mm Hg}$  or where the participant is currently on antihypertensive medication.” [27]

*Diabetes* was defined as “fasting plasma glucose levels  $\geq 7.0\text{ mmol/L}$  ( $126\text{ mg/dl}$ ); or using insulin or oral hypoglycaemic drugs; or having a history of diagnosis of diabetes” [27].

History of *cardiovascular disorder* was asked with questions on having had a heart attack and stroke (Yes, No) [27].

*Health risk behaviour* variables comprised alcohol use, exposure to secondary smoke, smoking status, dietary behaviour (<5 fruit and vegetable servings/day and number of meals outside home in the past week), and sedentary behaviour ( $\geq 8$  hours/day), and “low, moderate or high physical activity based on the Global Physical Activity Questionnaire” [27].

*Sociodemographic information* included age, sex, highest educational level, number of adult household members, and residence status [27]. Household crowding has been found to have an inverse relationship with socioeconomic status [28].

### Data analysis

All statistical procedures were adjusted for complex sample design and conducted with “STATA software version 13.0 (Stata Corporation, College Station, TX, USA)”. The data were weighted “to make the sample representative of the target population in Iraq (by sex and by age group: 18-39, 40-59, 60 and over).” [27]. Chi-square test calculated differences in proportions. Multinomial logistic regression was used to estimate predictors of overweight and obesity (with under or normal body weight forming the reference category). No multicollinearity was detected. Missing values (<5%) were excluded from the analysis.  $P < 0.05$  was considered significant.

## Results

### Sample and body mass index information

The sample consisted 3,916 individuals aged 18 years and older (median age: 40 years, 29-52 interquartile range), and 59.2% were female. More than half of the participants (51.5%) were living with five or more adult household members, 37.2% had less than primary education, and 23.7% lived in rural areas. In all, 3.6% of the study sample was underweight (BMI <18.5 kg/m<sup>2</sup>), 30.8% had normal weight (BMI 18.5-24.9 kg/m<sup>2</sup>), 31.8% overweight (25.0-29.9 kg/m<sup>2</sup>), and 33.9% obesity. Further sample details are shown in Table 1 (see Table 1).

Table 1: Sample and nutritional status by sociodemographic variables

Variable (#missing values)	Sample	Under-weight	Normal weight	Underweight and normal weight	Over-weight	Obesity	p-value
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
<b>All</b>	3916	87 (3.6)	912 (30.8)	999 (34.4)	1279 (31.8)	1638 (33.9)	
Age in years (#10)							
18-29	956 (44.4)	55 (6.9)	395 (46.8)	450 (53.7)	286 (27.6)	220 (18.7)	<0.001
30-44	1389 (26.6)	17 (1.1)	255 (19.8)	272 (21.0)	485 (37.2)	632 (41.8)	
45-59	927 (18.5)	7 (0.7)	122 (12.8)	129 (13.5)	299 (33.3)	499 (53.2)	

60-69	634 (10.5)	8 (1.1)	138 (22.3)	146 (23.4)	208 (33.2)	280 (43.3)	
Sex (#0)							
Female	2318 (59.2)	35 (2.2)	445 (24.5)	480 (26.7)	705 (30.3)	1133 (43.0)	<0.001
Male	1598 (40.8)	52 (4.8)	467 (36.2)	519 (41.0)	574 (33.1)	505 (25.9)	
Education (#22)							
<Primary	1683 (37.2)	28 (2.4)	367 (26.8)	395 (29.1)	500 (29.9)	788 (41.0)	<0.001
Primary	989 (24.4)	20 (2.9)	219 (30.1)	239 (33.0)	349 (33.6)	401 (33.4)	
>Primary	1222 (38.4)	39 (5.3)	321 (35.2)	360 (40.6)	421 (32.2)	441 (27.2)	
Adult household members (#5)							
1-2	1390 (17.3)	20 (1.5)	268 (20.7)	288 (22.2)	460 (34.4)	642 (43.4)	<0.001
3-4	1355 (31.2)	28 (3.3)	321 (28.8)	349 (32.1)	445 (32.4)	561 (35.6)	
≥5	1166 (51.5)	39 (4.6)	323 (35.4)	362 (39.9)	372 (30.5)	432 (29.6)	
Residence (#0)							
Rural	832 (23.7)	19 (3.7)	248 (37.0)	267 (40.7)	244 (28.9)	321 (30.4)	0.022
Urban	3084 (76.3)	68 (3.6)	664 (28.8)	732 (32.4)	1035 (32.7)	1317 (34.9)	
Fruit and vegetable consumption (#18)							
≥5 servings	870 (20.9)	22 (3.5)	187 (28.9)	209 (32.4)	295 (32.3)	366 (35.3)	0.636
<5 servings	3028 (79.1)	65 (3.7)	720 (31.2)	785 (34.9)	979 (31.6)	1264 (33.5)	
Meals outside home (#92)							
0	2232 (52.7)	51 (3.7)	501 (29.5)	552 (33.2)	717 (31.0)	963 (35.8)	0.005
1	778 (20.3)	16 (4.0)	172 (27.2)	188 (31.2)	268 (34.7)	322 (34.1)	
≥2	814 (27.0)	20 (3.5)	228 (37.0)	248 (40.5)	257 (30.7)	309 (28.8)	
Physical activity (#3)							
Low	2174 (52.2)	50 (3.3)	463 (28.0)	513 (31.3)	671 (30.2)	990 (38.5)	<0.001
Moderate	906 (22.6)	15 (3.2)	214 (28.0)	229 (31.3)	304 (33.7)	373 (35.1)	
High	833 (25.2)	22 (4.7)	234 (38.9)	256 (43.6)	304 (33.4)	273 (23.0)	
Sedentary behaviour (#42)							
<8 hours/day	2753 (73.0)	58 (3.4)	671 (32.1)	729 (35.5)	902 (31.6)	1122 (32.9)	0.093
≥8 hours/day	1121 (27.0)	27 (4.1)	230 (26.6)	257 (30.6)	359 (32.3)	505 (37.1)	
Smoking status (#0)							
Never	2946 (71.3)	58 (3.7)	642 (29.6)	700 (33.2)	942 (30.7)	1304 (36.0)	<0.001
Past	318 (7.4)	4 (0.8)	70 (24.7)	74 (25.6)	103 (33.8)	141 (40.6)	
Current	652 (21.3)	25 (4.5)	200 (36.8)	225 (41.2)	234 (34.5)	193 (24.3)	
Passive smoking (#8)							
No	1740 (39.4)	27 (2.6)	388 (29.5)	415 (32.1)	571 (30.3)	754 (37.6)	0.025
Yes	2168 (60.6)	59 (4.2)	520 (31.4)	579 (35.7)	708 (32.8)	881 (31.5)	
Ever alcohol use (#2)							
No	3820 (97.6)	86 (3.7)	891 (30.8)	977 (34.5)	1239 (31.4)	1604 (34.0)	0.058
Yes	94 (2.4)	1 (0.5)	20 (25.9)	21 (26.4)	40 (46.4)	33 (27.2)	
Hypertension (#27)							
No	2183 (63.8)	76 (2.9)	661 (30.3)	737 (33.2)	733 (31.3)	713 (35.5)	<0.001
Yes	1706 (36.2)	11 (0.2)	246 (11.8)	257 (12.0)	536 (33.0)	913 (55.0)	
Type 2 diabetes (#204)							
No	3116 (86.0)	74 (1.6)	761 (21.9)	835 (23.4)	1022 (32.9)	1259 (43.6)	<0.001
Yes	596 (14.0)	6 (1.7)	108 (17.4)	114 (19.1)	188 (28.8)	294 (52.1)	
Heart attack or stroke (#5)							
No	3670 (95.5)	84 (3.7)	875 (31.6)	959 (35.3)	1191 (31.4)	1520 (33.3)	<0.001
Yes	241 (4.5)	2 (0.7)	37 (13.3)	39 (14.0)	86 (39.3)	116 (46.8)	

The highest proportion of underweight was in the 18 to 29 years age group (6.9%, 8.5% in males and 4.6% in females), while the highest proportion of general and central obesity was in the 45 to 59 years age group (64.2% general obesity among women and 41.4% among men, and 91.8% central obesity among women and 56.4% among men) (see Table 2).

Table 2: Nutritional status by age and sex

	General weight status (Body Mass Index)		
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Variable	Under-weight	Normal weight	Overweight	Obesity	Central obesity	p-value
	%	%	%	%	%	
Age in years, female						
18-29	4.6	40.2	31.2	24.0	44.3	<0.001
30-44	0.6	16.5	32.0	50.9	80.6	
45-59	0.7	8.4	26.6	64.2	91.8	
60-69	0.8	19.2	29.2	50.8	86.9	
Age in years, male						
18-29	8.5	51.5	25.0	15.0	15.5	<0.001
30-44	1.6	23.2	42.5	32.7	38.4	
45-59	0.7	17.4	40.5	41.4	56.4	
60-69	1.4	25.3	37.0	36.3	56.1	

### Multinomial logistic regression for overweight and obesity

Factors positively associated with obesity were aged 40-49 years (Adjusted Relative Risk Ratio-ARRR: 4.47, Confidence Interval-CI: 3.39-5.91), urban residence (ARRR: 1.28, CI: 1.14-2.18), and hypertension (ARRR: 3.13, CI: 2.36-4.17), and negatively associated with obesity were male sex (ARRR: 0.47, CI: 0.33-0.68), having more than primary education (ARRR: 0.69, CI: 0.50-0.94), and larger household size ( $\geq 5$  members) (ARRR: 0.45, CI: 0.33-0.60). Apart from educational level, all these associations were also found for overweight (see Table 3).

Table 3: Multivariable associations with overweight and obesity (with under or normal weight as reference category)

Variable	Overweight		Obesity	
	Adjusted RRR (95% CI)	p-value	Adjusted RRR (95% CI)	p-value
Age in years				
18-39	1 (Reference)		1 (Reference)	
40-49	2.66 (1.98, 3.57)	<0.001	4.47 (3.39, 5.91)	<0.001
50 or more	1.20 (0.81, 1.80)	0.362	1.41 (0.90, 2.21)	0.131
Sex				
Female	1 (Reference)		1 (Reference)	
Male	0.73 (0.53, 1.00)	0.051	0.47 (0.33, 0.68)	<0.001
Education				
<Primary	1 (Reference)		1 (Reference)	
Primary	1.04 (0.75, 1.45)	0.790	0.87 (0.63, 1.19)	0.372
>Primary	0.96 (0.71, 1.29)	0.770	0.69 (0.50, 0.94)	0.020
Adult household members				
1-2	1 (Reference)		1 (Reference)	
3-4	0.62 (0.45, 0.83)	0.002	0.48 (0.35, 0.65)	<0.001
$\geq 5$	0.57 (0.43, 0.74)	<0.001	0.45 (0.33, 0.60)	<0.001
Residence				
Rural	1 (Reference)		1 (Reference)	
Urban	1.45 (1.08, 1.95)	0.014	1.58 (1.14, 2.18)	0.006
Meals outside home				
0	1 (Reference)		1 (Reference)	
1	1.28 (0.94, 1.76)	0.118	1.30 (0.92, 1.85)	0.140
$\geq 2$	1.01 (0.71, 1.44)	0.938	1.29 (0.88, 1.90)	0.194
Physical activity				
Low	1 (Reference)		1 (Reference)	

Moderate	1.10 (0.81, 1.49)	0.533	1.03 (0.76, 1.40)	0.852
High	0.96 (0.69, 1.32)	0.784	0.72 (0.50, 1.04)	0.082
Smoking status				
Never	1 (Reference)		1 (Reference)	
Past	1.13 (0.62, 2.05)	0.691	1.23 (0.75, 2.02)	0.406
Current	1.00 (0.71, 1.39)	0.991	0.72 (0.48, 1.08)	0.110
Passive smoking				
No	1 (Reference)		1 (Reference)	
Yes	1.07 (0.83, 1.39)	0.595	0.99 (0.73, 1.33)	0.944
Hypertensive				
No	1 (Reference)		1 (Reference)	
Yes	2.18 (1.62, 2.94)	<0.001	3.13 (2.36, 4.17)	<0.001
Type 2 diabetes				
No	1 (Reference)		1 (Reference)	
Yes	1.07 (0.72, 1.60)	0.730	1.18 (0.77, 1.81)	0.446
Heart attack or stroke				
No	1 (Reference)		1 (Reference)	
Yes	1.49 (0.86, 2.59)	0.154	1.40 (0.83, 2.35)	0.204

RRR=Relative Risk Ratio; CI=Confidence Interval

## Discussion

In this national 2015 Iraq STEPS survey, the found prevalence of overweight (31.8%,  $\geq 25.0 - 29.9 \text{ kg/m}^2$ ) and obesity (33.9%,  $\text{BMI} \geq 30.0 \text{ kg/m}^2$ ) or overweight/obesity (65.7%), seems much similar to previous local investigations, e.g., in Erbil city (33.4% overweight and 40.9% obesity) [4], in Basrah 55.1% were overweight or had obesity [5], females in out-patient clinics in Baghdad (39% overweight and 37% obesity) [6], among female relatives of primary care-attendees in Baghdad (35.2% obesity) [7], the 2005-2006 Iraq national STEPS survey (66.9% overweight or obesity, 25-65 years) [8], and in Kuwait (37% overweight and 40.3% obesity) [10], but lower than in Jordan ( $>75\%$  overweight or obesity) [12], and higher than in Iran (59.3% (2016) [11], in Morocco (35.5% overweight and 20.6% obesity ( $\geq 18$  years; 2017) [13], and global estimates (10.8% of men and 14.9% of women obesity) [1]. The high prevalence of obesity in this study may have contributed to the high prevalence of diabetes (14.0%) and hypertension (36.2%) in this study. Generally, the high prevalence of overweight and obesity in Iraq might be attributed to a continued demographic and epidemiological transition, economic improvement, and redistribution of wealth after political changes [7].

Consistent with previous studies [14,15-17], this study found that being female, being middle aged, and higher economic status (less household crowding), and residing in urban areas were associated with having overweight and/or obesity. Obesity interventions may be reinforced targeting women, middle aged, those with higher economic status, and those residing in urban areas. Of concern is as well that 55.2% of young women and 40.0% of young men aged 18-29 years were already overweight or obese, showing that a large



proportion of overweight/obesity is already established in early adulthood. Therefore, obesity interventions starting in childhood or adolescents should be prioritized in Iraq [10]. One additional factor contributing to a higher rate of obesity among women than in men, may be related to cultural restrictions limiting access to exercise [12]. This study found that higher education was protective against obesity, which is in line with a review showing that in middle income countries “education may protect against the obesogenic effects of increased household wealth as countries develop.” [30] and a study in Kuwait [10]. People with higher education may be more concerned with their health and consequently adopt a healthier lifestyle [12].

This study did not find an association between dietary behaviour (inadequate fruit and vegetable intake and having meals outside home) and overweight or obesity, unlike some previous research [19-21]. In agreement with previous studies [4,10,14,16,19,20,22,23], this study showed in bivariate analysis that current smoking,, passive smoking and physical activity were inversely associated with overweight and obesity. Smoking may act on body weight “by increasing energy expenditure and inhibiting the expected compensatory increase in caloric intake.” [31]. As shown previously [10,24,25], we found an association between NCDs (hypertension and in univariate analysis diabetes) and overweight/obesity. Some of the recommendations by the STEP report Iraq include a dietary and physical activity interventions, including “Promotion of urban planning and transportation policies supportive of physical activity; implementation of setting based physical activity programs at school and workplaces; enactment of nutritional policies using food products marketing, and initiation of indoor programmes on healthy diet and physical exercise targeting the female and the elderly [27].

### **Study limitations**

Apart from physical and biomedical measures self-reported questionnaire data may have suffered from biased responses. Another limitation was the crossectional nature of the survey, which does not allow for causative conclusions.

### **Conclusion**

The study found in the 2015 adult national Iraq STEPS survey that about two in three participants were overweight/obese. Several risk factors, including sociodemographic (middle aged 40-49 year-olds, female sex, lower education, higher economic status, and urban

residence) and hypertension, were identified for overweight and/or obesity, which can be targeted in interventions.

### **Availability of data and materials**

“The data for the current study are publicly available at the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>).”

### **Competing interests**

“The authors declare that they have no competing interests.”

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### **Authors’ contributions**

“All authors fulfil the criteria for authorship. SP and KP conceived and designed the research, performed statistical analysis, drafted the manuscript and made critical revision of the manuscript for key intellectual content. All authors read and approved the final version of the manuscript and have agreed to authorship and order of authorship for this manuscript.”

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“The data source, the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>), is hereby acknowledged.”

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