DHS WORKING PAPERS

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2014 No. 115

DEMOGRAPHIC
AND
HEALTH
SURVEYS

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September 2014

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ACKNOWLEDGMENTS

The authors would like to thank ICF International staff for their support during implementation of this study. Special thanks to Laurie Liskin, Sara Bradley, Shireen Assaf, and Tom Pullum for their advice and thoughtful suggestions.

Recommended citation:

Al-Nsour, Mohannad, and Ali Arbaji. 2014. *Obesity and Related Factors among Jordanian Women of Reproductive Age Based on Three DHS Surveys, 2002-2012*. DHS Working Papers No. 115. Rockville, Maryland, USA: ICF International.

EXECUTIVE SUMMARY

Objectives: The main objective of this study is to analyze the trends in obesity among Jordanian women of reproductive age over the 10-year period from 2002 to 2012 based on three Demographic and Health Surveys (DHS). Furthermore, the study aims to analyze the possible factors predicting obesity among Jordanian women.

Methodology: The individual and household member data sets for each survey provided data for ever-married and unmarried women, respectively. The body mass index (BMI) of each woman was calculated by dividing her weight in kilograms by the square of her height in meters. A binary variable identifying women with BMI of 30 kg/m^2 and above as obese was used throughout for descriptive, bivariate and multivariate analyses. Two sets of analyses were performed, one for all women and the other for ever- married women only. Each set of analyses covers the three DHS surveys, which were conducted in 2002, 2009 and 2012. For multivariate analysis, in addition to three models of standard logistic regression for individual surveys, we used a multi-level fixed effect model for the pooled data.

Independent variables included age, education, place of residence, wealth quintiles and marital status. For the ever-married sample additional variables related to parity, use of contraceptive method, smoking and working status were used. We used STATA version 12 to consolidate the data sets and the survey data analysis module in STATA to perform descriptive and multivariate analyses.

Results: No major differences in mean BMI or the prevalence of obesity were observed among women of reproductive age across the three examined surveys. The mean BMI of the all-women sample was approximately 27 kg/m^2 for the three surveys, while in the ever-married sample it went was slightly higher, at 29 kg/m^2. The prevalence of obesity for all women ranged from 26.3 percent in 2002 to 28.7 percent in 2012. In the ever-married women sample, the lowest prevalence of obesity occurred in 2002, at 37.4 percent, and the highest in 2009, at 38.9 percent. The prevalence of obesity ranged across the surveys from 8 percent to 13 percent for never-married women and from 37 percent to 39 percent for ever-married women. Even after adjustment for the age differences between these groups, the never-married were less likely to be obese than the ever-married.

The mean BMI for the all-women sample fell within the normal range, at around 23 kg/m^2, for the youngest group, age 15-19, while it increased to fall within the range of obesity, at about 32 kg/m^2, for the eldest group, age 45-49. In all three surveys the prevalence of obesity increased consistently across the five-year increments of age, starting at about 5-7 percent in the all-women sample for the youngest group and reaching 60-66 percent for the eldest group. The same trend was noted among the ever-married women.

The prevalence of obesity among women with higher education was less than that among women with no or only primary education. The prevalence of obesity for the overall sample in the higher education group ranged from 20 percent to 22 percent in the three surveys. By comparison, the prevalence of obesity among the lowest education group ranged from 44 percent to 49 percent. A similar pattern was observed for the ever-married women sample, but with somewhat higher percentages.

The percentage of obese women was consistently the lowest in the central region—26 percent in 2002 and 27 percent in the 2009 and 2012 surveys. The highest prevalence among regions was 33 percent in the south in 2009 for the all-women sample. For ever-married women, the percentage that was obese was the lowest, at 36 percent to 38 percent, in the central region and the highest, at 39 percent to 46 percent, in the south, depending on the survey year.

No major differences in the prevalence of obesity were observed based on residence in urban areas or in refugee camps. The same was true for wealth quintiles and working status.

For the ever-married sample, obesity was consistently more prevalent among non-smokers by a difference of four to five percentage points. As for contraceptive use, the prevalence of obesity was lowest among users of a traditional method, ranging from 33 percent to 35 percent across surveys, while those not using any contraceptive method had the highest prevalence, ranging from 39 percent to 42 percent.

The prevalence of obesity ranged from 48 percent to 51 percent among women with more than three children compared with 22 percent to 28 percent among women with fewer than 2 children, depending on the survey year.

Multivariate analysis for the all-women and ever-married samples identified age, education, marital status and region of residence as significant predicators of women's obesity

throughout the four models. The likelihood of a woman being obese increased with age, marriage, less education and residence in the southern or northern regions. Living in Badia areas was significantly associated with a lower likelihood of obesity only in the 2012 data. Poverty (as measured by wealth quintile), urban–rural residence and residence in camps were insignificant as predicators of women's obesity.

Among the additional variables in the ever-married women sample, having four and more children increased the likelihood of obesity compared with having fewer children. In some models smoking was associated with a lower likelihood of obesity. Non-users of contraceptives had a higher likelihood of obesity compared with method users, but this finding was not consistent across all models. Working status has no role in predicting obesity among women.

Conclusion: The high prevalence of obesity among Jordanian women raises the flag of urgent need for programmatic interventions. There is a pressing need to increase the awareness of decision-makers of the consequences of overweight and obesity in order to promote legislation and regulations that help to control and prevent overweight and obesity. There is also a need to empower women to take decisions that help to avoid overweight and obesity. Finally, a national program to prevent and control overweight and obesity with multi-component interventions should be considered.

1. INTRODUCTION

According to the World Health Organization, overweight and obesity have reached epidemic proportions globally. It is estimated that in 2008 more than 1.4 billion people were overweight, and at least 500 million of them were clinically obese. About 65 percent of the world's population lives in countries where overweight and obesity kills more people than underweight. This includes all high-income and middle-income countries. Globally, 44 percent of diabetes, 23 percent of ischemic heart disease and 7–41 percent of certain cancers are attributable to overweight and obesity. (WHO 2014a)

Jordan is a middle-income country possessing epidemiological features of developed countries in terms of non-communicable diseases and their risk factors, including overweight and obesity. While overall health conditions in Jordan appear good, judged by a life expectancy of 73 years and an infant mortality rate of 17 per 1000 live births, lifestyles have become a threat to individual health and societal well-being. The effects of unhealthy diets and sedentary lifestyles are evident in the current epidemic of overweight in Jordan. In 2007 about two-thirds of Jordanian adults age 18 years or older were overweight or obese; only one-third had a BMI in the normal range. (MOH 2007)

Epidemiologic research has shown the negative impacts of overweight and obesity, as well as of physical inactivity and associated poor cardio-respiratory fitness, on morbidity and mortality. (HHS 1999) Furthermore, the 2007 Jordan Behavior Risk Factors Survey (age 18+) revealed a prevalence of diabetes among those age 18 and older of 18.5 percent, impaired glucose tolerance among over 24 percent, hypertension at 26 percent, and hypercholesterolemia at 36 percent. Over 60 percent did not practice any regular physical activity. These conditions are commonly associated with overweight or obesity. (Misra et al. 2007; Chan and Woo 2010)

The main objective of this study is to analyze the trends in obesity among Jordanian women of reproductive age over the 10-year period from 2002 to 2012 based on the Demographic and Health Surveys carried during this period. Furthermore, the study aims to analyze the possible factors predicting obesity among Jordanian women.

Risks associated with overweight or obesity could be many. Still, the most obvious factors leading to overweight or obesity are recognized to be excessive intake of energy-dense

food, lack of physical activity, and sedentary life style. Unfortunately, our analysis is limited to variables available in DHS data sets, and Jordan DHS surveys do not collect data on food intake and physical activity.

2.   METHODOLOGY

Data for this study come from three Demographic and Health Surveys (DHS) conducted in Jordan over a period of one decade, specifically in 2002, 2009, and 2012. A fourth regular DHS survey, carried out in 2007, was excluded from this analysis because of noticeable flaws in data collection on anthropometric measurements and anemia. The individual and household member data sets for each survey were used to get data for ever-married and unmarried women respectively. The ever-married women individual data set is limited to those who slept in the household on the night preceding the survey (*de facto*). Therefore, only *de facto* women were included from the household member data set for the all-women sample.

The obesity variable for the study was derived from data on BMI collected in individual and household member data files. The BMI of each woman was calculated by dividing her weight in kilograms by the square of her height in meters. Women having a BMI of 30 kg/m^2 and above were considered obese, while women with a BMI of less than 30 kg/m^2 were classified as not obese. Pregnant and postpartum women as well as women with a BMI of less than 12 or more than 60 were excluded from the analysis. The generated binary obesity variable was used throughout for descriptive, bivariate and multivariate analyses.

Marital status was recoded to become a binary variable of ever-married and never-married. The wealth quintiles variable was recoded into two categories, first two quintiles categorized as poor and the other three quintiles as not poor. The terms "poor" versus "not poor" used in the narrative relate only to wealth quintiles as described and may not reflect actual poverty status. Because of small proportion of women with no education, the education variable was recoded into three categories, consisting of primary or less, secondary, and higher education. Two sets of analyses were performed, one for all women and the other for ever-married women only. Each set of analyses covered the three DHS surveys.

The descriptive analysis presents BMI mean and the prevalence of obesity with 95 percent confidence intervals by different background variables. The bivariate analysis presents the overall significance level for all categories, where bivariate linear regression was used for BMI mean and Pearson χ^2 test for obesity prevalence.

For comparison among categories of non-binary background variables, completely overlapping confidence intervals denote the absence of significant difference, while lack of overlap indicates significance at the 95 confidence level.

Three models based on the Jordan DHS data used standard single-level multivariate logistic regression analysis to include obesity as the dependent variable. Independent variables for all women (ever-married and never-married women) included age, education, region, urban-rural residence, Badia residence, Palestinian refugee camp residence, wealth quintiles, and marital status. Data on Badia residence were not available in the 2002 survey, and data on refugee camp residence were available only in the 2012 survey. Additional independent variables for the ever-married sample concerned parity, use of contraceptive method, smoking, and working status. All explanatory variables entered in the models were categorical except for the age variable.

In many regression applications observations have some kind of clustering, with observation within clusters tending to be correlated, especially for multi-stage clustering design. Furthermore, the assumption of independence of observations within a cluster does not hold because the subjects share the same cluster. Moreover, when the clustered outcomes are binary, a mixed effect logistic regression model is applicable. Therefore, a fourth model of two-level mixed effect logistic regression (containing fixed and random effects) was developed using the pooled data from all three surveys.

The mean BMI for the primary sampling units (or clusters) ranged from about 20 to 37 kg/m^2. Primary sampling units were used as a second level for the mixed effect logistic regression. Estimates of the cluster-specific parameters are presented for random-effects modeling. The null hypothesis is that there is no significant difference between single and multi-level random effect models. The likelihood ratio test between the multi-level random effect model and the single-level logistic model were significantly different, indicating that the random effect model provides a better fit. All explanatory variables available in all three surveys, in addition to the year of the survey, were used in this model.

Explanatory variables were tested for multicollinearity; the variance inflation factor (VIF) was found to be consistently less than 2 for various models, which indicates that predicator

variables are not collinearly associated. Thus, no variables were dropped from the models. Odds ratios with significance level and 95 percent confidence intervals are presented for all models.

STATA version 12 was used to consolidate data sets and for analysis. The survey data analysis module was used for descriptive, bivariate, and multivariate analysis. For pooled data the cluster variable was created based on the year of the survey and the cluster number variable. The strata variable was created based on governorate, urban–rural, Badia, and camp residence variables for 2012, to include 43 strata, and for the 2009 survey excluding the camp residence variable, to include 35 strata. Only region and urban–rural residence was used for the 2002 survey, to include six strata. The created cluster and strata as well as the standard relative weight variables were used to set up the multistage survey design for analysis.

3.   RESULTS

3.1.   Overall Sample

Table 1 shows the distribution of mean BMI and percentage of obese women by main background variables and serves as the reference for all descriptive and bivariate analyses throughout this section. Table 2 depicts three models of binary logistic regression on obesity for the surveys and the fourth model for pooled data using multi-level mixed logistic regression and will serve as the reference for multivariate analysis for section 3.1. Both tables present data for all women.

The total weighted number of cases was 7,681 for the 2002 survey, 6,666 for the 2009 survey, and 10,312 for the 2012 survey.

3.1.1.   Year of the survey

Differences in mean BMI among surveys were less than one-half percentage point. Mean BMI was 26.6 in 2002, 27.0 in 2009, and 26.8 kg/m^2 in 2012 as seen in Table 1. The differences in mean BMI were found to be not significant (p-value = 0.138). The percentage who were obese rose about two percentage points from 2002 to 2009 (26.3 to 28.7) but fell between 2009 and 2012, such that the overall increase from 2002 to 2012 was one about percentage point (26.3 to 27.4). Differences in obesity prevalence among years was not significant (p-value = 0.131).

Pooled data show that the odds of a woman being obese were 25 percent higher in 2009 than in 2002, while there was no difference between 2002 and 2012.

3.1.2.   Woman's age

The distributions of mean BMI and of the prevalence of obesity by age showed similar patterns in all three surveys (Figure 1). For the youngest group, 15-19, the mean BMI, at around 23 kg/m^2, fell within the normal range. In contrast, for the oldest group, 45-49, the mean BMI, at about 32 kg/m^2, fell within the obesity range. The prevalence of obesity increased consistently with the five-year increments of age, starting at about 6 percent in the youngest age group and rising to over 60 percent for the eldest group. The differences in mean BMI and in the prevalence of obesity among age groups were statistically significant in all three surveys (see Table 1).

6

Regression analysis showed that, in the pooled model, the odds of a woman being obese increased by 10 percent for every additional year of age. Logistic regression models for each survey showed similar results, with odds ratios of 1.11 for 2002 and 2009 and 1.09 for 2012 (see Table 2). Differences in all models were highly significant, with p values of less than 0.001. Adding an interaction term between age and marital status led to only minor changes in the odds ratios and did not change the significance of the results.

Figure 1. Distribution of mean BMI (bars) and proportion of obesity (lines) by women's age groups and year of the survey for all women age 15-49 years
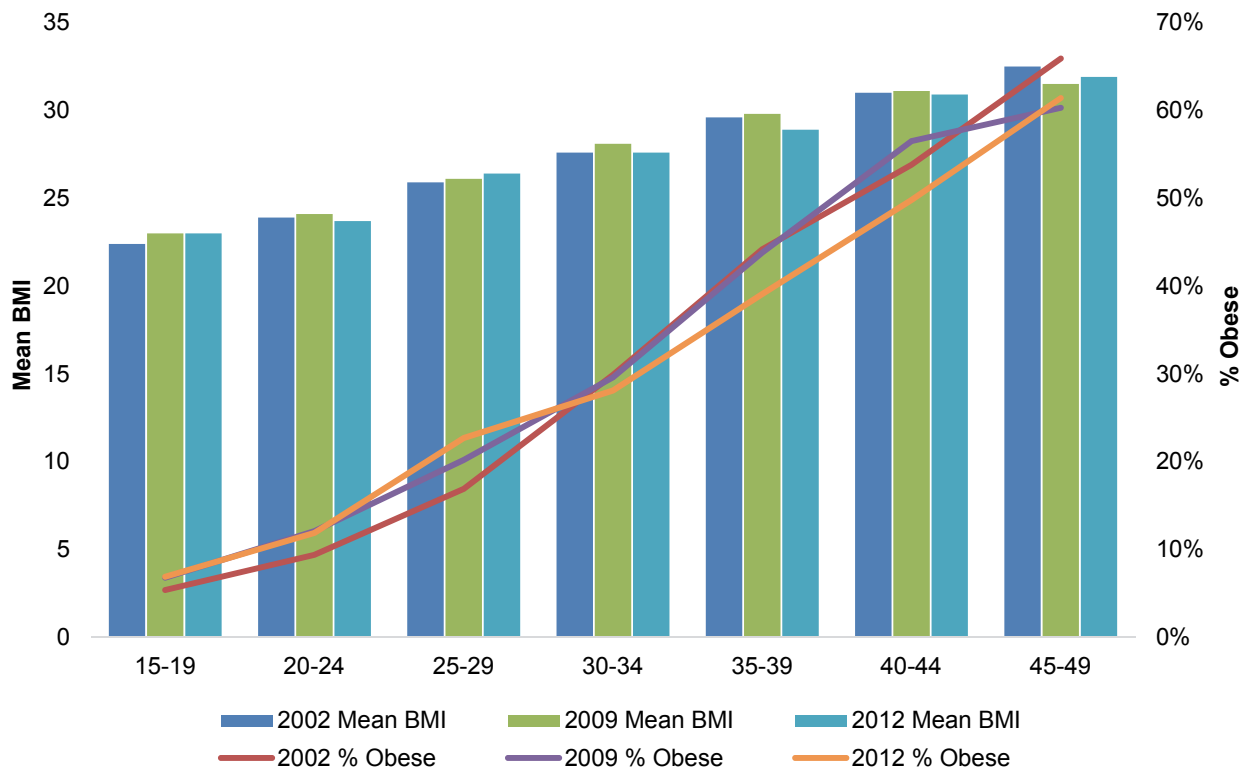
3.1.3. Educational categories

Figure 2 shows lower prevalence of obesity and lower mean BMI with higher level of education. The mean BMI was highest for the least educated group, at close to 30 kg/m^2, and lowest for women with higher education, at about 26 kg /m^2. The relationship of education to obesity is clear: In all three surveys women with no education have more than twice the

likelihood of obesity as women with higher education. These differences are highly significant (see Table 1).

As shown in Table 2, multivariate analysis of pooled data indicates that the odds of women with higher education being obese are 40 percent lower than for women with no or primary education—a significant difference. Figures for individual-year models showed that the odds of women being obese and belonging to the highest education group, for the 2002, 2009, and 2012 surveys, respectively, are 0.45, 0.55, and 0.54 times the odds for women in the lowest education categories. These differences, too, are statistically significant.

Figure 2. Distribution of mean BMI (bars) and proportion of obesity (lines) by educational category and year of the survey for all women age 15-49 years, Jordan Demographic and Health Surveys 2002, 2009, and 2012
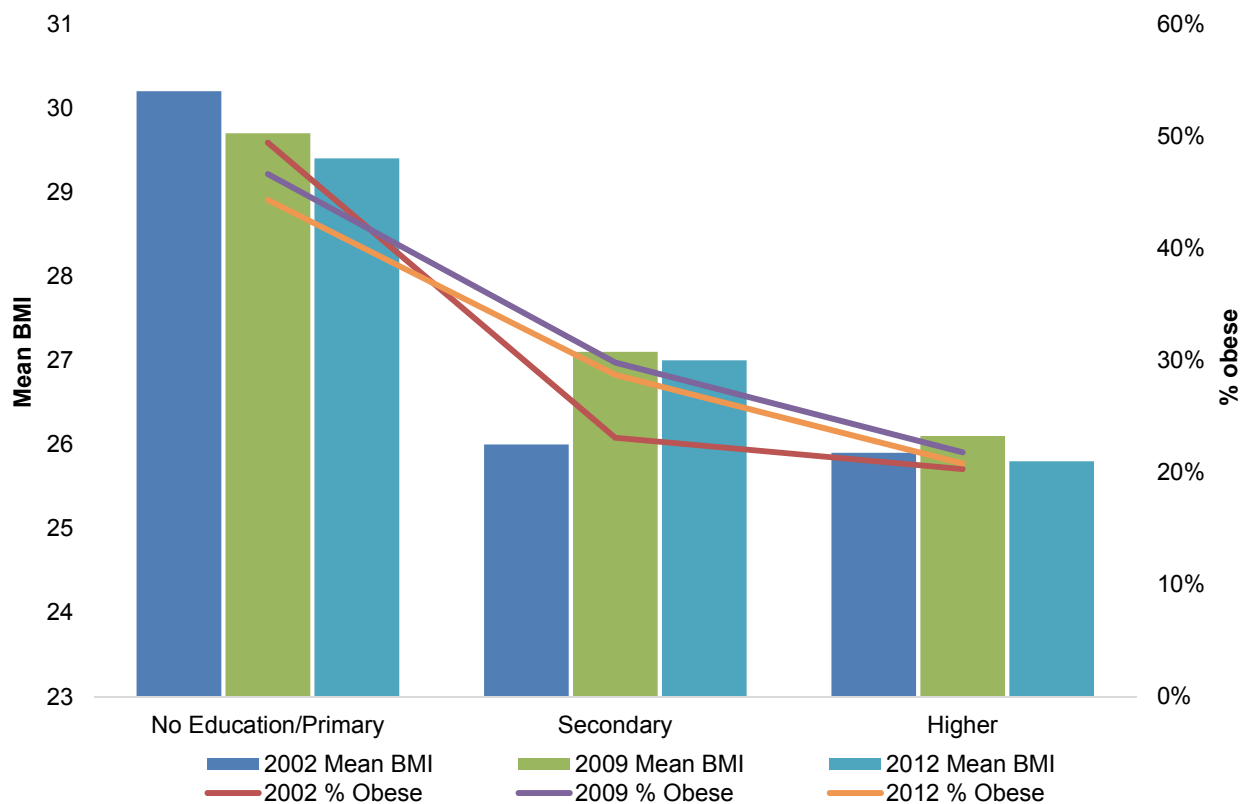
3.1.4. Geographical location

No major differences were observed among regions or across surveys in mean BMI, with figures of around 27 kg/m^2. The percentage of women who were obese was consistently the lowest in the central region, however, compared with women in the northern and southern regions. Differences were most pronounced in the 2009 survey, when 27 percent of women in the central region were obese compared with 30 percent in the northern region and 33 percent in the southern region. The 2002 and 2012 surveys did not show much variation among regions. As shown in Table 1, the differences in mean BMI as well as obesity prevalence among regions were statistically significant only in the 2009 survey.

No major observed differences in mean BMI are seen between rural and urban residents in any of the surveys. The prevalence of obesity was almost identical among rural and urban residents in the 2002 and 2012 surveys. The 2009 survey showed a higher prevalence of obesity, in rural areas, at 31 percent, than in urban areas, at 28 percent. However, differences in mean BMI and in the prevalence of obesity were not significant in any survey.

In the 2012 survey only, the mean BMI of Badia residents, at 26.8 kg/m^2, was significantly higher than the mean BMI of non-Badia residents, at 26.2 kg/m^2. In 2009 the means of BMI were statistically similar at 27 and 27.2 kg/m^2. In 2009 residence in the Badia was associated with higher prevalence of obesity, at over 30 percent, than residence elsewhere, at 28.6 percent. This observation was reversed for the 2012 survey, with Badia residents showing less prevalence of obesity, at 24 percent, than non-residents, at 28 percent. Only the difference in 2012 was significant, and that marginally so (p-value = 0.045).

According to the 2012 data, the prevalence of obesity among women residing in Palestinian refugee camps based was only one percentage point higher than for women residing outside the camps (28.3 and 27.4, respectively). This difference is not statistically significant.

Multivariate analysis, as shown in Table 2, found significant differences in the prevalence of obesity among regions. The pooled model reveals that the odds of a woman being obese and residing in the northern and southern regions were 23 percent and 29 percent higher, respectively, than the odds for those living in the central region. In the 2002 survey only, the northern region had a significant odds ratio, 1.21, compared with the central region. The regional

difference was most noticeable in the 2009 survey, where the northern and the southern regions showed significant odds ratios of 1.29 and 1.53, respectively. In 2012 the odds of women being obese and residing in the south were 25 percent higher than for women living in the central region, but there was no difference between the central and northern regions. Badia residence was a significant factor only for the 2012 survey, where the odds of women residing in Badia area and being obese were 27 percent lower than the odds for women living outside the Badia. Urban–rural residence was not a significant predicator of women's obesity in any of the individual models. The pooled model showed 8 percent lower odds of obesity among women living in rural areas than among those living in urban areas. Refugee camp residence made no significant differences to the prevalence of obesity among women in 2012.

3.1.5. Wealth index

The mean BMIs for both poor and not-poor categories of wealth was close to the survey means for the 2002 and 2009 surveys, with no statistically significant differences. In 2012 the mean BMI for the poor category, at 27.3 kg/m^2, was significantly higher than that for the non-poor population, at 26.5 kg/m^2. In the 2002 survey the prevalence of obesity among poor women was less than one percentage point higher than for the not-poor, but the difference was more evident for the other two surveys. In the 2009 and 2012 surveys, the prevalence of obesity among poor women was 30 percent compared with 28 percent among the not-poor in 2009 and 30 percent compared 26 percent in 2012. The difference was significant only in 2012 (p-value = 0.007).

Poverty as measured by the wealth index was not a significant predictor of obesity in any of the four models except for 2012 (see Table 2). The 2012 model shows that poverty is associated with women's obesity; the odds of being obese were 20 percent greater for a poor woman than for a not-poor woman.

3.1.6. Marital status

Descriptive analysis shows that the mean BMI of never-married women lay with the normal range at 23 to 24 kg/m^2, while the mean BMI of married women was 29 kg/m^2 across the three surveys—a significant difference. The prevalence of obesity among never-married women ranged between 8 and 10 percent across the surveys, while the prevalence among ever-married

women ranged between 37 percent and 39 percent. Bivariate analysis showed highly significant differences in the prevalence of obesity between the marital status categories in all three surveys.

Figure 3 shows the prevalence of obesity by marital status after adjusting for age using the population distribution by 5-year age groups provided in the individual DHS surveys. Age standardization was performed to control for the effect of age as the mean age was around 21 years for not married women compared to 35 years for ever-married women across surveys. With age adjustment, a less pronounced trend of higher prevalence of obesity among ever-married compared with non-married women was observed.

Figure 3. Age-adjusted prevalence of obesity by marital status and year of survey for women age 14-49, Jordan Demographic and Health Surveys 2002, 2009, and 2012
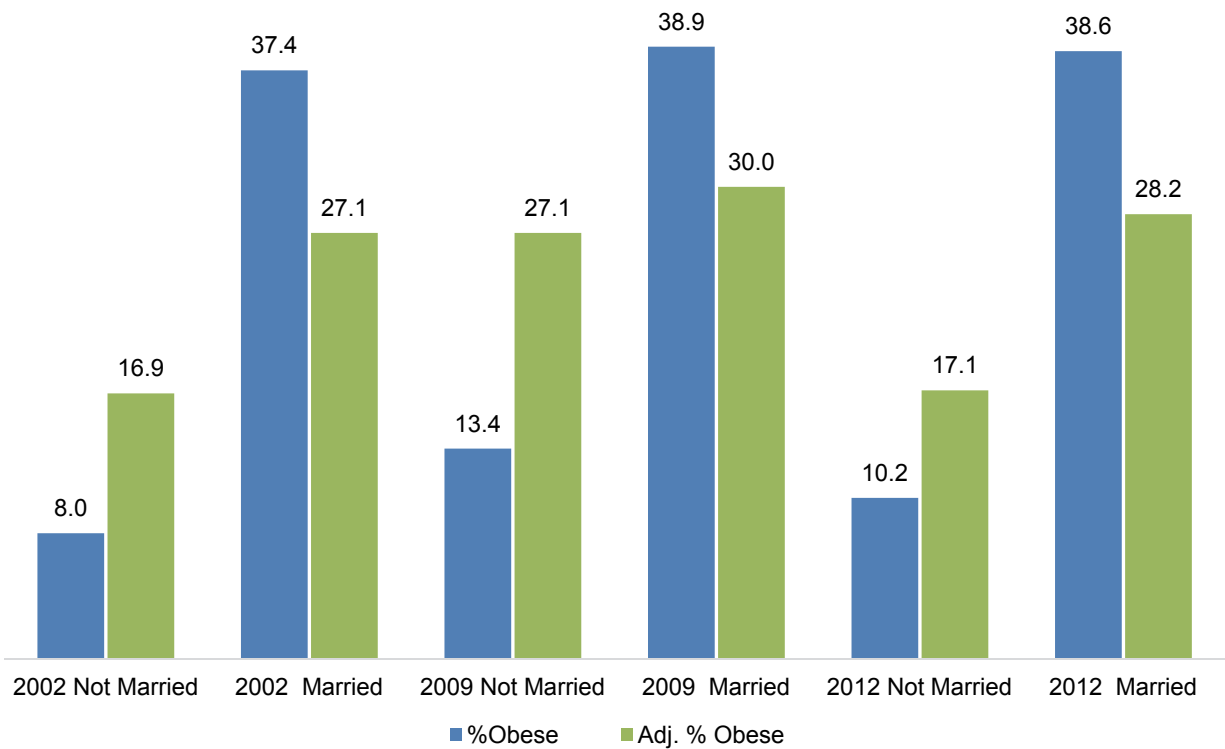
The pooled model shows that the odds of a woman being obese were 77 percent higher for ever-married than for never-married women. The differences in these odds, at 90 percent in the 2002 model and 84 percent in the 2012 model, were statistically significant.

Table 1. Distribution of mean BMI and prevalence of obesity by background variables for all women age 15-49 years, Jordan Demographic and Health Surveys 2002, 2009, and 2012

Variable	2002		2009		2012	
	Mean BMI [95% CI]	% obese [95% CI]	Mean BMI [95% CI]	% obese [95% CI]	Mean BMI [95% CI]	% obese [95% CI]
Total	26.6 [26.4-26.8]	26.3 [25-27.5]	27.0 [26.7-27.3]	28.7 [26.7-30.6]	26.8 [26.6-27]	27.4 [26-28.9]
*p value**	= 0.138 for means and = 0.131 for proportions among years of the survey					
Age						
15-19	22.4 [22.2-22.7]	5.4 [4-6.7]	23.0 [22.7-23.3]	6.8 [5-8.7]	23.0 [22.7-23.3]	6.9 [5.2-8.6]
20-24	23.9 [23.6-24.2]	9.4 [7.6-11.2]	24.1 [23.6-24.6]	12.1 [9-15.3]	23.7 [23.3-24.2]	11.9 [9.3-14.4]
25-29	25.9 [25.5-26.3]	16.9 [14.2-19.6]	26.1 [25.6-26.6]	20.2 [16.2-24.3]	26.4 [25.9-27]	22.7 [18.8-26.5]
30-34	27.6 [27.2-27.9]	29.9 [26.8-32.9]	28.1 [27.5-28.6]	29.6 [23.7-35.5]	27.6 [27.2-28.1]	28.1 [24.7-31.6]
35-39	29.6 [29.3-30]	44.2 [40.9-47.5]	29.8 [29.1-30.5]	43.8 [37.8-49.9]	28.9 [28.3-29.4]	39.1 [34.5-43.7]
40-44	31.0 [30.5-31.5]	53.8 [49.5-58]	31.1 [30.6-31.7]	56.5 [51.5-61.6]	30.9 [30.2-31.5]	49.8 [45.3-54.4]
45-49	32.5 [31.9-33]	65.9 [61.5-70.3]	31.5 [30.6-32.4]	60.3 [51.4-69.1]	31.9 [31.2-32.5]	61.4 [56.6-66.3]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Education						
No/primary	30.2 [29.8-30.7]	49.4 [45.9-53]	29.8 [28.9-30.6]	46.6 [40.4-52.7]	29.4 [28.5-30.3]	44.3 [38.9-49.7]
Secondary	26.0 [25.8-26.2]	23.1 [21.6-24.5]	27.1 [26.8-27.4]	29.8 [27.6-32.1]	27.0 [26.6-27.3]	28.7 [26.5-30.8]
Higher	25.9 [25.6-26.3]	20.3 [18-22.7]	26.1 [25.7-26.6]	21.8 [18.4-25.2]	25.8 [25.5-26.1]	20.8 [18.6-23.1]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Region						
Central	26.5 [26.3-26.8]	25.7 [23.9-27.5]	26.8 [26.4-27.2]	27.2 [24.3-30.1]	26.7 [26.4-27.1]	26.9 [24.7-29]
North	26.8 [26.5-27]	27.6 [25.8-29.4]	27.2 [26.9-27.6]	30.2 [27.5-32.9]	26.8 [26.6-27.1]	27.9 [26-29.8]
South	26.5 [26.1-26.9]	26.2 [23.8-28.7]	27.6 [27.3-28]	33.0 [30.7-35.4]	27.1 [26.8-27.4]	29.7 [27.4-31.9]
p value	0.513	0.265	0.006	0.044	0.270	0.289

(Continued...)

Table 1. – *Continued*

Variable	2002 Mean BMI [95% CI]	2002 % obese [95% CI]	2009 Mean BMI [95% CI]	2009 % obese [95% CI]	2012 Mean BMI [95% CI]	2012 % obese [95% CI]
Urban–rural residence						
Urban	26.7 [26.4-26.9]	26.3 [24.8-27.8]	27.0 [26.7-27.3]	28.3 [26-30.6]	26.8 [26.5-27.1]	27.4 [25.7-29.1]
Rural	26.3 [26-26.6]	26.2 [24.1-28.3]	27.2 [26.8-27.6]	30.5 [27.8-33.2]	26.8 [26.5-27.1]	27.7 [25.8-29.6]
p value	0.093	0.941	0.354	0.225	0.892	0.783
Badia residence						
Non-Badia			27.0 [26.7-27.3]	28.6 [26.5-30.6]	26.8 [26.6-27.1]	27.7 [26.1-29.2]
Badia			27.2 [26.6-27.8]	30.1 [25.6-34.5]	26.2 [25.8-26.6]	24.3 [21.4-27.1]
p value			0.456	0.542	0.005	0.045
Camp residence						
Non camps					26.8 [26.5-27]	27.4 [25.9-28.9]
Camps					27.2 [26.8-27.6]	28.3 [25.5-31]
p value					0.081	0.595
Wealth						
Not poor	26.5 [26.2-26.8]	26.0 [24.3-27.8]	26.8 [26.5-27.2]	27.7 [25.1-30.3]	26.5 [26.2-26.8]	25.8 [23.8-27.8]
Poor	26.8 [26.5-27]	26.7 [24.9-28.4]	27.3 [26.9-27.6]	30.3 [27.7-32.8]	27.3 [26.9-27.6]	29.8 [27.8-31.8]
p value	0.152	0.608	0.090	0.150	0.001	0.007
Marital status						
Never-married	23.2 [23-23.5]	8.0 [6.7-9.3]	24.2 [23.8-24.6]	13.4 [11-15.7]	23.5 [23.3-23.8]	10.2 [8.7-11.7]
Ever-married	28.6 [28.4-28.9]	37.4 [35.6-39.1]	28.9 [28.6-29.2]	38.9 [36.5-41.3]	28.9 [28.6-29.2]	38.6 [36.5-40.7]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

* *p value* for mean BMI is based on bivariate linear regression

* *p value* for % obese is based on Pearson χ^2 test

Table 2. Logistic regression on obesity by background variables for all women age 15-49 years, Jordan Demographic and Health Surveys 2002, 2009, and 2012 and pooled data

Variable	2002 Odds Ratio [95% CI]	2009 Odds Ratio [95% CI]	2012 Odds Ratio [95% CI]	Pooled Odds Ratio [95% CI]
Year				
2002				1.00 (Ref)
2009				1.25*** [1.14-1.38]
2012				1.09 [1.00-1.18]
Age	1.11*** [1.10-1.12]	1.11*** [1.09-1.12]	1.09*** [1.08-1.10]	1.10*** [1.09-1.10]
Education				
No/primary	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Secondary	0.72** [0.60-0.88]	0.97 [0.71-1.33]	0.84 [0.63-1.13]	0.87** [0.79-0.96]
Higher	0.45*** [0.36-0.57]	0.55** [0.39-0.78]	0.54*** [0.39-0.74]	0.60*** [0.54-0.67]
Region				
Central	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
North	1.21* [1.05-1.40]	1.29* [1.03-1.61]	1.18 [1.00-1.40]	1.23*** [1.13-1.34]
South	1.10 [0.91-1.33]	1.53*** [1.24-1.89]	1.25* [1.04-1.51]	1.29*** [1.18-1.40]
Urban–rural residence				
Urban	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Rural	0.97 [0.84-1.13]	1.09 [0.86-1.38]	1.06 [0.90-1.24]	0.92* [0.85-1.00]
Badia residence				
Non-Badia		1.00 (Ref)	1.00 (Ref)	
Badia		1.02 [0.70-1.49]	0.73** [0.58-0.91]	
Camp residence				
Non-camps			1.00 (Ref)	
Camps			0.92 [0.75-1.14]	

(Continued...)

Table 2. – *Continued*

Variable	2002 Odds Ratio [95% CI]	2009 Odds Ratio [95% CI]	2012 Odds Ratio [95% CI]	Pooled Odds Ratio [95% CI]
Wealth				
Not poor	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Poor	1.02 [0.87-1.19]	1.04 [0.84-1.27]	1.20* [1.01-1.43]	0.97 [0.90-1.03]
Marital status				
Never married	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Ever-married	1.90*** [1.54-2.35]	1.20 [0.90-1.60]	1.84*** [1.45-2.34]	1.77*** [1.62-1.93]

* p<0.05, ** p<0.01, *** p<0.001

3.2.   Ever-Married Women Sample

Table 3 shows the distribution of mean BMI and prevalence of obesity by main background variables and serves as the reference for all descriptive and bivariate analysis throughout this section. Table 4 depicts three models of multivariate binary logistic regression on obesity for the three DHS surveys and a fourth model for pooled data using multi-level mixed logistic regression; it serves as the reference for the multivariate analysis presented in this section. Both tables utilize data for ever-married women only.

The total weighted number of ever-married women was 4,778 for the 2002 survey, 4,000 for the 2009 and 6,258 for the 2012 survey.

3.2.1. Year of the survey

As shown in Table 3, no differences among the three surveys in mean BMI, which was about 29 kg/m^2 in all three surveys.

Only minor differences in the prevalence of obesity among ever-married women of reproductive age were observed among the 2002, 2009, and 2012 surveys. The prevalence of obesity was lowest in 2002, at 37 percent, compared with about 39 percent for both 2009 and 2012 (see Table 3). There was no statistically significant difference in obesity prevalence among surveys (p-value = 0.584).

Multivariate analysis of pooled data shows a significant difference between the 2002 and 2009 surveys only. The likelihood of a woman being obese in 2009 was 19 percent greater than in 2002.

3.2.2. Woman's age

While the mean BMI, at around 24 kg/m^2, fell within the normal range for the youngest group (age 15-19), for the oldest group (45-49), at about 32 kg/m^2, it fell within the obesity range. The difference in the mean BMI across the seven age categories was highly significant in all three surveys (see Table 3).

Obesity prevalence consistently increased with five-year increments of age starting at figures ranging between 7 percent in 2012 and 15 percent in 2009 for the youngest age group. In contrast, levels of obesity among women in the oldest group ranged from 61 percent in 2009 to 67 percent in 2002. The difference in the prevalence of obesity among age groups was highly significant, with p value less than 0.001.

Regression analysis for the pooled model showed that the odds of a woman being obese increased by 9 percent for every additional year of age (see Table 4). Individual survey models had similar results, with the likelihood of a woman's being obese increasing by 8 percent with each year of age in 2002 and 2009 and 9 percent in 2012. Differences in all models were highly significant, with a p value less than 0.001.

3.2.3. Educational categories

Through all three surveys mean BMI ranged from a low of about 28 kg/m^2 for ever-married women in the higher education category to about 31 kg/m^2 for women with no education or only primary education. The differences in the mean BMI among the educational categories revealed highly significant differences in all surveys (see Table 3).

Obesity was most prevalent among women with no or primary education, ranging from 51 percent in 2012 and to 56 percent in 2002. In contrast, the prevalence of obesity was lowest among the women of the higher education group, at about 31 percent in the 2009 and 2012 surveys and about 28 percent in the 2002 survey. Differences in the prevalence of obesity in the three educational categories were highly significant in each of the three surveys.

The multi-level mixed model for pooled data shows that the odds of a woman with higher education being obese are 32 percent lower than the odds for a woman with no or primary education—a significant difference. For each survey individually, this difference in likelihood was 49 percent in 2002, 43 percent in 2009, and 42 percent in 2012.

3.2.4. Parity

The mean BMI for a woman with four or more children was around 30 kg/m^2 in all three surveys, while the mean for women with one or no children ever born was consistently about 27 kg/m^2. There were highly significant differences in mean BMI among parity categories in each of the survey years (see Table 1).

Among women with four or more children, the prevalence of obesity was 49.5 percent in 2002 and 51 percent in 2009. In contrast, the prevalence of obesity was almost half these rates among women with one child or none as well as women with 2-3 children. The 2012 survey revealed that the prevalence of obesity was 1.7 times greater among women with four or more children than among those with one child or none (see Table 3). These differences in obesity prevalence by parity were highly statistically significant in all three surveys.

Except for the 2012 survey, the various multivariate analyses in Table 4 showed significant differences in obesity for women with four children or more compared with women with one child or none. The odds ratios for women having 2-3 children were not significant in all four models. The pooled model showed that the odds of an ever-married woman being obese and having more than four children were 42 percent higher than the odds for a woman with one child or none. This difference amounted to 82 percent in 2002 and 75 percent in 2009.

3.2.5. Geographical location

Regional differences in mean BMI did not go beyond one unit in the 2002 and 2012 surveys and just above one unit in 2009. The differences in mean BMI between the regions were significant in 2002 and 2009 but not in 2012 (see Table 3).

As with the all-women sample, the prevalence of obesity was consistently lower in the central region than in the other two regions in all three surveys (see Table 3). The percentage of obese women ranged from 36 to 38 for the central region and over 40 percent for the other two

regions, reaching over 46 percent in the south in 2009. The differences in the prevalence of obesity between the regions were significant in the 2002 and 2009 surveys but not in 2012.

As in the overall sample, the mean BMI for ever-married women did not vary between urban and rural residents. There was no difference in mean BMI in 2002, and the difference was less than one unit higher among rural residents in the other two surveys. The prevalence of obesity was consistently lower among urban residents, with figures ranging from 37 to 38 percent, than among rural residents, with prevalence ranging from 39 to 44 percent across surveys. Between urban and rural residents, differences in mean BMI as well as prevalence of obesity were significantly different only in the 2009 survey.

Badia or non-Badia residence did not have much effect on mean BMI; levels were the same among Badia and non Badia residents in the 2009 survey and less than one unit higher among urban residents in the 2012 survey, which was not significant. In 2009 the prevalence of obesity among Badia residents was higher, at 42 percent, than among non-Badia residents, at 39 percent. The 2012 survey found the prevalence of obesity just two percentage points higher among non-Badia residents. In both surveys the bivariate analysis showed no statistical differences in the prevalence of obesity with Badia or non-Badia residence.

The mean BMI and the prevalence of obesity did not vary among ever-married women whether they lived in or outside Palestinian refugee camps.

The pooled multivariate mixed level model showed significant differences in the prevalence of obesity among regions (see Table 4). The odds of obesity for women residing in the northern and southern regions were 24 and 27 percent higher than for women in the central region. The 2002 model showed higher odds only for the northern region compared with the central region, with a statistically significant odds ratio of 1.24. The 2009 model showed the most pronounced differences—40 percent higher in the north and 70 percent higher in the south than in the central region. Non-Badia residence significantly predicted obesity only in the 2012 survey, where the odds of a woman living in the Badia and being obese were 0.71 times the odds of a woman living outside Badia areas. Levels of obesity among urban and rural residents as well as among women living in and outside the refugee camps were similar, with no statistically significant difference in any model.

3.2.6. Wealth index

The mean BMIs for poor and not-poor categories were similar, with less than one unit difference across surveys. The difference was significant in the 2002 and the 2012 surveys. The prevalence of obesity in 2002 was lower among poor women, at 35 percent, than among the not-poor, at 39 percent (p-value = 0.026). In 2012 the trend was reversed, with poor women having a higher prevalence of obesity, at 42 percent, compared with 36 percent for the not-poor (p-value = 0.008). In 2009 the prevalence of obesity among the two groups was almost the same, at about 39 percent (p-value = 0.650).

Poverty, as measured by the two categories based on the wealth index, was not a significant predicator of obesity in any of the four logistic regression models (see Table 4).

3.2.7. Contraceptive use

Contraceptive use made little difference to mean BMI across the surveys. The prevalence of obesity among users of traditional methods was the lowest, ranging from 33 to 35 percent among the surveys, while non-users had the highest prevalence, ranging from 39 to 42 percent. Differences were significant only in 2012 (p-value = 0.030) as shown in Table 3.

The pooled mixed model revealed that women using traditional or modern contraceptive methods had 15 percent and 14 percent lower odds, respectively, of being obese than non-users (see Table 4). In the individual survey models, only the 2009 survey showed a significant difference—a 28 percent lower likelihood of obesity among users of traditional methods than among non-users.

3.2.8. Smoking

The mean BMI of smokers was generally about one unit lower than that of non-smokers, with a statistical difference between the two smoking status categories only in the 2002 survey (see Table 3). Obesity was consistently more prevalent among non-smokers by four to five percentage points in all surveys. However, the differences in the prevalence of obesity were not statistically significant in any of the surveys (see Table 3).

As shown in Table 4, the mixed level model shows that smoking women had 0.69 times the odds of being obese as non-smokers. Among the individual year regression models, only

2009 showed a significant difference—a 41 percent lower likelihood of smokers being obese when compared with smokers.

3.2.9. Working status

As shown in Table 3, the mean BMI was similar for women who were working and those who were not working. The prevalence of obesity was lower among working women by one to four percentage points. These differences were not statistically significant, and the four logistic regression models failed to show working status to be a predicator of obesity.

Table 3. Distribution of mean BMI and prevalence of obesity by background variables, ever-married women age 15-49 Years, Jordan Demographic and Health Surveys 2002, 2009, and 2012

	2002		2009		2012	
Variable	**Mean BMI [95% CI]**	**Percent obese [95% CI]**	**Mean BMI [95% CI]**	**Percent obese [95% CI]**	**Mean BMI [95% CI]**	**Percent obese [95% CI]**
Total	28.6 [28.4-28.9]	37.4 [35.6-39.1]	28.9 [28.6-29.2]	38.9 [36.5-41.3]	28.9 [28.6-29.2]	38.6 [36.5-40.7]
*p value**	= 0.329 for means and = 0.584 for proportions among years of the survey					
Age						
15-19	24.3 [23.3-25.3]	11.6 [4.7-18.5]	24.4 [22.8-25.9]	14.5 [0.1-28.8]	23.7 [22.4-25]	6.6 [2.0-11.3]
20-24	24.7 [24.2-25.2]	13.7 [10.4-17.1]	25.8 [24.9-26.7]	18.3 [12.3-24.2]	24.8 [24.1-25.5]	17.0 [11.6-22.4]
25-29	26.4 [25.9-26.8]	19.1 [15.9-22.3]	26.3 [25.8-26.9]	20.7 [16-25.4]	27.0 [26.4-27.7]	24.6 [19.9-29.3]
30-34	27.8 [27.4-28.1]	30.8 [27.6-34.1]	28.1 [27.5-28.6]	28.9 [22.5-35.2]	27.8 [27.3-28.3]	28.8 [25.1-32.6]
35-39	29.8 [29.4-30.3]	45.2 [41.7-48.7]	29.7 [29-30.3]	42.6 [36.5-48.8]	29.1 [28.6-29.7]	40.3 [35.5-45.2]
40-44	31.1 [30.5-31.6]	54.6 [50.2-59]	31.1 [30.6-31.7]	57.0 [51.9-62.1]	31.2 [30.5-32]	52.0 [47.1-57]
45-49	32.5 [31.9-33.1]	66.5 [62-71]	31.5 [30.5-32.4]	60.6 [51.2-70]	32.2 [31.5-32.9]	63.6 [58.3-68.9]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

(Continued...)

Table 3. – *Continued*

Variable	2002 Mean BMI [95% CI]	2002 Percent obese [95% CI]	2009 Mean BMI [95% CI]	2009 Percent obese [95% CI]	2012 Mean BMI [95% CI]	2012 Percent obese [95% CI]
Education						
No/primary	31.1 [30.6-31.5]	55.1 [51.3-58.8]	30.5 [29.7-31.3]	52.3 [45.7-58.8]	30.8 [29.8-31.7]	51.2 [45.6-56.9]
Secondary	28.3 [28-28.6]	35.1 [32.9-37.3]	29.1 [28.7-29.5]	40.6 [37.4-43.9]	29.1 [28.7-29.5]	40.1 [37.3-42.9]
Higher	27.5 [27.1-27.9]	28.5 [25-32]	27.9 [27.5-28.4]	30.6 [26.6-34.6]	27.9 [27.4-28.3]	30.9 [27.3-34.5]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Parity						
One child or none	26.5 [25.9-27]	21.7 [18.1-25.4]	26.6 [26-27.2]	23.1 [18.8-27.5]	27.0 [26.3-27.6]	28.3 [24-32.6]
2-3 children	26.5 [26.1-26.8]	21.0 [18.2-23.7]	27.5 [27.1-27.9]	25.8 [21.5-30]	27.6 [27.2-28.1]	28.5 [25.1-31.8]
4 and more children	30.2 [30-30.5]	49.5 [47.3-51.7]	30.4 [30-30.7]	51.0 [47.7-54.2]	30.3 [30-30.7]	48.2 [45.6-50.8]
p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Region						
Central	28.4 [28-28.7]	35.7 [33.3-38.1]	28.4 [28-28.8]	35.7 [32.5-39]	28.8 [28.4-29.3]	37.6 [34.5-40.7]
North	29.2 [28.8-29.5]	41.1 [38.4-43.9]	29.6 [29.1-30]	43.5 [39.6-47.5]	29.0 [28.6-29.3]	39.5 [36.9-42.1]
South	28.8 [28.3-29.3]	38.6 [35.3-42]	29.7 [29.4-30.1]	46.1 [43.2-49.1]	29.3 [29-29.7]	42.6 [39.6-45.6]
	0.014	0.004	<0.001	0.003	0.240	0.134
Urban–rural residence						
Urban	28.6 [28.3-28.9]	36.9 [34.8-39]	28.8 [28.4-29.1]	38.0 [35.2-40.7]	28.9 [28.5-29.2]	38.1 [35.7-40.5]
Rural	28.6 [28.2-28.9]	39.1 [36.3-41.9]	29.4 [29-29.8]	43.7 [40.5-46.9]	29.1 [28.7-29.4]	41.0 [38.2-43.9]
p value	0.762	0.210	0.023	0.008	0.522	0.122
Badia residence						
Non-Badia			28.9 [28.6-29.2]	38.6 [36.1-41.1]	29.0 [28.6-29.3]	38.7 [36.5-40.9]
Badia			29.0 [28.5-29.5]	41.7 [36-47.5]	28.2 [27.5-28.9]	36.6 [31.4-41.9]
p value			0.651	0.327	0.058	0.472

(Continued...)

Table 3. – *Continued*

Variable	2002		2009		2012	
	Mean BMI [95% CI]	**Percent obese [95% CI]**	**Mean BMI [95% CI]**	**Percent obese [95% CI]**	**Mean BMI [95% CI]**	**Percent obese [95% CI]**
Camp residence						
Non-camps					28.9 [28.6-29.2]	38.6 [36.4-40.8]
Camps					29.4 [28.8-29.9]	38.7 [34.5-42.8]
p value					0.139	0.971
Wealth						
Not poor	28.9 [28.5-29.3]	39.1 [36.4-41.9]	28.9 [28.6-29.3]	38.5 [35.6-41.3]	28.6 [28.2-28.9]	36.2 [33.4-39]
Poor	28.3 [28-28.6]	35.0 [32.7-37.2]	28.8 [28.4-29.2]	39.5 [35.9-43.1]	29.4 [28.9-29.9]	42.0 [38.9-45.2]
p value	0.028	0.026	0.594	0.650	0.004	0.008
Contraceptive use						
Not using	28.9 [28.5-29.3]	39.4 [36.5-42.2]	29.0 [28.5-29.6]	40.2 [36.1-44.3]	29.4 [28.8-30]	42.3 [38.8-45.9]
Traditional method	28.3 [27.8-28.8]	34.9 [31-38.8]	28.7 [28.2-29.2]	32.9 [27.7-38]	28.3 [27.7-28.9]	34.5 [29.7-39.3]
Modern method	28.5 [28.2-28.8]	36.6 [34.2-39]	28.8 [28.4-29.3]	40.3 [36.4-44.3]	28.8 [28.5-29.2]	37.7 [34.6-40.8]
	0.140	0.136	0.591	0.083	0.163	0.030
Smoking status						
No	28.7 [28.5-29]	37.9 [36.2-39.7]	28.9 [28.6-29.2]	39.5 [37.1-41.9]	28.9 [28.6-29.2]	39.4 [37.1-41.7]
Yes	27.7 [27-28.4]	32.5 [26.8-38.2]	28.4 [27.4-29.4]	33.7 [26.2-41.2]	28.8 [28-29.6]	35.2 [30.3-40.2]
p value	0.003	0.079	0.305	0.153	0.676	0.144
Working status						
No	28.7 [28.4-28.9]	37.5 [35.7-39.4]	28.9 [28.6-29.3]	39.5 [36.8-42.1]	28.9 [28.6-29.3]	38.8 [36.4-41.2]
Yes	28.3 [27.7-28.9]	35.7 [30.8-40.5]	28.5 [27.8-29.2]	35.4 [29.7-41]	28.8 [28.3-29.3]	37.7 [32.6-42.8]
p value	0.284	0.468	0.230	0.210	0.610	0.727

* *p value* for mean BMI is based on bivariate linear regression

* *p value* for % obese is based on Pearson χ^2 test

Table 4. Logistic regression on obesity by background variables for ever-married women age 15-49 for individual DHS Surveys and pooled data, Jordan Demographic and Health Surveys, 2002, 2009, and 2012

Variable	2002 Odds ratio [95% CI]	2009 Odds ratio [95% CI]	2012 Odds ratio [95% CI]	Pooled odds ratio [95% CI]
Year				
2002				1.00 (Ref)
2009				1.19*** [1.07-1.31]
2012				1.08 [0.98-1.18]
Age	1.08*** [1.07-1.10]	1.08*** [1.06-1.11]	1.09*** [1.07-1.10]	1.09*** [1.08-1.09]
Education				
No/primary	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Secondary	0.80* [0.65-0.98]	0.96 [0.69-1.33]	0.92 [0.69-1.22]	0.97 [0.87-1.08]
Higher	0.51*** [0.39-0.66]	0.57** [0.38-0.83]	0.58** [0.41-0.82]	0.68*** [0.60-0.77]
Parity				
One child or none	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
2-3 children	0.96 [0.71-1.29]	1.18 [0.81-1.71]	0.91 [0.66-1.24]	1.01 [0.89-1.14]
4 and more children	1.82*** [1.36-2.44]	1.75** [1.20-2.57]	1.13 [0.82-1.56]	1.42*** [1.24-1.61]
Region				
Central	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
North	1.24** [1.06-1.45]	1.40** [1.09-1.80]	1.13 [0.94-1.36]	1.24*** [1.13-1.36]
South	1.04 [0.85-1.27]	1.70*** [1.37-2.11]	1.20 [0.98-1.46]	1.27*** [1.15-1.40]
Urban–rural residence				
Urban	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Rural	0.97 [0.82-1.13]	1.07 [0.83-1.38]	1.12 [0.94-1.33]	0.95 [0.87-1.03]
Badia residence				
Non-Badia		1.00 (Ref)	1.00 (Ref)	
Badia		1.08 [0.71-1.64]	0.71* [0.54-0.93]	

(Continued...)

23

Table 4. – *Continued*

Variable	2002 Odds ratio [95% CI]	2009 Odds ratio [95% CI]	2012 Odds ratio [95% CI]	Pooled odds ratio [95% CI]
Camp residence				
Non-camps			1.00 (Ref)	
camps			0.89 [0.70-1.13]	
Wealth				
Not poor	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Poor	0.96 [0.80-1.14]	1.00 [0.79-1.26]	1.22 [1.00-1.50]	0.93 [0.87-1.01]
Contraceptive use				
Not using	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Traditional method	0.91 [0.72-1.15]	0.72* [0.52-0.99]	0.79 [0.59-1.07]	0.85** [0.76-0.95]
Modern method	0.88 [0.72-1.07]	0.98 [0.73-1.32]	0.89 [0.70-1.13]	0.86** [0.79-0.95]
Smoking status				
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	0.76 [0.57-1.00]	0.59** [0.40-0.85]	0.83 [0.63-1.09]	0.69*** [0.61-0.77]
Working status				
No	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Yes	1.12 [0.87-1.45]	1.02 [0.75-1.39]	1.08 [0.81-1.45]	0.97 [0.87-1.08]

* p<0.05, ** p<0.01, *** p<0.001

4.   STUDY LIMITATIONS

The data for this study come from cross-sectional surveys; therefore, cause and effect cannot be determined for the association of BMI with different explanatory variables.

The following three measures were used to evaluate the goodness of fit of our logistic regression models:

- The first and most straightforward measure is simply to look at the extent to which the model accurately predicts the dependent variable. The predictive accuracy was about 75 percent for the three models covering the overall sample combining the ever-married and never-married women. The figure was about 67 percent for the three models of ever-married women.

- The pseudo R^2s of about 0.17 for the overall sample and about 0.10 for the married women sample indicate somewhat poor fit of the selected predictors and that over 80 to 90 percent of variability in obesity among women is not explained by the fitted independent variables.

- The Goodness of Fit Chi Square test showed p values of higher than 0.05 across all models, indicating that they fit the data well.

In summary, the above three measures tell us that our model is not optimally fitting the data which is considered a limitation of the multivariate analysis performed. The available independent variables for running regression models were limited to those collected in the DHS surveys. Jordan DHS surveys lack important variables related to behaviors that may predict obesity such types of food consumed and physical exercise. Most of the variables in our study are either biological (age and parity) or socioeconomic (education, marital status). It is difficult to interpret our findings without information on the more important factors of food consumption and level of exercise. There is an urgent need to carry out an extensive risk factors survey in Jordan that can better address possible causes of obesity.

5. DISCUSSION AND CONCLUSIONS

To the best of our knowledge, there is no literature presenting evidence of the high prevalence of obesity among Jordanian women over the decade from 2002 to 2012. The data presented here are concerning. Having approximately 27 percent of Jordanian women of reproductive age and 38 percent of ever-married women being obese is a serious public health concern that needs the attention of decision-makers and policymakers in this country.

The prevalence of obesity found in these surveys can be compared with the findings of the 2007 Jordan Behavioral Risk Factor Survey (JBRFS). The JBRFS found an overall prevalence of obesity of 35 percent (95% CI: 30-40) for women aged 18-49 years. The Jordan DHS for all women of the same age group found a prevalence of 30 percent (95% CI: 28-31) in 2002, 33 percent (95% CI: 31-35) in 2009, and 31 percent (95% CI: 30-34) in 2012. The overlapping confidence intervals among the three DHS surveys and the JBRFS indicate similar results. Thus, over the last decade the prevalence of obesity appears to be staying at unacceptably high and frightening levels.

Our findings on obesity among women of reproductive age are higher than those of the World Health Organization publication for the East Mediterranean Region (WHO 2014b), which reports a prevalence of obesity of 24 percent, compared with about 27 percent in our surveys. For further comparison, the prevalence of obesity in the United States reported by Vahratian (2009) (Vahratian 2009) was about 24 percent among women age 20-44 years, lower than for this same age group in Jordan, at 29 and 32 percent depending on the year of the DHS survey.

For the overall sample, woman's age, educational level, marital status, and region of residence were the predicting factors for women's obesity irrespective of the fitted model. Badia residence was a predicating factor for the 2012 survey only. For ever-married women, age, parity, educational level, region, use of a traditional contraceptive method, and smoking were associated with obesity.

The positive association of obesity with increasing age and with marriage found in this study has been reported by several other studies. (Lipowicz et al. 2002; Janghorbani et al. 2008; Tzotzas et al. 2010; Ogden et al. 2012; Ortega Anta et al. 2013; Moghimi-Dehkordi et al. 2013) Not surprisingly, parity, which is related to age and marital status, was a predictor of obesity in

Jordan, where women with four and more children are almost twice as like to be obese as women with one child or none. Wolfe et al. (1997) reported a strong association between obesity and parity among US women. (Wolfe et al. 1997)

Education was inversely associated with obesity: Women with higher education were almost half as likely to be obese as women in the lowest educational category. An inverse association between obesity and educational level was reported among Greek women by Tzotzas et al. (2010) and among Iranian women by Moghimi-Dehkordi et al. (2013). In contrast, Lipowicz et al. (2002) found a positive association between obesity and education among Polish women. (Lipowicz et al. 2002)

We found obesity more prevalent among nonsmokers than smokers among Jordanian women. Similarly, several large studies have found that smokers are less likely to be overweight or obese than nonsmokers among American women. (Patel et al. 2011; Chiolero et al. 2007) British women (Canoy et al. 2005) and among women participating in the first WHO MONICA survey covering 21 countries. (Molarius et al. 1997)

Our analysis did not find any differences in the prevalence of obesity on the basis of urban or rural residence or residence in Palestinian refugee camps. Women living in the southern and northern regions of Jordan are more likely to be obese than women living in the central region. Women living in the Badia region, which accounts for 75 percent of Jordan's territory but only about 6 percent of the country's population, were found to be significantly less obese in 2012 survey than women in other areas. This might be explained by the fact that women residing in the Badia region are more physically active.

The finding in some models that users of modern or traditional contraceptives methods are less likely to be obese than non-users of contraception may be due to chance, as no causal link is apparent.

Given that most of the predictors of obesity in our study are either biological (age and parity) or socioeconomic factors (education, marital status) and are not subject to intervention measures, there is a need to look at more important factors that can be influenced, particularly food consumption and physical activity. An extensive risk factors survey in Jordan would shed more light on the manageable factors contributing to obesity.

Obesity is a clearly associated with a variety of adverse health outcomes such as diabetes mellitus, cardiovascular diseases, and higher mortality. Thus, the high prevalence of obesity among Jordanian women reported here flags the urgent need for programmatic interventions. Obesity is a complex, multifactorial chronic disease, requiring a multidisciplinary approach. There is a pressing need to raise the awareness of decision makers and to promote policy, legislation, and regulations to address the multiple factors that contribute to obesogenic environments.

William H. Dietz et al. (2009) showed that law has played a critical role in the control of chronic diseases including obesity and the behaviors that lead to them in the United States. (William et al. 2009) In Jordan, legislation to combat obesity can be enacted in various fields. There is a need to provide clients and their healthcare providers with powerful tools to treat and reduce obesity by improving access to obesity screening and counseling services, and new prescription drugs for chronic weight management and associated morbidities. Another potential area is the improvement of public transportation where people can improve physical activity by walking to public transportation from their home. School programs to prevent selling and eventually utilizing carbonated soft drinks and fast food and enforcing physical education classes is another example. Promotion of physical exercise though building sidewalks and playgrounds and make school playgrounds, and open space accessible to local household after hours requires certain legislations to be enforced. Finally, there is also need to empower women to take decisions that help them to prevent overweight and obesity.

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