

Obesity of women in Jordan - Prevalence and associated factors : making a case for a comprehensive obesity policy

Citation for published version (APA):

Göllner, S., & Nimeh, Z. (2014). *Obesity of women in Jordan - Prevalence and associated factors : making a case for a comprehensive obesity policy*. UNU-MERIT. UNU-MERIT Working Papers No. 079

Document status and date:

Published: 01/01/2014

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.



**UNITED NATIONS
UNIVERSITY**

UNU-MERIT

UNU-MERIT Working Paper Series

#2014-079

**Obesity of women in Jordan - Prevalence and associated factors:
Making a case for a comprehensive obesity policy
Sebastian Göllner and Zina Nimeh**

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: <http://www.merit.unu.edu>

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: <http://mgsog.merit.unu.edu>

Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499

UNU-MERIT Working Papers

ISSN 1871-9872

**Maastricht Economic and social Research Institute on Innovation and Technology,
UNU-MERIT**

**Maastricht Graduate School of Governance
MGSOG**

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at UNU-MERIT and MGSOG to stimulate discussion on the issues raised.

Obesity of Women in Jordan - Prevalence and associated factors: Making a case for a comprehensive obesity policy

Authors¹: Sebastian Göllner and Zina Nimeh

Keywords: obesity, public health, Jordan

JEL: I18, I15

Abstract

This paper analyses the current burden of obesity in the female population of Jordan on a national scale and examines the factors associated with it. Demographics and Health Surveys (DHS) were used for the years 2002, 2007 and 2009 covering a total of 23,197 women, 15-49 years of age, and variables including body mass index, age, governorate, educational level, marital status and wealth index, among others were investigated. The overall prevalence of obesity (body mass index, BMI \geq 30) in Jordanian women was found to be 26.3 percent in 2002, 19.7 percent in 2007 and 28.2 percent in 2009. Multivariate analysis demonstrated that being obese was significantly associated with increasing age, being married and having only primary education. Apart from age, the strength of these associations decreased from 2002 to 2009 which could point to a generalisation obesity epidemic, for all population groups. This paper contributes to the increasing research on obesity in Jordan, and confirms many findings of smaller studies, by including a larger sample size and greater geographic coverage, on a national scale. The contextual policy analysis reveals that the public health efforts of the Jordanian government are relatively limited in this area, and concludes by trying to make a case for a more comprehensive approach in order to moderate the health impact of obesity in Jordan.

¹ Sebastian Göllner – UNU-MERIT, Maastricht, NL (s.gollner@alumni.maastrichtuniversity.nl),
Zina Nimeh – UNU-MERIT, Maastricht, NL (zina.nimeh@maastrichtuniversity.nl)

Table of Contents

- 1. Introduction 4
- 2. Obesity in Jordan – Literature Review 8
- 3. Methodology 11
 - 3.1 Data 11
 - 3.2 Sample Design and Restrictions 11
 - 3.2 Sample characteristics of Jordanian women 12
 - 3.3 Using BMI 13
 - 3.4 Methods 14
- 4. Results 15
 - 4.1 Mean BMI and obesity prevalence by categories 15
 - 4.2 Multivariate Analysis 22
- 5. Discussion & Recommendations 27
 - 5.1 Discussion of Results 27
 - 5.2 The impact of obesity in Jordan and the Jordanian health system 30
 - 5.3 The complexity of obesity policies and approaches 33
 - 5.4 Obesity policy in Jordan 37
 - 5.4.1 *Building a case for action on obesity* 37
 - 5.4.2 *Identifying contribution factors and points of intervention* 38
 - 5.4.3 *Defining opportunities for action* 39
 - 5.4.4 *Evaluating potential interventions* 41
 - 5.4.5 *Selecting a portfolio of specific polices, programmes and actions* 42
- 6. Conclusion 43
- 7. References 44
- 8. Annex 50

List of Tables & Figures

Table 1: Survey details

Table 2: Sample characteristics (percentages) of the female Jordanian population

Table 3: Analysis of variance (ANOVA)

Table 4: Mean BMI and percentage obese of the total female population

Table 5: Obesity prevalence in percent by governorate

Table 6: Logistic Regression modelling obesity as a dichotomous variable (Model 1)

Table 7: Logistic Regression modelling obesity as a dichotomous variable (Model 2)

Table 8: FAO Food Balance Sheets Jordan (excerpt)

Figure 1: BMI by categories and survey years

Figure 2: Obesity prevalence in percent by residence

Figure 3: Obesity prevalence in percent by region

Figure 4: Age-adjusted obesity prevalence in percent by marital status

Figure 5: Obesity prevalence in percent by educational level

Figure 6: Obesity prevalence in percent by wealth index

Figure 7: Percentage of female obese population by age

1. Introduction

Obesity has become a global public health problem. The World Health Organization (WHO) estimated that in 2008, 500 million people (300 million women and 200 million men) were considered obese – a number twice as big as in 1980. The associated health impacts position overweight and obesity as the fifth highest risk factor for global deaths as it increases the susceptibility to a range of serious illnesses such as diabetes, hypertension and cardiovascular diseases (WHO, 2013a & Solomon & Manson, 1997). The higher burden of obesity for women has been attributed to various biological and environmental factors such as the female metabolism being less active in burning excessive fat compared to the male body which stores more lean tissue when energy imbalance occurs (James et al., 2001).

In developing and transitional countries a multitude of nutritional, environmental, economic and social factors have been identified to influence obesity prevalence. A major development under which many of these factors has been described is the so-called “nutrition transition”. Most commonly this transition describes a change in nutrition behaviour, physical activity and body composition or in other words a shift towards a “higher fat and higher refined carbohydrate Western diet” (Popkin, 2001). Globalisation of food markets, economic growth and an increase of average income have led to a higher daily caloric intake, but at the same time the structure of the diet has changed as well. In many countries consumption of fat, edible oil, sugar, animal products and processed food has significantly increased as food access and availability have improved. In combination with a lower intake of vegetables and fruits, such dietary patterns have been associated with an increased risk for obesity (Astrup et al., 2008). Additionally, physical activity and hence caloric expenditure has decreased partially due to a shift from physical labour intensive employment in previously agricultural economies to more service sector oriented jobs and less physical modes of transportation in urbanised and industrialised societies, further fuelling obesity prevalence (Popkin & Gordon-Larsen, 2004).

Although a nutrition transition has been observed in almost all countries in the world as they develop economically, the speed of the transition in lower and middle income countries has been described as exceptional due to the influence and timing of economic, technological and social transformation. Simultaneously a sharper increase in obesity prevalence and nutrition-

related non-communicable diseases than industrialised countries has been identified (Popkin, 2004). To date, more people in developing countries die of heart disease, diabetes and some cancers than in developed countries (Atinmo et al., 2009).

At the same time these countries are facing a dual burden of disease. While still dealing with issues of under-nutrition and micro-nutrient deficiencies as they develop, they are increasingly affected by obesity, which leads to an array of public health problems and challenges (WHOa, 2003). This dual burden has not only been witnessed on country and community levels but also on household levels as food distribution within poor households can differ due to social norms in regard to gender or generation. For example, the (male) household head might be receiving the largest share of food hence become obese whereas the children in the household suffer from under-nutrition. Even on an individual level a dual burden can exist as the over-consumption of cheap low-quality food can simultaneously lead to extensive weight gain and simultaneously to stunting or micronutrient deficiencies such as anaemia (Doak et al., 2005 & Ramachandran, 2009).

Nevertheless, the relationship between obesity and poverty is complex and has also changed over time. A rise in obesity rate in developing countries had been traditionally considered to be related to a rise in gross national product and improvement of economic status and hence assumed to concentrate within the upper economic classes. However, being poor only 'helps to protect' against obesity in the low-income countries and becomes a systematic risk factor as economies develop (Monteiro, 2004). The reasons for this relationship are under debate but common assumptions are that in low-income countries the caloric imbalance of poor population is driven by scarcity of food and high physical activity of manual labour whereas in more developed countries the availability of cheap energy dense food, less demanding labour as well as increased urbanisation diminish the effects of these drivers (Caballero, 2005). While obesity could be considered a worldwide problem, it has also been argued the burden of obesity is higher for many countries in Africa, Asia, Latin America and the Middle East as fat patterning, body composition and its associated risk to heart diseases adversely differ compared to Western countries (Popkin, Adair & Ng, 2012).

Mehio Sibai et al. (2010) have analysed the rapid changes in obesity prevalence in the Middle East and Northern Africa (MENA) region and identified an average increase in caloric intake of 730kcal per person per day between 1970 and 2005. Despite the diversity of countries in

the MENA region ranging from economies benefitting from oil such as Kuwait and the United Arab Emirates to less privileged desert countries such as Yemen, numerous studies have confirmed that obesity is prevalent in every MENA country. Martorell et al. (2000) summarised an obesity rate of 17.2 percent for women in MENA for the time frame 1990-2000 using nationally representative nutrition surveys from Egypt, Morocco, Iran and Kuwait. A further extensive systematic review of cohort studies covering 1980 to 2005 was conducted by Motlagh et al. (2009) who arrived at an overall obesity prevalence rate of 24.5 percent. For 2008, MENA was among the sub-regions with the highest obesity prevalence together with North America, Central and Southern Latin America and Southern Sub-Saharan Africa according to Stevens et al. (2012). As obesity is becoming a major threat to public health in the MENA region extensive research has been conducted on the national and sub-national level. Cross-sectional studies have analysed obesity rates and its risk factors in almost all MENA countries.

Particular attention has been given to school children in Egypt (El Derwi, El Sherbiny, & Atta, 2011; El-Gilany & El-Masry, 2011; Ismail, Kamel, & Ibrahim, 2011; Mohamed et al., 2005), Tunisia (Ben Slama et al., 2002; Gaha et al., 2002), Morocco (Benjelloun, 2002; Cherkaoui Dekkaki et al., 2011; Soualem, Ahami, Aboussaleh, Elbouhali, & Bonthoux, 2012), Jordan (Khader et al., 2008b) and Yemen (Raja'a & Bin Mohanna, 2005). Various other studies have covered male and female subgroups in countries such as Egypt (Abolfotouh, Soliman, Mansour, Farghaly, & El-Dawaiaty, 2008; Asfaw, 2007), Morocco (Ayachi et al., 2008; El Rhazi et al., 2011; 2010) and Lebanon (Sibai et al., 2003).

The most common factors associated with obesity were nutrition patterns, lower physical activity, higher levels of TV consumption and having a family history of obesity. There also appeared to be a higher prevalence of obesity among urban populations compared to rural populations. In 1996 the obesity rate of Moroccan woman was 14.6 percent in urban and 10.3 percent in rural areas. In Tunisia the difference was even greater in 1997 with 28.3 percent of urban compared to 12.3 percent of rural women being obese (Mokhtar et al., 2001). However, this divide has decreased in the recent years as obesity prevalence of rural population has increased at a faster pace compared to urban populations (Popkin, Adair & Ng 2012).

Whilst most analysis of obesity in the MENA region has focused on selected groups only a few studies have used nationally representative data and even less studies have compared

obesity rates over various points of time. Nationwide analysis has been conducted in Morocco (Benjelloun, 2002) as well as in Egypt where Nahmias (2010), Austin et al. (2011) and Aitsi-Selmi et al. (2011) have used Demographics and Health Surveys (DHS) to observe obesity rates in different years. All of these studies have demonstrated significant increases in obesity over the last two decades.

Whereas extensive research on obesity has been conducted in most of the MENA countries, current national representative studies for the country of Jordan are limited. Existing analyses have predominantly been based on random samples of subpopulations in specific geographic regions at one specific point of time. Particularly the female population, which is on a global scale more prone to obesity, requires more detailed research attention. At the current stage it is evident that obesity is a health issue in Jordan but it is difficult to determine its severity and progression on a national scale. The complex nature of obesity also poses further questions on what differences between population subgroups exists, what factors are associated with obesity in Jordan and how these have changed in recent times. Answers to these questions are necessary for an adequate public health response to address the health impact of obesity.

Hence, the research objective of this paper is to analyse obesity prevalence of women in Jordan on a national scale over three points of time of the last decade to exhibit noteworthy changes and developments of associated factors as well as to make a case for a comprehensive policy response. The analysis is based on the nationally representative Demographic and Health Surveys which allow for comparisons between different years, namely 2002, 2007 and 2009. The paper begins with a review of the existing research on obesity prevalence in Jordan. Next, an overview of the data and methodology used to assess obesity in Jordan is provided, while addressing technical issues. This is followed by a decomposition of obesity prevalence rates according to various subgroups such as age, educational and marital status, and are presented for each survey year. A multivariate analysis is then conducted to assess strength and changes of factors associated with obesity over time. The paper is concluded with a discussion of the findings in light of the current state of obesity policy in Jordan and recommendations for comprehensive and evidence-based interventions are presented. This paper contributes specifically to the literature on the case of Jordan by confirming many findings of smaller studies, through the analysis of larger sample size and greater geographic coverage, on a national scale.

2. Obesity in Jordan – Literature Review

Jordan is a small landlocked country in the Middle East, neighbouring the countries of Iraq, Israel, Palestine, Saudi Arabia and Syria. The country has a predominantly urban population of 6.5 million (November 2013 estimate (DOS Jordan, 2013a)) and is considered a lower-middle income country. For the past thirty years the Human Development Index of Jordan has been rising, placing it on rank 100 out of 187 countries in 2012 – well above the average of neighbouring Arab states (UNDP, 2013). Similarly GDP per capita has been increasing and in 2011 stood at 5,269 USD (UNDP, 2012).

When it comes to health, the typical characteristics of the nutrition transition can be observed in Jordan. Daily per capita calorie intake and food availability have significantly increased over the last decades. The typical Jordanian diet comprises of wheat, rice, vegetables and animal products and has generally been changing towards a westernised food consumption style (FAO, 2011). Analysis of food consumption patterns particularly in Amman has shown irregular meal intake as well as less than recommended consumption of food and vegetables (El-Qudah, 2008), while the supply of cereals, milk, eggs, meat, vegetable oil and sweeteners rose, supply of fruit and vegetables decreased. Energy-dense food sources, which lack the necessary micronutrients, have become the most affordable. The country has massively urbanised and physical activity decreased as agricultural employment shifted to less demanding labour (Madanat et al., 2008). Urban population grew from 70 percent in 1980 to 83 percent in 2004 where it remained stable until 2012. Urban growth has not only been fuelled by the traditional migration to the cities but also by populations affected by conflict in Iraq and Syria during the last decade (DHS, 2013a).

Jordan also faces the double burden of the nutrition transition. Although chronic malnutrition is at a very low level, micronutrient deficiencies such as anaemia and vitamin A deficiency are a recognised public health problem particular among children. On the other hand, overweight and obesity prevalence rates have been rising at an alarming pace throughout the country (FAO, 2011).

Extensive research on obesity in Jordan evolved around 15 years ago with the first analysis of prevalence and distribution in four semi-urban communities. The study which included all individuals in households older than 25 years of age unfolded an overall obesity prevalence of 49.7 percent. Women were considerably more affected with a rate of 59.8 percent compared

to 32.7 percent of men. Older people (above 40 years of age) showed particularly higher rates of obesity as well as illiterate populations. Further, a strong association between obesity and hypertension and diabetes mellitus was identified. The authors concluded that obesity is a common health problem in Jordan that should be addressed at the national level (Aljouni et al., 1998).

Since then, several studies have attempted to assess the severity of obesity and associated factors in Jordan by collecting and analysing random samples of different (sub-) populations and of different levels of representativeness. Most of the studies focused on regional populations in rural (Ahmad et al, 2006), semi-urban (Aljouni et al., 1998 & Khader et al., 2008a) and urban (Ibrahim, Ali & Sivarajan, 2010; Al-Akour et al. 2012; El-Quadah, 2008 & Madanat et al., 2007) areas. Nationally representative studies have utilised data from the Behavioral Risk Factor Surveillance System (BRFSS), a national survey based on Jordanian census data which assesses a range of self-reported health and demographic characteristics of Jordanians above 18 years of age (Shebab et. al, 2003). The Behavioral Risk Factor Surveillance System (BRFSS), which was established by the Jordan Ministry of Health in cooperation with the World Health Organization and the Centers for Disease Control and Prevention, has been so far conducted for three years (2002, 2004 and 2007). The national obesity prevalence rate for 2002 was 12.8 percent and 19.5 percent for 2004 (Al-Nsour, 2012). However, these rates have potentially been affected by bias as height and weight were self-reported by participants. The significance of this bias becomes visible with the analysis of Zindah et al. (2008) who interviewed and medically examined a random sub-sample of the 2004 BRFSS survey population and arrived at an obesity prevalence of 34.8 percent. Similarly, Al-Nsour et al. (2012) examined a sub-sample of the 2007 survey and concluded 36.0 percent of the subpopulation to be obese. Similar results were obtained with an analysis of 2009 data of the Demographic and Health Survey with an obesity prevalence of 38.8% for Jordanian women (Al-Nsour et al., 2013).

A further noteworthy finding from the BRFSS, which also assessed a range of behavioural factors, is weight awareness. Around a quarter of the obese study population reported their weight to be average or nearly average in 2002 and 2007 (CDC, 2006). Similarly, only 42 percent of the women interviewed for a survey in 2004 considered themselves as overweight whereas the actual rate was 88 percent (Jordan Ministry of Health, 2005). Consequently,

Zindah et al. (2008) called for “multicomponent interventions for weight control, healthy eating, and physical activity” (p. 4) in Jordan to moderate the risk of obesity.

Other cross-sectional studies on obesity in Jordan can mainly be divided between the subpopulations studied. Whereas the majority of studies have focused on adults with a slightly greater focus on women, some studies have investigated obesity among adolescents and children. For the latter, the dual burden of the nutrition transition was once again visible as Ibrahim et al (2007) observed almost the same rates of underweight and obesity in a semi-urban children aged 3-6 years. Obesity was also found to be prevalent in children of 6-12 years of age in another cross-sectional study whereas TV consumption, pocket money and having an obese parent were associated with obesity (Al-Kloub et al., 2010 & Khader et al., 2008b).

Several other studies also attempted to determine associated factors of obesity. Although these cross-sectional studies are not directly comparable, certain trends can be observed. Increasing obesity was found to be associated with increasing age in some studies as well as non-smoking, having other obese family members, being married and having no or hardly any education (Ahmad et al, 2006, Aljouni et al., 1998; Al-Nsour et al., 2013; El-Quadah, 2008 & Khader et al., 2008a).

Most notably is the difference of obesity prevalence between genders as in all studies that differentiated between women and men, the female subgroup had significantly higher rates of obesity (ibid). These findings are in line with global obesity statistics such as the WHO estimate of 300 million women and 200 million men being obese (WHOa, 2013). Some authors assumed that this gap is attributed to genetic predisposition, as the male human body deposits more lean than fat tissue in cases of energy imbalance, as well as dietary factors and differences in physical activity (Khader et al., 2008a).

A considerable amount of obesity research in Jordan has focused on associated diseases such as diabetes. Jordan has undergone an epidemiologic transition as infectious diseases and malnutrition have decreased and the burden of non-communicable diseases (NCD) has become the main cause of death (Al-Nsour, et al., 2012). Obesity was found to be contributing to the increasing burden of NCD as obese study populations in many cases also had higher prevalence of metabolic abnormalities such as diabetes mellitus, hypertension and fat

metabolism disorder as well as high blood pressure and asthma (Aljouni et al., 1998, Zindah et al., 2008).

3. Methodology

3.1 Data

The data used to examine obesity in Jordan is constructed from the Jordan Population and Family Health Surveys (JPFHS) which were conducted as part of the worldwide Demographics and Health Surveys (DHS) programme to allow for cross-national comparison. JPFHS are large surveys on households and ever-married women of reproductive age and include data on various indicators on demographics, health and nutrition. The objective of JPFHS is to assist researchers, planners and decision and policy makers dealing with population and health programs by providing comprehensive data (DOS Jordan, 2013b). The first JPFHS was carried out in 1990 and the latest, which is not yet available, in 2012. To observe trends over time the surveys on Jordan from the years 2002, 2007 and 2009 were used in this paper.

3.2 Sample Design and Restrictions

The sample of JFPHS was designed to feature reliable estimates for the main survey variables at country level as well as for rural and urban areas. At the regional level the 2002 survey divided Jordan into three regions and into three major governorates (Amman, Irbid and Zarqa) whereas the 2007 and 2009 survey produced estimates for all 12 governorates of Jordan, while also featuring estimates for three regions to allow for comparison with older surveys (JFPHS, 2010).

The JFPHS samples are based on the national censuses as a sample frame and follow a multi-stage sampling process. Each of the twelve governorates of Jordan formed an independent stratum which were then further stratified into to urban and rural areas. For the 2002 JFPHS urban areas were defined as having a population of 5,000 or more whereas five major cities (Amman, Wadi Essier, Zarqa, Russeifa) and Irbid formed independent strata themselves. For the 2007 and 2009 JFPHS the division between urban and rural was similar whereas all cities with a population of more than 100,000 were considered independent strata. In total 29 strata were formed for 2002 and 30 for 2007 and 2009.

Within these strata clusters were selected on the basis of the 1994 and 2004 Jordanian Population and Housing Census using a probability proportional to size sampling method. Certain populations such as nomads in remote areas and people living in collective dwellings such as prisoners were excluded from the sample frame. The finite amount of clusters selected was not proportional to the size of the governorates as in smaller governorates more clusters had to be selected to achieve a representative sample size. 498 clusters were selected for the 2002 JFPHS, and 903 clusters were selected for the ones in 2007 and 2009. Within each cluster 16 households were randomly selected for interviews. To adjust for actual size of governorates, JFPHS included sample weights for each individual surveyed.

All three surveys made use of two questionnaires – one household and one individual questionnaire. Medical examinations such as blood testing and measuring height and weight were obtained from half of the female sample population for the 2007 and 2009 survey whereas for 2002 all eligible women were targeted. Anthropometric measurements were collected by interviewers of all eligible women 15-49 years of age instead of using self-reported figures to eliminate possible bias. Further, wealth indicators were not included for the 2002 survey. Despite the limitations JFPHS allows for useful comparison between the survey years while covering the majority of the female population base and a variety of important characteristics. JFPHS have showed high response rates for all three survey years used as can be seen in Table 1.

Table 1: Survey details

		Year		
		2002	2007	2009
Households	Number	7,907	14,748	13,959
	Response rate (%)	99.0	98.8	97.3
Women	Number	6,151	11,113	10,401
	Response rate (%)	97.6	97.9	97.2

3.2 Sample characteristics of Jordanian women

As can be seen from table 2, the age distribution among all three survey years is relatively constant, especially among the older ages. Nevertheless a slight ageing of the female Jordanian population is visible, as the percentage of women under 25 years of age has decreased and the 25 to 54 years age groups increased. Similarly, marital status is relatively constant throughout the surveys years with an increasingly married majority of Jordanian women. Furthermore, the urbanisation effect is visible and increasing, as most Jordanian

women are living in urban areas. The most noteworthy change seems to be the education status of women which appears to have improved over the years as the percentage of women without any form education has decreased and the percentage of women with higher education has increased by 5 percentage points from 2002 to 2009.

Table 2: Sample characteristics (percentages) of the female Jordanian population

	2002	2007	2009
Age			
<05	12.7	12.7	13.0
05-14	25.6	24.4	22.8
15-24	21.3	20.8	20.2
25-34	16.0	15.3	16.2
35-44	9.8	12.1	12.1
45-54	6.1	6.4	7.1
55-64	4.5	4.4	4.5
65-74	2.7	2.8	2.8
<75	1.2	1.2	1.3
Marital Status			
Never Married	37.6	35.8	34.5
Married	53.5	55.8	56.9
Divorced	1.3	1.5	1.3
Not Living Together	n. a.	0.2	0.1
Widowed	7.6	6.7	7.3
Residence			
Urban	78.8	83.2	82.9
Rural	21.2	16.8	17.1
Region			
Central	63.1	62.0	61.5
North	27.1	28.7	29.4
South	9.8	9.3	9.1
Education			
No education	25.7	23.7	22.2
Primary	22.6	20.4	21.3
Secondary	37.2	38.7	36.5
Higher	14.4	17.2	19.9

3.3 Using BMI

A key variable used in the analysis of obesity is the body mass index (BMI) which is commonly used as an index to determine overweight and obesity², and has been used as a

² BMI is defined as individual weight (in kilograms) divided by squared individual height (in centimetres). Underweight is defined by the World Health Organization as BMI of under 18.5 and the normal weight range is

universal tool to determine levels of obesity and make comparisons between populations. However, this universalistic approach also bears certain limitations. BMI does not take into account different body shapes and weight compositions (lean versus fat tissue) or where fat is stored in the body which plays an important role for the health risk associated with obesity for an individual (Wajchenberg, 2000). Additionally, the WHO cut off points have been criticised to be arbitrary. For example, some researchers have witnessed high prevalence of hypertension and diabetes in Asian populations already at smaller increases below a BMI of 25 and argued for a lower cut off point (James, 2001). Nevertheless, these arguments are rather a concern on a medical level and BMI still provides a useful measurement for statistical analysis and comparison of populations. Height and weight are also easily obtainable and reliable measurements, especially for large survey populations.

For the subsequent calculations of body mass indices pregnant and pregnant women and women who had given birth 2 months prior to the survey interview were excluded to avoid potential weight biases. Overall the BMI data of 23,197 women (2002: n=7880; 2007: n=8343; 2009: n=6974) was used for analysis.

3.4 Methods

For the descriptive analysis, mean BMIs and obesity prevalence rates were calculated for several subgroups and adjusted with the sample weights provided by DHS. To estimate different effects on the probability of being obese logistic regression was applied to the data. A dichotomous variable for being obese (obese=1) was created, whereas the value of one was applied to all women with a BMI equal or above 30, and used as dependent variable for the logistic regression. Regression of obesity as a dichotomous variable instead of BMI as a continuous dependent variable was chosen in order to enable more precise statements of obesity probabilities. Regressing for BMI would be useful for describing general changes in BMI rather than obesity probabilities as such regression models do not allow for immediate statements in regard to the cut-off point at a BMI of 30.

Two regression models (see Tables 5 & 6) were created due to the limitations in regards to predictor variables of the 2002 survey as well as to examine if a further differentiation of

set at 18.5 to 24.99. The cut off points for overweight and obesity have been set at having a BMI of 25 and higher and at 30 and higher respectively.

certain factors was useful. Odd ratios were calculated for the different coefficients and a *p* value at ≤ 0.05 was considered significant. For the logistic regression in Model 1 dummy variables were created for the three different regions (North, South, Central), marital status (never married, married, widowed, divorced) and educational level (no education, primary-, secondary-, higher education). In the second model, geographic location was split up into the governorates of Jordan and dummy variables for each of the five wealth quintile were added. As this data was not available for the 2002 survey, the second model could only be applied to the survey years of 2007 and 2009. Both regression models were statistically significant for all survey years and correctly predicted obesity in 74 to 80 percent of the cases with the 2007 models being the most precise.

A further subdivision into urban and rural residence was not included in the logistic regression models presented, as the effect was only statistically significant in Model 1 for 2007 and proved to be marginal. The 2007 and 2009 surveys also included a further variable to divide Jordan into Badia and non-Badia areas³. In 2007 and 2009 around eight percent of the population lived in Badia areas. However, differences in obesity prevalence rates between Badia and non-Badia areas were only marginal (± 1.5 percentage points) and not statistically significant when included into the regression analysis. This is also in line with the findings of the descriptive analysis where the difference between urban and rural obesity prevalence was not greater than three percent.

Further considerations were taken to include more predictor variables in the regression model, but could not be carried out due to problems with the data. A variable for nationality was not included as the number of foreigners included in the data set was very small. Predictors for smoking and number of children were excluded due to high amounts of missing values.

4. Results

4.1 Mean BMI and obesity prevalence by categories

For all three survey years the mean BMI of Jordanian women was above the threshold for overweight (BMI $>$ 25) with 26.6 (2002), 25.7 (2007) and 26.9 (2009) already indicating a high

³ The Jordan Badia is defined a predominantly arid and semi-arid area with scattered settlements which covers 80 percent of Jordan. Economic activity is rather limited due to migration to cities and the impact of the climate on agricultural productivity. A government fund was launched in 2003 to socio-economically develop the region (Hashemite Fund for the Development of Jordan Badia, 2013).

prevalence of overweight obesity in Jordan. Unsurprisingly, the differences in mean BMI between the survey years are rather small due to the small time period, but nevertheless significant as the analysis of variance (ANOVA) in Table 3 reveals.

Table 3: Analysis of variance (ANOVA)

Source of Variation	SS	df	MS	F
Mean BMI	6,235.59	2	3,117.79	87.20
Error	829,291.13	23,194	35.75	
total	835,526.72	23,196		

$$F_{0.05(1),2,23194} = 3.06$$

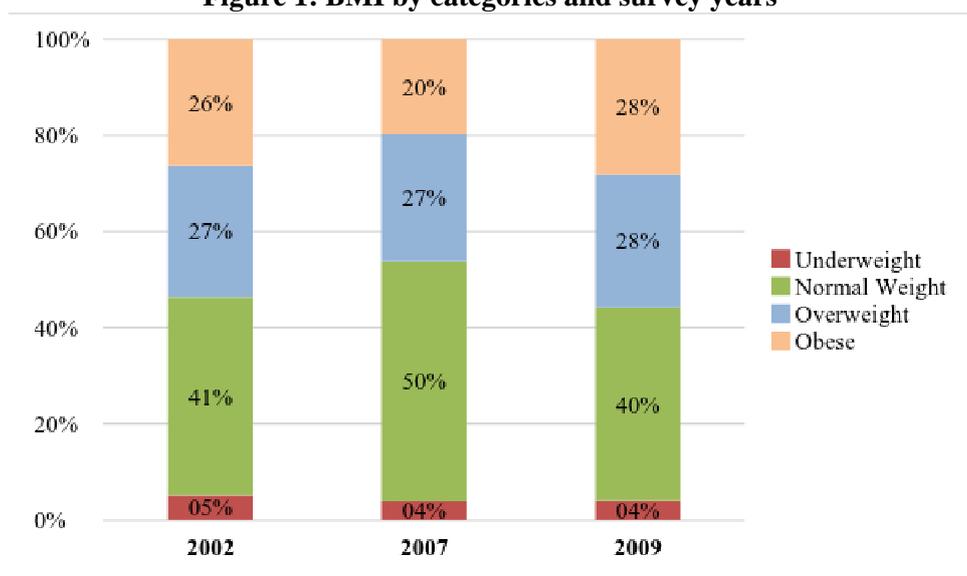
$H_0 = \mu_1 = \mu_2 = \mu_3$ can be rejected at $\alpha=0.05$

Source: Authors' Calculations

There was a statistically significant difference between groups as determined by the one-way ANOVA and the null hypothesis of all three means being equal was rejected at $\alpha=0.05$. Filtered according to WHO cut off points (Figure 1) the data show an obesity prevalence of 26.3 percent in 2002 which decreased to 19.7⁴ percent in 2007 and rose again to 28.2 percent in 2009. Whereas 2002 and 2009 are relatively similar regarding the distribution among BMI categories, the decrease in obesity in 2007 appears to be concurrent with an increase in normal weight prevalence. In 2002 and 2009 more than half of the female Jordanian population was considered either overweight or obese compared to 46.3 percent in 2007. Despite the high prevalence of obesity, underweight is still prevalent to a minor extent, demonstrating the dual burden of the nutrition transition which Ibrahim et al (2007) had also found in Jordanian children.

⁴ This point is discussed in section 5 discussions & Recommendations

Figure 1: BMI by categories and survey years



Source: Authors' Calculations

Table 4 shows the distribution of mean BMI scores and obesity prevalence by age groups. In all three datasets obese populations can be found in all age groups and increasing age appears to be highly associated with weight increase as mean BMI and obesity prevalence continuously rise throughout the age groups. Whereas obesity prevalence for the 15 to 19 years old women ranges between 4.4 and 6.8 percentage, it is more than twice as high as the mean obesity prevalence in each survey years for women from the 40 to 49 years age group.

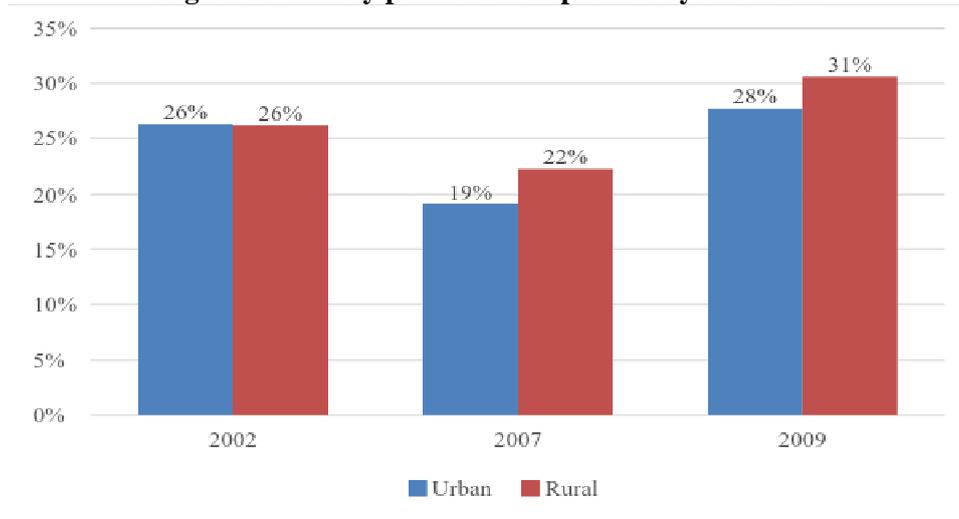
Table 4: Mean BMI and percentage obese of the total female population

Age groups	2002		2007		2009	
	Mean BMI	% Obese	Mean BMI	% Obese	Mean BMI	% Obese
15-19	22.39	5.2	22.13	4.4	23.03	6.77
20-24	23.91	9.3	23.39	7.57	24.03	11.55
25-29	25.86	16.48	25.31	13.81	25.89	19.3
30-34	27.64	30.24	26.69	21.21	27.91	28.69
35-39	29.71	44.73	28.15	31.89	29.83	43.86
40-44	30.95	53.66	29.71	41.82	31.11	56.45
45-49	32.48	66.19	31.12	51.26	31.47	60.07
N	7880	2000	8343	1500	6974	1890

Source: Authors' Calculations

The place of residence appears to have no substantial effect on obesity prevalence as rates between urban and rural populations differ by zero to three percentage points only (Figure 2).

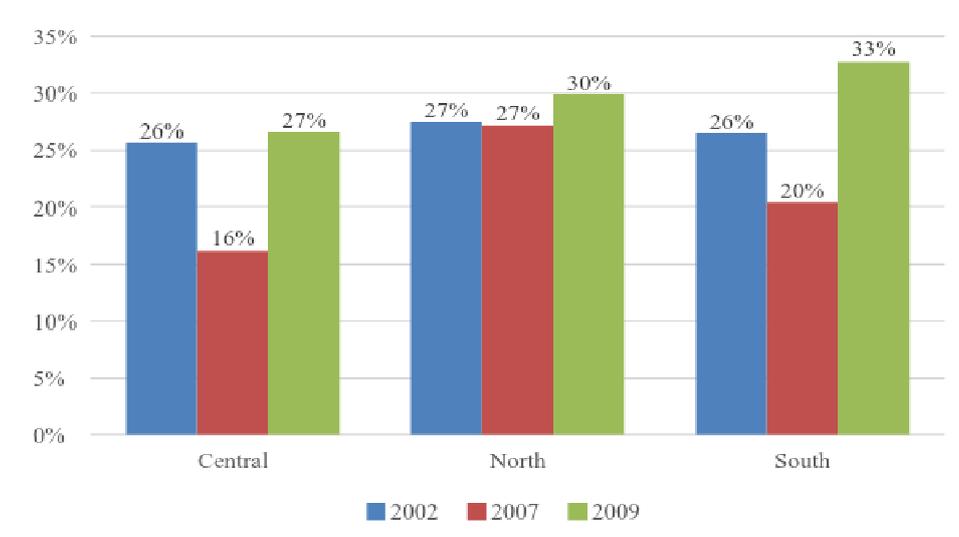
Figure 2: Obesity prevalence in percent by residence



Source: Authors' Calculations

More notable are the differences between geographic locations. The North Region comprises the governorates of Ajloun, Irbid, Jarash and Mafraq; the Central Region includes Amman, Balqa, Madaba and Zarqa; and the South covers Aqaba, Karak, Ma'an and Tafilah. Regional obesity prevalence rates were relatively equal in 2002 but drifted apart in the following survey years with the most substantial difference in 2007 when 16.2 percent in central Jordan were obese compared to 27.1 percent in the north (Figure 3). The latest survey reveals that the highest obesity prevalence is now to be found in the southern region with 32.8 percent of the female population being obese compared to 29.8 in the north and 26.6 in central Jordan.

Figure 3: Obesity prevalence in percent by region



Source: Authors' Calculations

On governorate-level the picture becomes more detailed (Table 5). Survey data of 2002 as mentioned already is only representative for Amman, Irbid and Zarqa which had obesity prevalence rates of 25.3, 28.2 and 26.7 percent respectively. From 2002 to 2007 the prevalence rates for Amman and Zarqa strongly decreased to 15.8 and 13.1 percent respectively only to increase again in 2009. Whereas Amman remained close to its 2002 level, Zarqa witnessed an increase to reach 31.1 percent. Obesity prevalence in Irbid was around 29 percent for all three survey years.

For 2007 and 2009 survey data is representative for each governorate. Obesity prevalence rates in all but two governorates (Ajlun and Madaba) increased by more than ten percentage points on average from 2007 and 2009. The spread of obesity prevalence rates strongly differed among the two survey years. In 2007 it ranged from 13.1 percent in Zarqa to 28.9 percent in Irbid, whereas in 2009 it ranged from 24.4 percent in Amman to 34.5 percent in Karak.

Table 5: Obesity prevalence in percent by governorate

Governorate	2002	2007	2009
Amman	25.3	15.8	24.4
Ajlun		27.9	26.6
Aqaba		18.2	32.0
Balqa		21.3	29.6
Irbid	28.2	28.9	29.5
Jarash		18.1	31.0
Karak		20.2	34.5
Ma'an		19.7	30.9
Madaba		26.4	26.0
Mafraq		25.5	32.5
Tafiela		24.5	31.3
Zarqa	26.7	13.1	31.2

Source: Authors' Calculations

Obesity prevalence rates according to marital status were age-adjusted (Figure 4) to control for the effect of age as mean ages for Jordanian women were around 21 years for never married women; 34 for married women around; and around 42 for widowed women in all

three survey years. Nevertheless substantial differences between the groups within each survey year still remained as large as 11.9 percentage points in 2002 (between never-married and married women) and 13.6 percentage points in 2007 (between never-married and widowed women). However, in 2009 the burden of obesity was more equally distributed among all subgroups with the largest difference of 7.5 percentage points between never-married and married women.

Considering the different subgroups between different survey years, obesity prevalence rates of never-married, married and divorced women decreased from 2002 to 2007 only to rise above 2002 levels in 2009. Widowed women were the only subgroup where obesity prevalence increased from 2002 to 2007 and decreased in 2009. Most notable in general appears to be the obesity prevalence difference between never-married women and being married, widowed or divorced.

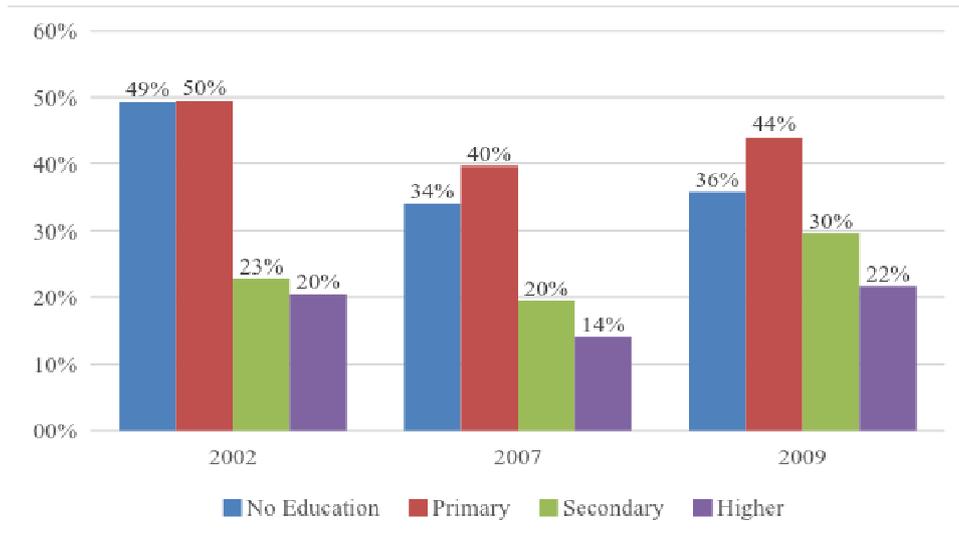
Figure 4: Age-adjusted obesity prevalence in percent by marital status



Source: Authors' Calculations

Education appears to be a decisive factor for obesity as prevalence rates of Jordanian women with no or primary education were around more than twice as high compared to women with secondary or higher education (Figure 5). The size of this gap declined over the following years as prevalence rates decreased for women with no or primary education decreased and increased for women with secondary or higher education. Nevertheless Jordanian women with primary education still carried the highest burden of obesity in 2009 with a prevalence rate of 44 percent.

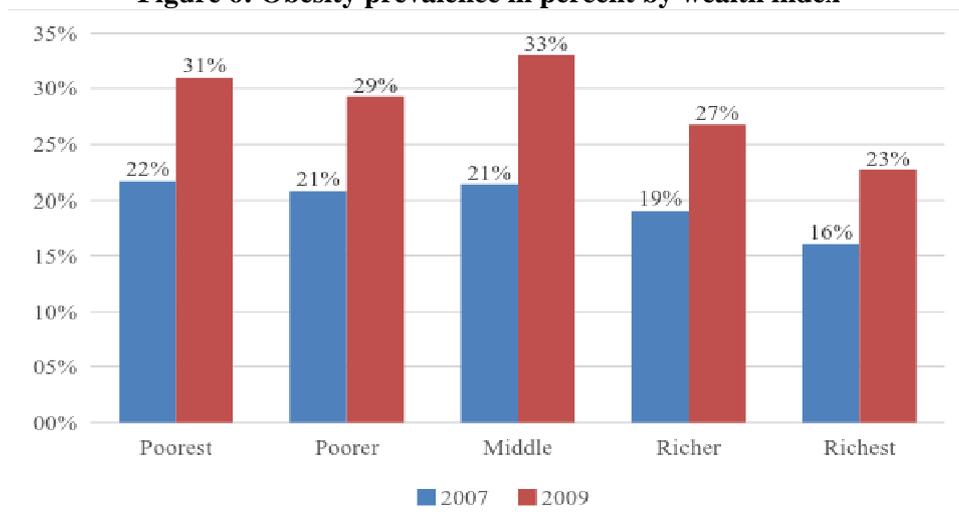
Figure 5: Obesity prevalence in percent by educational level



Source: Authors' Calculations

The influence of economic status could only be analysed for the years 2007 and 2009 as a wealth index variable was not included in the JFPHS survey for 2002 (Figure 6). In 2007 obesity was relatively equally distributed among the first four wealth quintiles and shows a sharper decrease for the richest wealth quintile. For 2009 obesity prevalence was relatively equally distributed among the first four wealth quintile and was significantly lower for the richest wealth quintile. These results contribute to the findings of Caballero (2005) that low economic status does not protect from the risk of obesity when economies develop as the availability of inexpensive and energy dense food increases and less labour becomes less physically demanding.

Figure 6: Obesity prevalence in percent by wealth index



Source: Authors' Calculations

The descriptive analysis shows a significant increase in mean BMI and obesity prevalence from 2002 to 2009 with a short decrease in 2007. Overall, Jordanian women were more obese with increasing age in all three survey years. Living in rural or urban areas appears to make no substantial difference for obesity prevalence rates but difference between the three regions became more relevant in 2009 with the Jordanian women in the south showing a six percentage points higher obesity rate compared to the central region. On governorate level obesity prevalence rates fluctuated strongly between the survey years but showed an overall increase for most of the governorates. The effect of education on obesity prevalence was visible throughout all survey years but became smaller up to 2009 with more educated women being less obese. Although adjusted for age, the effect of marriage still constituted a significant variation for obesity rates among Jordanian women. A smaller influence was that of wealth, where lower obesity prevalence rates for women in the two upper wealth quintiles was demonstrated.

4.2 Multivariate Analysis

Age was found to have a strong and statistically significant impact on the probability of being obese in both models throughout all survey years. Holding all other factors at a fixed level, the odds of being obese increased by 10 percent for a one year increase in age. Only for 2002 this effect was slightly higher with 11 percent. Overall this effect became stronger in the higher ages due to the logistic nature of the model. Whereas the predicted odds for being obese for a 20 year old woman were only around 1.6 times higher compared to a 15 year old woman, they were around 17.4 times higher for a 45 year old. For women 49 years of age, the last age group BMI measurements were taken for; the odds were around 26 times higher. The strength of the variable for age did not significantly change from Model 1 to Model 2 which could be an indication that the effect of age is similar among Jordanian women of all governorates and wealth quintiles.

The regional breakdown in Model 1 shows some differences of which all but the variable for the southern region in 2002 were significant. The probability of being obese among regions was most similar in 2002 when the odds in the North were only 8 percent higher compared to the central region. The strongest regional difference occurred in 2007 when the odds for being

obese in the North were 26 percent higher. Regional difference remained in 2009 with the north and the south showing significantly higher odds for obesity.

As in the descriptive analysis the subdivision into governorates provides a more detailed picture. All but one governorate were statistically significant in at least one of the survey years. Only three governorates were statistically significant in both survey years, of which the odds for two decreased (Mafraq and Tafilah) by .1 and one increased (Karak) by .4. However, a comparison between the two survey years is rather difficult as the strength of reference variable for Amman most likely decreased due to the drastically changed obesity prevalence from 15.8 percent in 2007 to 24.4 in 2009. Nevertheless, all but one governorate (Zarqa: 0.6) showed higher odds for being obese in both years, compared to the reference governorate of Amman. The deviation in the probability of obesity between different governorates decreased from 2007 to 2009; in 2007 most of the statistically significant governorates had 80 to 118 percent higher odd ratios whereas in 2009 the odds were between 50 and 70 percent higher.

Marriage was found to have a significant effect on being obese as it increased the odds in both models and all survey years in contrast to non-married Jordanian women. Whereas the odds were twice as high in 2002 for married women, the effect decreased down to 1.5 in 2009. A statistically significant difference for divorced women could not be established and the odds for widowed women were also only valid once in 2007 where they were 88 percent higher compared to non-married women. When geographic location was split up into governorates and wealth indicators were added (Model 2) the effect of being married and divorced changed marginally for the statistically significant predictors which could be an indication that effect of marital status is relatively similar among the entire female Jordanian population and not affected by residence and wealth.

Certain levels of education had significant effects on obesity probability in both regression models for 2002 and 2009. However, no variable for education was statistically significant in 2007. In 2002 the odds for being obese were 75 percent higher for women with primary education in comparison to women with no or preschool education. The effect was slightly smaller in 2009 with odds being around 50 percent greater. Higher education only had an effect in 2002 where it decreased the odds by 26 percent and secondary education increased the odds by 38 percent in 2009 for regression model 1.

The second regression model decreased the effect of primary and secondary education by five percentage points in comparison to the first model. Therefore it could be argued that the effect of education was slightly affected by residence and wealth and controlling for these factors enables a more precise prediction of obesity risk. Nevertheless, these predictors did not correlate significantly and interaction terms included into the regression didn't result in statistically significant results. Hence the distortion effects between those predictors can be arguably disregarded.

Table 6: Logistic Regression modelling obesity as a dichotomous variable (Model 1)

Parameter	2002	2007	2009
Age	1.11 ** (0.00)	1.10 ** (0.00)	1.10 ** (0.00)
Region			
<i>Central (ref)</i>	1	1	1
North	1.08 * (0.04)	1.26 ** (0.05)	1.11 ** (0.04)
South	1.07 (0.04)	1.11 ** (0.04)	1.18 ** (0.04)
Marital Status			
<i>Never married (ref)</i>	1	1	1
Married	1.99 ** (0.17)	1.78 ** (0.14)	1.49 ** (0.12)
Widowed	1.40 (0.28)	1.88 ** (0.39)	1.45 (0.31)
Divorced	0.95 (0.24)	1.31 (0.32)	1.20 (0.29)
Education Level			
<i>No Education/Preschool (ref)</i>	1	1	1
Primary	1.75 ** (0.22)	1.23 (0.13)	1.57 ** (0.25)
Secondary	1.23 (0.13)	1.09 (0.10)	1.38 * (0.19)
Higher	0.74 * (0.09)	0.80 (0.00)	0.99 (0.14)
Constant	0.01 ** (0.00)	0.01 ** (0.00)	0.01 ** (0.00)
Likelihood Ratio (chi²)	1821.7 ** 3	1526.34 **	1462.79 **
Correctly predicted	76.64 %	79.56%	74.43%
No. observations	7880	8343	6974
<i>Standard errors are reported in parentheses.</i>			
<i>*, ** indicates significance at the 95%, and 99% level, respectively.</i>			

Source: Authors' calculations

Overall, the multivariate analysis revealed that increasing age, being married and having primary education showed the highest probabilities for being obese throughout the survey years and, as in the descriptive analysis, women in certain governorates are more prone to obesity than others. Regardless of age, for married women with primary education the probability of obesity was 74 percent higher in 2002 and 69 percent higher in 2009 compared to never married women with no education. In relative terms this high probability group was present in all governorates with a share of three to seven percent. Hence the majority of married women with primary education was found in the three governorates with the highest populations of Amman, Irbid and Zarqa. However, the size of this population was rather small as only few women fulfil both criteria. In 2002 only 7.2 percent of the female population were married and had primary education. The size of this high probability group further decreased to 4.65 percent of all Jordanian women in 2009.

Table 7: Logistic Regression modelling obesity as a dichotomous variable (Model 2)

Parameter	2007			2009		
	OR		SE	OR		SE
Age	1.10	**	0.00	1.10	**	0.00
Governorate						
<i>Amman (ref)</i>	1.00			1.00		
Irbid	2.18	**	0.30	1.24		0.17
Ajloun	1.93	**	0.28	1.21		0.17
Jarash	1.18		0.17	1.46	**	0.21
Ma'raq	1.78	**	0.25	1.68	**	0.23
Balqa	1.30		0.19	1.28		0.18
Zarqa	0.62	**	0.09	1.22		0.17
Madaba	1.96	**	0.27	1.03		0.15
Karak	1.37	*	0.19	1.74	**	0.24
Tafilah	1.74	**	0.24	1.62	**	0.22
Aqaba	1.04		0.15	1.34	*	0.20
Ma'an	1.26		0.18	1.51	**	0.21
Marital Status						
<i>Not married (ref)</i>	1.00			1.00		
Married	1.81	**	0.15	1.48	**	0.12
Widowed	1.85	**	0.39	1.44		0.31
Divorced	1.40		0.33	1.20		0.30
Educational Level						
<i>No Edu./Preschool (ref)</i>	1.00			1.00		
Primary	1.27		0.18	1.52	**	0.25
Secondary	1.12		0.14	1.33	*	0.19
Higher	0.83		0.11	0.97		0.14
Wealth Index						
<i>Poorest (ref)</i>	1.00			1.00		
Poorer	1.02		0.09	1.12		0.09
Middle	1.17		0.10	1.24	*	0.11
Richer	1.12		0.11	1.13		0.11
Richest	0.72	**	0.08	0.91		0.10
Constant	0.01	**	0.00	0.01	**	0.00
Likelihood Ratio (chi²)	1639.96	**		1488.69	**	
Correctly predicted	80.37%			74.69%		
No. observations	8343			6974		

*, ** indicates significance at the 95%, and 99% level, respectively.

Authors' Calculations

5. Discussion & Recommendations

5.1 Discussion of Results

This study is the first nationally representative study which utilises height and weight measurements which are not self-reported. A rough estimate of the resulting bias of self-reporting in Jordan can be derived by comparing the results of the 2002 JFPHS and the 2002 Behavioral Risk Factor Surveillance System (Shehab et. al, 2007). Both produce nationally representative estimates of obesity prevalence for women, but slightly differ in the sample design. Whereas the JFPHS gathers height and weight measurements for women 15 to 49 years of age, the BRFSS gathers data on individuals 18 years and older. Considering the effect of age on obesity found in this study, one would expect a higher obesity prevalence rate for the BRFSS as it also covers higher age groups. However, the BRFSS reported a female obesity prevalence rate of 16 percent in contrast to the rate of 26 percent found in the JFPHS data. Hence, self-reported measurements of Jordanians should be considered with care despite the limitation of different sample designs.

The overall trend of rising obesity and the effects of the nutrition transition in the region and in Jordan were confirmed by the data of the three survey years. The dual burden of the nutrition transition continued until the last survey year with four percent of Jordanian women being underweight and large populations being overweight and obese. Despite the rather small time period of seven years between the first and the last survey, obesity prevalence and mean BMIs strongly fluctuated, but increased overall and for most subgroups.

The fluctuations of obesity prevalence within Jordanian governorates and differences in the size of the spread between 2007 (16 percentage points) and 2009 (10 percentage points) present a necessary requisite for further investigations, either involving the robustness of the available data or the possible short term changes in caloric intake and expenditure. A possible explanation however, is the nature of weight categories which are defined according to the BMI cut-off points. If a considerable amount of women have a BMI in proximity to the cut-off point for obesity, even small weight gains can significantly increase overall obesity prevalence. This was the case in all three survey years as between eight and ten percent of the survey population had a BMI between 29 and 31. For example, a woman with a height of 1.6 meters and a weight of 76 kilograms has a BMI of 29.3 and is considered overweight. To fall into the obese category she only needs to gain two kilograms of weight which could be

regarded as a common weight fluctuation. This could be due to the Ramadan period effect, where predominantly Muslim countries such as Jordan are also particularly prone to such weight changes due to the fastening period of Ramadan (Ziaee et al., 2006 & Sweileh et al., 1992). While the 2002 and the 2009 DHS both interviewed the survey population during a period which did not cover Ramadan, the 2007 interviews took place from June to November 2007 which incidentally included Ramadan from mid-September to mid-October. Hence, the nature of weight categories and the survey period could provide an explanation for the fluctuation in obesity rates.

The few smaller decreases of obesity prevalence between the three survey years within other subgroups such as widowed and divorced women and women with no or only primary education only partially affected overall obesity prevalence rates as these changes were compensated by increases in obesity prevalence in the other respective subpopulations. The burden of obesity was hence more equally distributed among the entire population in 2009 than in 2002. Formulated in a more drastic way, one could argue that the obesity epidemic in Jordan is generalising for all population groups. With that said, the probability of being obese was still dependent on certain factors with increasing age having the strongest effect. The increase of obesity among the age groups was very similar between the survey years, whereas 2007 showed slightly greater fluctuations compared to the increase in 2009 which was relatively smooth (see Annex - Figure 7). This effect has been observed in many other studies worldwide (see for example, Flegal, 1998) as well as in regional studies in Jordan (Khader et al., 2008a). The age limitations of the JFPHS surveys do not allow to identify a peak age of obesity which is usually observed around the age of 60 and explained by higher mortality rates of obese people in contrast to populations of normal weight (Flegal, 1998).

Similarly, the results confirm the positive association between obesity and marriage which is in line with other studies on obesity in Jordan (Ahmad, 2006). Even when controlled for age the differences in obesity prevalence between never-married and married women remained relatively strong although it decreased until the last survey year. The higher obesity probability for married women is of particular concern as more than half of the women in all three survey years were married. Scientific literature provides several explanations for this effect. The traditional role for married women includes food preparation for the family which could imply a different nutrition in contrast to single women in terms of regularity of food intake and overall available food (Lipowicz et al., 2002). Some studies have also suggested

that the emotional state of being married increases appetite (Waite, 1995) and having children decreases overall physical activity due to the time constraints of parental duties (Sobal et al. 1992). The effect of children could however not be analysed due to the aforementioned missing values in the data sets.

In terms of education, women with only primary education had the highest probability to be obese among all three survey years. As with the other factors the effect of education decreased over time as the regression analysis shows. These results are in line with the studies of Ajlouni et al. (1998) and to a certain extent with Khader et al. (2008a) who differentiated between less and more than twelve years of education, but contradict with the findings of Ahmad et al. (2006) who found higher levels of obesity at young female adults with higher education. However, as their study only covered females 20-25 years of age, this difference can arguably be disregarded. Noteworthy is the effect of secondary education in 2009 which demonstrated a six percent lower obesity prevalence rate compared to women with no education. In the regression analysis however, the odd ratio for secondary education is significantly higher compared to the reference category of having no education. This finding might indicate that levels alone have certain constraints in the application to obesity prevalence analysis and supports the view that the aspect of education has to be examined in a greater socio-economic context (Gutierrez-Fisac et al., 2002). Some scholars have even argued for a reverse relationship between obesity and educational level as they discovered that obese adolescents, especially women, achieved a lower educational level than non-obese populations (Gortmaker et al., 1993).

Although the DHS surveys provide no information on nutrition patterns it is worth comparing the results with additional data. Food Balance Sheets of the Food and Agriculture Organization of the United Nations (FAO) present a comprehensive picture of the pattern of a country's food supply during a given time period. In the case of Jordan data is available for all DHS survey years used in this study and lists all primary food commodities. However, as Food Balance Sheets show the supply of kcal/per capita/per day only limited claims can be made on the actual utilisation, although they are adjusted for feed, seed, industrial production and waste. It is also not possible to split the data up according to gender, age groups, governorates etc. In Jordan, food supply increased from 2977 kcal/per day/per capita in 2002

to 3104 kcal/per day/per capita in 2007 and decreased again to 2886 kcal/per day/per capita in 2009.

Table 8: FAO Food Balance Sheets Jordan (excerpt)

	2002	2007	2009
	KCal / per Capita / per Day		
Grand Total	2977	3104	2886
Vegetal Products	2586	2701	2569
Animal Products	390	403	317

The share between vegetal and animal products remained relatively similar over these time period. The biggest changes from 2002 to 2009 were seen in cereals (+43 kcal), meat (+25 kcal) and milk (+53 kcal) which somewhat reflects the characteristics of the nutrition transition. The food balance sheet data is in contrast to the changes in female obesity prevalence as the survey year with the greatest food supply showed the lowest obesity rates in women. Hence the comparison of the DHS data with Food Balance Sheets can provide only limited indications on the nutrition related aspects of obesity in Jordan and rather poses additional questions in regard to who consumes what and in which quantity.

Overall, this study contributes to increasing obesity research in Jordan as it confirms many findings of smaller studies, in terms of sample size and geographic coverage, on a national scale. The obesity prevalence first discussed by Ajlouni et al. in 1998 has become a nationwide problem which affects women of all backgrounds. These findings pose several questions in regard to the impact of obesity in Jordan as well as policies and initiatives that address this severe health problem.

5.2 The impact of obesity in Jordan and the Jordanian health system

Obesity is a recognised public health problem associated with a range of non-communicable diseases (NCD). These associations have also been confirmed in Jordan, where obesity was associated with increased odds for impaired fasting glycaemia, diabetes mellitus, high blood pressure, low high-density lipoprotein cholesterol, hypertriglyceridemia. Prevalence of diabetes in Jordan has risen from six percent in 2002 to 19 percent in 2007. Hypertension was identified in 15 percent of the adult population in 2004 and 23 percent showed high

cholesterol (see Khader et al., 2008a & Al-Nsour et al, 2012). Obesity is further a risk factor for other cardiovascular diseases, musculoskeletal disorders and endometrial, breast and colon cancer and can impede physical mobility (WHO, 2013a). The risk of death was found to be two to three times higher for obese individuals in a comparative study, even when adjusted for pre-existing diseases. Additionally, the increase of morbidity results in a greater number of unhealthy life years before death (Adams et al., 2006). Studies examining the direct health impact on Jordanians are however limited. Al-Akour et al. (2011) who examined adolescents in the north of Jordan found obese individuals to have significantly lower health-related quality of life scores. Despite the limited local evidence, but in light of the global evidence, obesity in Jordan can be regarded as having an impact on rates of morbidity and mortality.

Fortunately, increasing obesity prevalence has not had a severe enough impact to halt the improving mortality rate and life expectancy in Jordan in the last two decades. The improvement in these rates is mostly attributed to the decreased burden of infectious diseases which has conversely been replaced by an increase in NCD prevalence. NCD have been responsible for more than half of all deaths in Jordan in 2005. Of all NCD, heart conditions and cancer accounted for most of the deaths. NCD especially affect older people which will most likely increase overall NCD prevalence in the future due to the ageing population of Jordan. Whereas the fraction of people above the age of 60 was around five percent in 2000, it is projected to be three times as high in 2050. Considering the population growth in Jordan, current estimates project one to three million Jordanians being affected by diabetes, high blood pressure or high blood cholesterol by 2050. This increase will put a severe strain on the health care system of Jordan as NCD require extensive health care use (Brown et al., 2009).

With obesity being a risk factor for developing NCD, it will certainly contribute to the increased utilisation of health care. Several studies have attempted to calculate the effects of obesity on health expenditure. Sturm (2002) analysed the impact of smoking and obesity on the health care system of the United States. The results demonstrated that obesity had overtaken the financial burden of smoking as medical expenditure for obese patients compared to non-obese patients (36 percent higher for inpatient and outpatient care and 77 percent higher for medication). Obesity was also found to have the approximately the same effect for developing chronic health conditions as twenty years of ageing. Further studies came to similar conclusions when computing medical spending attributable to obesity. Direct costs associated to obesity were estimated at 5 to 6 percent in 1995 and 1998 of total United

States health expenditure, a time when obesity prevalence was below 20 percent. Decreased life expectancy was also not found to reduce overall health care costs as they were compensated by preceding years of morbidity before death. Depending on the health care financing scheme these costs have to be transferred to the individual either through increased out of pocket expenditure or increased insurance premium, whether public or private (Wolf & Colditz, 1998 & Finkelstein et al., 2003). In the case of Jordan no studies estimating the additional burden of obesity on the health care system exist to date, nevertheless certain impacts can be estimated.

Jordan has a relatively well established health care system, especially compared to other countries in the region and modern health services are accessible to nearly everyone. Total health expenditure was estimated at around nine percent of GDP throughout the last decade which is fairly high for a lower-middle income country and rather comparable to expenditures found in other developed countries. In 2011 around two thirds of total health expenditure was financed by the government and around one third by private expenditure which marks a sharp increase since 2001 when health expenditure was relatively equally shared between the private and the public sector. External donor contributions to the health system have been decreasing and stood at three percent of total health expenditure in 2011. Government health expenditure accounted for 17.6 percent of the total government budget of which a major share (28 percent) went into public social security funds. The share of private expenditure on health covered by insurance schemes has risen over the past decade (18.1 percent in 2011) but the majority of private expenditure is still covered by out of pocket payments (76.5 percent) (WHO, 2014).

Critiques have argued that the growth rate of health expenditure in regard to Jordanian GDP is not sustainable in the future and a reform of the health system is necessary particularly in light of the ageing population and modest economic growth rates. Especially the increasing share of government health expenditure and out of pocket payments being the second largest source of health financing have been criticised (USAID, 2011). The improvement of insurance coverage is further impeded due to limited amount of reliable data on utilisation of health care services and insurance enrolment as well as severe fragmentation of private and public health services (High Health Council, 2011).

The aforementioned associated health care costs of obesity are hence accelerating the growth of health expenditure in Jordan. Increasing obesity prevalence has an impact on both the public and the private sector. Publicly financed health care services and insurance schemes are affected by increased utilisation, similarly private insurance schemes need to raise their premiums to balance higher risks of morbidity and households face higher out of pocket expenditure. Thus, adequate policies and initiatives need to be put in place to moderate the impact of growing obesity in Jordan.

5.3 The complexity of obesity policies and approaches

As mentioned earlier, obesity is basically the result of a caloric intake that exceeds caloric expenditure and hence facilitates weight gain. Caloric intake depends on the nutrition and caloric expenditure depends on the physical activity of the individual. To prevent obesity the two need to be in balance with each other. Obesity policy essentially aims at establishing and sustaining individual behaviour that maintains this balance. This simple relationship however depends on a vast range of behavioural, environmental, political, economic and cultural factors on the individual and societal level and includes a variety of stakeholders which makes obesity policy a complex issue. As a starting point for obesity policy, it is argued that the policy must be approached from both individual and political dimensions.

First of all, individually, obesity is a health condition that develops slowly and does not require immediate treatment such as a broken arm. Similarly, comorbidities of obesity take time to progress to a critical state. An individual might neglect healthier nutrition and not change levels of physical activity before reaching critical levels of morbidity. Once the state of obesity has been reached, no quick fix solution to reverse the excessive weight gain exists, but rather a behavioural change with goals only reachable in the medium to long term is necessary. These properties certainly impede the efficiency of obesity prevention and treatment efforts. Hence, comprehensive obesity policy has to concern several if not the majority of factors influencing individual behaviour.

Second, from the political level, this apparent lack of urgency, creates a kind of impediment for establishing an agenda for and implementing obesity policy. As there is no shock effect caused by obesity and the results of a policy are only visible in the long term, establishing obesity on the political agenda appears to be an unattractive topic in political systems with

election periods shorter than the time needed to achieve a change in obesity prevalence. Once obesity has entered the political agenda decisions in regard to target groups and sectors, policy options, competing interests and policies and funding priorities have to be made which is again a very difficult process due to the range of factors and sectors that can have an impact on obesity prevalence.

To comprehensively analyse all underlying factors that influence behaviour in regard to obesity, several scholars have applied different frameworks for analysis. Lang & Rayner (2007) based their analysis on the different explanations of what causes obesity including theories of genetic causation, economic transition, technological and cultural change, psychosocial factors, obesogenic environment and the nutrition transition. In their view obesity is a problem as complex as climate change that poses challenges not only on a technical, nutritional or health care level but on society as a whole. Sacks et al. (2009) focused on factors that influence the food environment and physical activity on different governmental levels such as finance, commerce and trade, education, employment, transport and sport and recreation. They arrived at a similar conclusion arguing that opportunities to combat obesity are available in every sector and a combined approach is necessary. Thus it is useful to have a closer look at how different sectors are related to obesity, how they can be influenced by obesity policy and who is responsible for implementation.

Most prominently discussed is the role of the food industry or the food system, particularly production, marketing and distribution. Modern food manufacturing technology has enabled the food industry to produce energy-dense food at decreasing prices especially when compared to less energy-dense food. Consumers are therefore able to buy more food but also depend on the decision of the food manufacturer in regard to nutritional composition. The food choice of consumers is further influenced by marketing and distribution efforts of the food producers which can generate a favourable environment for obesity. Further examples are the educational sector which can play a role in terms of nutrition education and provision of school meals; the physical environment, including modes of transportation, sports and recreational areas which can influence energy expenditure; and the health care system which determines treatment of obesity (Finkelstein et al., 2005).

All these sectors can be influenced by public policy in a number of ways. A basic distinction can be made between 'hard' and 'soft' policy instruments which either directly change the

behaviour of individuals, indirectly alter their obesogenic environment, or encourage behaviour change in regard to obesity. Instruments include laws, regulation, taxation and education which can differ greatly in terms of feasibility, funding needs and impact. Obesity policy is also a question of paternalism as the degree of external pressure and control on individual behaviour has to be decided upon. How acceptable a policy measure is also often depends on the political and cultural background which influences how the interference with the life of an individual is perceived or if a top-down or bottom-up approach is more useful. Similarly, competing interests with other policies and the extensiveness and equity of obesity policy have to be considered (Lang & Rayner, 2007). To further illustrate the variety of policy instruments to tackle obesity, it is useful to discuss a few examples in regard to their actors, feasibility, funding requirements, acceptability, interference with other policies or sectors, impact and issues of equity.

Taxation can be regarded as one of the most directly influencing policy measures. In the case of obesity, it can be used to increase the price of unhealthy food and hence influence buying decisions of consumers. The way products are taxed can take various forms such as generally putting a sales tax on all foods with a certain level of an unhealthy ingredient such as sugar or more selectively by levying a tax on soft drinks in the food retail sector. This mechanism can also be used the other way around by putting less tax on healthier food items. Funding requirements are relatively low and rather concern the preceding efforts on how to define what is considered unhealthy. However, such a tax can greatly affect the food industry and might produce unacceptable economic outcomes. Further, a sales tax is also always a question of equity as poorer populations, who generally spend a higher proportion of their income on food, will be proportionally more affected by the tax (Nestle & Jacobson, 2000).

A slightly softer way to alter buying decisions of consumers is distinctive labelling of food ingredients and calories. This less paternalistic mechanism has a lesser economic and regulatory impact on food producers and arguably enables the consumer to make more informed decision on food consumption regardless of their economic background. Nevertheless, adequate label design is complex and the consumer can still disregard the information on the label and continue buying unhealthy products.

Influencing overall behaviour in regard to food consumption and physical activity can be achieved by education efforts, either directly in schools or on a larger scale by health

campaigns. Both require extensive funding and coordination efforts between different levels of government to decide on content, target groups and forms of delivery. Extending the school curriculum by extra lessons in nutrition education might find opposition by parents or a poorly targeted health campaign might not reach most at risk groups.

A further approach to obesity policy is the redesign urban development to promote more physical activity. Proposed measures include bicycle paths, development of sports and recreational facilities and creation of automobile free-zones. Most of these instruments are capital intensive long term approaches and affect a range of stakeholders.

The diversity of approaches to obesity policies and their respective limitations raise two questions: What works and which policies should be chosen? The view that obesity is being shaped by the previously described environmental and social factors has been generally accepted nowadays (WHO, 2000). However, past interventions predominantly focused only on the individual level which produced small scale weight losses but merely affected the general obesity epidemic. Control studies were conducted on clinical treatment level which could confirm that certain interventions generated weight loss but did not assess environmental factors (Jain, 2005). Hence, evidence of effective obesity policy as large-scale public health intervention has been relatively scarce. First of all, no country to date has so far been able to effectively reverse the trend of rising obesity prevalence. Second, in addition to obesity as a complex issues itself, interventions at population level incorporate a range of uncontrollable confounding factors. Attempts to isolate these factors with randomised control trials are too expensive and timing consuming, especially in light of the rising obesity epidemic. Therefore, public health experts have voted for a broader redefinition of evidence-based policy in regard to obesity by including comparisons between countries and communities, evaluations based on historical data and by borrowing from other disciplines such as (behavioural) economics (ibid).

At the same time obesity policy should be as comprehensive as possible by considering the majority underlying factors and not just focus on one single intervention. However, this widened focus results in ever more policy options, each of them competing for implementation and funding – a situation that has been described by Lang & Rayner (2007) as policy cacophony. To overcome these complexities it is useful to construct a decision-making

framework that incorporates the best evidence available to inform the decision-making process but also considers feasibility in regard to implementation.

Such a framework has been proposed by Swinburn et al. (2005) on the basis of previous consultations with public health experts of the International Obesity Task Force. The framework builds upon five key policy and programme issues:

- (i) *building a case for action on obesity;*
- (ii) *identifying contributing factors and points of Intervention;*
- (iii) *defining the opportunities for action;*
- (iv) *evaluating potential interventions; and*
- (v) *selecting a portfolio of specific policies, programmes, and actions.*

(Swinburn et al., 2005, p. 26)

This proposed decision-making framework offers a whole-system approach that attempts to be as comprehensive as possible by relying on a broad set of evidence. It supports the development and implementation of obesity policy by including all relevant stakeholders and thorough evaluation of the policy formulation. Thus, the following section will assess how the case of Jordan and obesity fits into the framework of Swinburn et al. (2005).

5.4 Obesity policy in Jordan

To analyse the state of obesity policy in Jordan online research was conducted and relevant stakeholders were contacted to obtain policy documents, strategies and assessments. The yield of this approach was relatively limited and the chance that more official or unpublished documents are available offline certainly exists. To obtain more relevant policy documents and surveys closer cooperation with the ministry of health and other stakeholders would have been useful, but was beyond the scope of this research. Nevertheless, the information found provides a useful addition to the scientific discussion on obesity in Jordan.

5.4.1 Building a case for action on obesity

The initial literature review of this study revealed that the problem of obesity in Jordan was already identified by Ajlouni et al. in 1998. These results were further confirmed by the

Behavioural Risk Factor Surveys System. In line with the global development women were more affected than men. This study demonstrated that obesity prevalence in women is generalising on a national scale and identified age, marriage and primary education as factors associated with a higher probability for obesity. It also highlighted that the obesity prevalence differences on the regional level should be treated carefully when targeting obesity policy. Up to date data as well as data on men is limited but new publications of the Demographics and Health Survey and other data sources can be expected. Both BRFSS and DHS can be regarded as reliable sources that can be utilised to convince policy makers of the burden of obesity in Jordan. This study also presented an outlook on the potential impact of obesity on the health care system of Jordan which provides a further argument in the obesity policy discourse.

5.4.2 Identifying contribution factors and points of intervention

The contributing factors of age, marriage and primary education found in this study confirmed the findings identified by the smaller cross-sectional studies conducted in Jordan. Additionally, non-smoking and a family history of obesity were associated with obesity as well. For childhood obesity TV consumption, pocket money and as well obese family members were found to be contributing factors (Al-Kloub et al., 2010). These environmental factors can hence be used as reference points for interventions and need to be considered when selecting target groups. Further noteworthy is the Jordanian health care system in regard to obesity counselling, as only 23.3 percent of the obese BRFSS 2004 survey population who visited health care facilities were told to lose weight by health care staff.

On the nutrition side only limited resources are available. General nutrition data is available in the form of FAO Food Balance Sheets and the average annual consumption data collected in the Household and Economic Survey of the Jordanian Department of Statistics (DOS, 2008). The BRFSS is supposed to have questions on nutrition included in the latest survey, but so far no nutrition analysis has been published. In a more detailed approach, El-Qudah (2008) observed regular meal intake among an adult population in Amman, but revealed lower than recommended fruit and vegetable consumption. The study did however not examine nutrition behaviour associated with obesity.

Key stakeholders in the establishment and implementation of obesity policy are the Jordanian government, on national, regional and municipality level; the health care system, especially practitioners dealing with overweight and obese patients and research initiatives related to the

problem of obesity such as National Center for Diabetes, Endocrinology and Genetics (NCD, 2013); NGOs with a nutrition or health focus; educational facilities, especially primary schools; media; and donor organisations conducting research and providing technical support in the health sector. Further considered in the policy discussion should be the food industry, and insurance companies. Possible interference with other policies could occur in areas where obesity is a risk factor or which have similar underlying factors such as policy initiative on NCD. The latter appears to have received greater attention in detail than obesity alone as several initiatives and strategies in Jordan indicate (NCD Alliance, 2011). Similarly, efforts in family and health planning have also been supported by external donors such as the U.S. Agency for International Development (USAID) and might be competing on the political agenda (Higher Population Council and Health Policy Project 2013).

Hence two major issues remain for the second stage. First, more extensive research on nutrition in Jordan and its association with obesity is necessary to develop effective interventions that target nutrition behaviour. At the current state it is not possible to clarify if the increase of obesity prevalence is related to an overall increase in caloric intake, certain dietary changes, or changes on the food supply side in terms of food composition and marketing. Second, a more detailed assessment of the political landscape is necessary to determine available capacities and funding to establish obesity on the political agenda and ensure its implementation. Both issues could be completed by technical working groups including health and nutrition professionals as well as policy makers.

5.4.3 Defining opportunities for action

As the third stage results in the formulation of a comprehensive strategy and action plan, a completion is beyond the feasibility and scope of this study. Therefore this section covers previous policy efforts of the Jordanian government in regard to obesity.

In 2006 a collaborative project between the Jordanian Ministry of Health and the WHO published an update and plan of action on nutrition in Jordan (JMoH & WHO, 2006). This document was the result of several meetings of a technical working group with the input of a broad range of national experts from the governmental and non-governmental sector and proposed strategic directions for national food policy. It highlighted the rise of obesity and NCD in Jordan but general had a greater focus on food security, micronutrient deficiencies and food safety. Nevertheless, the reduction of diet-related diseases that result from unhealthy

diet and physical inactivity became one of the proposed policy objectives which included the following strategies:

1. *Establishing a surveillance system and monitoring nutritional patterns and non-communicable disease risk factors;*
 2. *Initiating community intervention programmes for risk factor reduction;*
 3. *Strengthening early detection and screening for common NCD risk factors;*
 4. *Promoting healthy eating patterns ensuring the availability and affordability of healthy food.*
 5. *Addressing commercial interests which contribute to unhealthy dietary trends.*
 6. *Establishing an effective infrastructure for NCD prevention by expanding the NCD Division in the Ministry of Health to enable it to accommodate surveillance, prevention and health care functions for all major NCDs and involving all relevant government and nongovernmental sectors in planning, implementing and evaluating NCD prevention programmes.*
- (ibid, pp. 75-77).

In regards to obesity the proposed strategies included goals to conduct a food consumption survey every five years as well as a regular nutrition knowledge and behaviour survey. The previously discussed lack of weight loss advice by health care professionals was to be addressed with healthy diet education for health care staff. Among others, the document proposed a national dietary guideline, promotion of physical activity, nutrition education of the public, media messages, coordination with the local food industry and healthy school meals. Stakeholders such as health staff, the Jordanian Department of Statistics, school canteens and the food industry were briefly addressed as well. To monitor and evaluate implementation a list of indicators was included such as healthy diet trainings for health care staff completed, pilot programmes in communities conducted and national strategy for physical activity promotion implemented.

However, certain elements of this policy objective were either missing or vague which might be due to weak documentation of the preceding workshops that lead to this document. The policy objective on dietary related disease included several indicators that cannot to be related to the strategies proposed before such as share of food items which are correctly labelled in terms of nutritional composition. Overall, the Update and Action Plan on Nutrition in Jordan presents a variety of approaches which are closely related to obesity but lacks a clear direction on how to proceed. Within the framework of this research it was also difficult to estimate which of the proposed measures had been implemented. Nevertheless, two related efforts by the Jordanian government could be identified which are presented in light of the fourth issue in the following section.

5.4.4 Evaluating potential interventions

In 2008 the Jordanian Department of Statistics extended their regular *Household Expenditure and Income Survey* by a list on the average annual consumption of food items per household member. Although the list provides no clear reference, it could be an indication that some of the proposed measures to improve nutrition surveillance of the 2006 action plan were actually implemented. The list provides information on food, beverage and tobacco consumption for more than 240 items such as cereals, meats, fish, dairy products, oils, fats, fruits, vegetables, spices, nuts, sugars, tea and coffee and is categorised according to governorate, urban, rural and national population (DOS, 2008). However, the unit of measurement is either kilograms, litres or piece which makes it difficult to define average caloric intake according to the categories but comparison of difference in food composition is still superficially possible. Nevertheless, the extensiveness of the survey can be regarded as a sign that the concern of the Jordanian government in regard to general nutrition has increased. Adjusting the existing survey framework to produce more detailed statistics on actual caloric intake should be technically feasible within the capacities of the Jordanian Department of Statistics.

A further major public initiative which included obesity began in 2004 with the Jordan Health Communication Partnership (JHCP, 2013) which was initially funded by USAID and implemented by the Center for Communication Programs (CCP) of the Johns Hopkins Bloomberg School of Public Health. JHCP was basically a broad behaviour change communication program targeted at promoting healthy lifestyles. It was drawn from a baseline survey and the social ecological model which focuses on behaviour change, advocacy, supportive environments, linkages between different sectors, institutional capacity building and sustainability. In coordination with government actors, NGOs and media companies several interventions were implemented on a variety of health topics such as general health awareness, smoking, family planning and reproductive health, maternal and child health and chronic disease control, among others. Despite the broad range of interventions obesity was only specifically addressed in a TV series that centred on a restaurant and its owners. The format was used to broadcast several health messages in a way Jordanians could relate to and each actor represented a different health issue. The midterm project survey in 2007 found that 24 percent of the viewers had started with physical activity. Unfortunately, the obesity efforts of JHCP were brought to an end in 2007 when the donor organisation USAID requested to shift the focus entirely and only on family planning and reproductive health (ibid).

These two examples demonstrate that obesity as a public health problem has been recognised by the Jordanian government to a certain extent. However, despite the severity of the problem the issue of obesity has so far been only addressed as part of other policies on nutrition or general health. It can be assumed that competing interests with other policies, budgetary issues and expectations of external donors have interfered with the effective implementation of obesity policy.

5.4.5 Selecting a portfolio of specific policies, programmes and actions

The existing research as well as this study have demonstrated the severity of the obesity burden in Jordan which provides a compelling case for obesity policy that could further be further supplemented by additional research on obesity in the male population. However, the existence of evidence does not automatically draw political attention to the topic and certain advocacy and lobby efforts aimed at political decision makers are necessary, especially in regard to the competing policy interests previously identified. Such a mobilisation could be started on community level with the support of NGOs but also on a technical level including government institutions such as the ministry of health or the department for statistics who already have minor experience with the issue of obesity. These advocacy efforts are also important for the completion of stage two as more research on nutrition behaviour contributing to obesity in Jordan is necessary to develop effective interventions. Similarly, a further evaluation and identification of previous policy efforts at all levels is required to broaden the evidence base.

Therefore, it might be useful to draw upon the experience of the staff of the Jordanian Health Communication Partnership as well as the nutrition analysts at the department of statistics. These experts might already have extensive knowledge in the field of obesity due to previously proposed interventions which were unable to compete with other issues on the political agenda. Generally, an advanced stakeholder analysis is necessary to ensure that new interventions can be effectively implemented and are not confounded by other actors.

Overall, Jordan arguably has the technical capacity to implement a broad range of comprehensive policy measures to moderate the health impact of obesity. In light of the

scarce available evidence on existing obesity policies in Jordan, an emphasis on the portfolio approach of Swinburn et al. (2005) should be taken to generate a sustainable impact.

However, greater political will is required to achieve implementation. Therefore it is also necessary to clarify if obesity will remain a part of previous policies on general nutrition and NCD or if an exclusive obesity policy enables a greater impact. This decision also depends on competing political interests as well as funding capacities. Obtaining external donor funding is arguably difficult as obesity is not a common topic on the development agenda of donor organisations. Hence, the proposed decision framework should be regarded as a useful tool and point of reference for compiling evidence on the burden of obesity, establishing the topic on the political agenda, formulating evidenced based policies, programmes and actions and achieving a successful implementation.

6. Conclusion

The decision-making framework presented and applied to Jordan in this study can be used as a starting point to make the case for a more comprehensive obesity policy. Future efforts should be based on evidence, utilise a portfolio approach with multiple interventions in various sectors and involve all relevant stakeholders in a coordinated approach to ensure a sustainable health impact.

This study confirmed the burden of obesity in Jordan on a national scale with 28.2 percent of Jordanian women being obese in 2009. It has demonstrated that certain factors such as age, being married and having only primary education are associated with an increased probability of obesity for Jordanian women. However, apart from age, the strength of these associations decreased from 2002 to 2009, which could be regarded as an indication that the health issue of obesity is generalising as all subpopulations became more equally affected. In light of the ageing population and increasing health expenditure of Jordan, the potential future impact of obesity cannot be neglected. The assessment of obesity policy in Jordan revealed that governmental efforts have shown no clear direction and previous efforts are limited. Obesity issues have been part of other policies and policy measures rather focused on single, unsustainable interventions.

7. References

- Abolfotouh, M.A., Soliman, L.A., Mansour, E., Farghaly, M. & El-Dawaiaty, A. A. (2008) Central obesity among adults in Egypt: prevalence and associated morbidity. *Eastern Mediterranean Health Journal*, 14 (1), 57-68.
- Adams, K. F., Schatzkin, A., Harris, T. B., Kipnis, V., Mouw, T., Ballard-Barbash, R., Hollenbeck, A. & Leitzmann, M. F. (2006). Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *New England Journal of Medicine*, 355(8), 763-778.
- Ahmad, M. N., Tukan, S. K., & Takruri, H. R. (2006). Obesity and overweight in young adult females of Northern Badia of Jordan. *Malaysian Journal of Nutrition*, 12(2), 157-166.
- Aitsi-Selmi, A., & Marmot, M. (2010). The reversal of the social gradient of obesity among women in Egypt: an analysis of trends using multiple cross sectional surveys 1995–2008. *Journal of Epidemiology and Community Health*, 64(1), A19-A20.
- Ajlouni, K., Jaddou, H., & Batieha, A. (1998). Obesity in Jordan. *International journal of obesity*, 22(7), 624-628.
- Al-Akour, N. A., Khader, Y. S., Khassawneh, M. Y., & Bawadi, H. (2012). Health-related quality of life of adolescents with overweight or obesity in the north of Jordan. *Child: Care, Health and Development*, 38(2), 237-243.
- Al-Kloub, M. I., Al-Hassan, M. I., & Froelicher, E. S. (2010). Predictors of obesity in school-aged Jordanian adolescents. *International journal of nursing practice*, 16(4), 397-405.
- Al-Nsour, M., Zindah, M., Belbeisi, A., Hadaddin, R., Brown, D. W., & Walke, H. (2012) Prevalence of selected chronic, noncommunicable disease risk factors in Jordan: results of the 2007 Jordan Behavioral Risk Factor Surveillance Survey. *Preventing Chronic Disease*, 9, E25.
- Al Nsour, M., Al Kayyali, G., & Naffa, S. (2013). Overweight and obesity among Jordanian women and their social determinants. *EMHJ*, 19(12).
- Astrup, A., Dyerberg, J., Selleck, M. & Stender, S. (2008). Nutrition transition and its relationship to the development of obesity and related chronic diseases. *Obesity Reviews*, 9 (1), 48-52.
- Atinmo, T., Mirmiran, P., Oyewole, O. E., Belahsen, R. & Serra-Majem L. (2009). Breaking the poverty/malnutrition cycle in Africa and the Middle East. *Nutrition Reviews*, 67 (1), S40-S46.
- Austin, A. M., Hill, A. G., & Fawzi, W. W. (2011). Maternal obesity trends in Egypt 1995–2005. *Maternal & Child Nutrition*, 9 (2), 167-179.
- Ayachi Mohammed, E., Mohamed, M., Denis, L., & Rehia, B. (2008), Prevalence of parameter indicators of obesity and its relationship with metabolic syndrome in urban Moroccan women. *American Journal of Human Biology*, 20, 484–486.

- Belbeisi, A., Zindah, M., Walke, H., Jarrar, B., & Mokdad, A. H. (2006). Assessing risk factors for chronic disease--Jordan, 2004. *Morbidity and Mortality Weekly Report*, 55(23), 653-655.
- Ben Slama, F., Achour, A., Belhadj, O., Hsairi, M., Oueslati, M., & Achour, N. (2002). Obesity and life style in a population of male school children aged 6 to 10 years in Ariana (Tunisia). *Tunis Med.*, 80 (9), 542-7.
- Benjelloun, S. (2002). Nutrition transition in Morocco. *Public Health Nutrition: 5(1A)*, 135–140.
- Brown, D. W., Mokdad, A. H., Walke, H., As' ad, M., Al-Nsour, M., Zindah, M., & Belbeisi, A. (2009). Projected burden of chronic, noncommunicable diseases in Jordan. *Preventing Chronic Disease*, 6(2), 1-3.
- Caballero, B. (2005). A Nutrition Paradox — Underweight and Obesity in Developing Countries. *The New England Journal of Medicine*, 352 (15), 1514-1516.
- Dekkakia, I. C., Mouanea, N., Ettaira, S., Meskinia, T., Bouklouzeb, A., & Barkat, A. (2011). Prevalence of Obesity and Overweight in Children: A Study in Government Primary Schools in Rabat, Morocco. *Archives of Medical Research*, 42 (8), 703–708.
- Doak, C. M., Adair, L. S., Bentley, M., Monteiro, C., & Popkin, B. M. (2004). The dual burden household and the nutrition transition paradox. *International journal of obesity*, 29(1), 129-136. DOS, 2013
- Department of Statistics (DOS) Jordan (2013a). *Population Estimates by 6/11/2013*. Retrieved 6.11.2013 from http://www.dos.gov.jo/dos_home_e/main/index.htm
- Department of Statistics (DOS) Jordan (2013b). *Jordan Population and Family Health Survey 2012*. Retrieved 22.01.2014 from <http://www.measuredhs.com/pubs/pdf/FR282/FR282.pdf>
- Department of Statistics (DOS) Jordan (2008). *Average Annual Consumption of Household Member from Food Items and Tobacco by Governorate, Urban and Rural*. Retrieved 22.01.2014 from http://www.dos.gov.jo/dos_home_e/main/sdb_ec_e/household/2008/7-1.pdf
- El Derwi, D., El Sherbiny, N., & Atta, A. H. (2011). Exploring Fayoum (Upper Egypt) preparatory school students' and teachers' attitude towards obesity as health risk. *Journal of Public Health and Epidemiology*, 3(9), pp. 401-406.
- El Rhazi, K., Nejari, C., Zidouh, A., Bakkali, R., Berraho, M., & Barberger Gateau, P. (2010). Prevalence of obesity and associated sociodemographic and lifestyle factors in Morocco. *Public Health Nutrition: 14(1)*, 160–167.
- El-Gilany, A. & El-Masry, R. (2011). Overweight and Obesity among Adolescent School Students in Mansoura, Egypt. *Childhood Obesity*, 7 (3), 215-222.
- El-Qudah, J. M. (2008). Food consumption patterns and prevalence of obesity in an adult population in Amman, Jordan. *Australian Journal of Basic and Applied Sciences*, 2(4), 1165-1171.

- Food and Agriculture Organisation (FAO) (2011). *Food and Nutrition Profile – The Hashemite Kingdom of Jordan*. Retrieved on 10.10.2013 from <ftp.fao.org/ag/agn/nutrition/ncp/jor.pdf>.
- Finkelstein, E. A., Ruhm, C. J., & Kosa, K. M. (2005). Economic causes and consequences of obesity. *Annual Review of Public Health, 26*, 239-257.
- Finkelstein, E. A., Fiebelkorn, I. C., & Wang, G. (2003). National medical spending attributable to overweight and obesity: how much, and who's paying. *Health Affairs, 22*(3), W3-219.
- Gaha, R., Ghannem, H., Harrabi, I., Abdelazi, A. B., Lazreg, F., & Fredj, A. H. (2002). *Archives de Pédiatrie, 9* (6), 566-571.
- Gortmaker, S. L., Must, A., Perrin, J. M., Sobol, A. M., & Dietz, W. H. (1993). Social and economic consequences of overweight in adolescence and young adulthood. *New England journal of medicine, 329*(14), 1008-1012.
- Gutierrez-Fisac, J. L., Regidor, E., Banegas, J. B., & Artalejo, F. R. (2002). The size of obesity differences associated with educational level in Spain, 1987 and 1995/97. *Journal of Epidemiology and Community Health, 56*(6), 457-460.
- High Health Council (2011). *Jordan National Health Accounts 2008. Technical Report Nr. 2*. Retrieved 2.02.2014 from http://www.who.int/nha/country/jor/jordan_nha_2008.pdf?ua=1
- Higher Population Council and Health Policy Project (2013). *Jordan National Reproductive Health/Family Planning Strategy*. Policy Brief September 2013. Retrieved 02.02.2014 from http://www.healthpolicyproject.com/pubs/239_JordanNationalRHStrategyBrief.pdf
- Ismail, M. A., Kamel, M. H., & Ibrahim, D. E. (2011). Assessment of knowledge, attitude and practice of adolescents towards obesity in the preparatory schools in Ismailia city – Egypt. *The Egyptian Journal of Community Medicine, 29*(2), 17-30.
- Jain, A. (2005). Treating obesity in individuals and populations. *British Medical Journal, 331*(7529), 1387-1390.
- James, P. T., Leach, R., Kalamara, E., & Shayeghi, M. (2001). The Worldwide Obesity Epidemic. *Obesity Research, 9* (4), 228-233.
- Jordanian Health Communication Partnership (2013). *JHCP 2004-2013: End of Project Report*. Retrieved 01.01.2014 from <http://www.k4health.org/sites/default/files/JHCP%20End%20of%20Project%20Report.pdf>
- Jordan Ministry of Health, World Health Organization (JMoH & WHO) (2006). *Nutrition in Jordan: Update and Plan of Action*. First Edition 2006.
- Jordan Ministry of Health (2005). *2005 Communication Partnership for Family Health Baseline Survey – Key Results*. Retrieved on 10.12.2013 from: <http://www.jhuccp.org/sites/all/files/Jordan%20pdf%20Key%20aseline%20Results.pdf>

- Khader, Y., Batiha, A., Ajlouni, H., El-Khateeb, M., & Ajlouni, K. (2008a). Obesity in Jordan: prevalence, associated factors, comorbidities, and change in prevalence over ten years. *Metabolic Syndrome And Related Disorders*, 6(2), 113-120.
- Khader, Y., Irshaidat, O., Khasawneh, M., Amarin, Z., Alomari, M., & Batiha, A. (2008b). Overweight and Obesity Among School Children in Jordan: Prevalence and Associated Factors. *Maternal Child Health Journal*, 13, 424-431.
- Lang, T., & Rayner, G. (2007). Overcoming policy cacophony on obesity: an ecological public health framework for policymakers. *Obesity reviews*, 8(S1), 165-181.
- Lipowicz, A., Gronkiewicz, S., & Malina, R. M. (2002). Body mass index, overweight and obesity in married and never married men and women in Poland. *American Journal of Human Biology*, 14(4), 468-475
- Madanat, H. N., Brown, R. B., & Hawks, S. R. (2007). The impact of body mass index and Western advertising and media on eating style, body image and nutrition transition among Jordanian women. *Public Health Nutrition*, 10(10), 1039-1046.
- Madanat, H. N., Troutman, K. P., & Al-Madi, B. (2008). The nutrition transition in Jordan: the political, economic and food consumption contexts. *Promotion & Education*, 15(1), 6-10.
- Manal Ibrahim, A. K., Mousa Ali, A. H., & Erika Sivarajan, F. (2010). Predictors of obesity in school-aged Jordanian adolescents. *International Journal of Nursing Practice*, 16(4), 397-405.
- Martorell, R., Kettel Khan, L., Hughes, M. L., & Grummer-Strawn, L. M. (2000) Obesity in women from developing countries. *European Journal of Clinical Nutrition*, 54, 247-252.
- Mohamed, E. M., Hany, A. M., Selim, M. E. D. A. R., & Khalil, M. A. (2005). Obesity among secondary school students in Assiut City, Egypt (prevalence and risk factors). *El-Minia Medical Bulletin*, 16(1), 224-238.
- Mokhtar, N., Elati, J., Chabir, R., Bour, A., Elkari, K., Schlossman, N. P., Caballero, B., & Aguenou, H. (2001). Diet Culture and Obesity in Northern Africa. *The Journal of Nutrition*, 131 (3), 887S-892S.
- Monteiro, C. A., Conde, W. L., Lu, B., & Popkin, B. M. (2004). Obesity and inequities in health in the developing world. *International Journal of Obesity (2004)* 28, 1181–1186.
- Motlagh, B., O'Donnell, M., & Yusuf, S. (2009). Prevalence of cardiovascular risk factors in the Middle East: a systematic review. *European Journal of Cardiovascular Prevention and Rehabilitation*, 16, 268–280.
- Nahmias, P. (2010). *The Social Epidemiology of Maternal Obesity in Egypt*. Doctoral dissertation, Princeton University.
- National Center for Diabetes, Endocrinology and Genetics (NCD) (2013). *About us*. Retrieved 02.02.2014 from <http://www.ncd.org.jo/>
- NCD Alliance (2011). *Jordan forms National NCD Committee to Implement National NCD Strategy*. Retrieved 02.02.2014 from <http://www.ncdalliance.org/node/3582>

- Nestle, M., & Jacobson, M. F. (2000). Halting the obesity epidemic: a public health policy approach. *Public health reports*, 115(1), 12.
- Pekka, P., Pirjo, P., & Ulla, U. (2002). Influencing public nutrition for non-communicable disease prevention: from community intervention to national programme-experiences from Finland. *Public Health Nutrition*, 5(1A), 245-252.
- Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews*, 70(1), 3–21.
- Pokin, B. M. (2004). The Nutrition Transition: An Overview of World Patterns of Change. *Nutrition Reviews*, 62 (7), S140-S143.
- Popkin, B. M. & Gordon-Larsen, P. (2004). The nutrition transition: worldwide obesity dynamics and their determinants. *International Journal of Obesity*, 28, S2-S9.
- Popkin, B. M. (2001). The Nutrition Transition and Obesity in the Developing World. *The Journal of Nutrition*. 131(3), 871S-873S.
- Ramachandran, P. (2009). Maternal & child nutrition: new dimensions of the dual nutrition burden. *The Indian Journal of Medical Research*, 130(5), 575.
- Raja'a, Y. & Bin Mohanna, M. A. (2005). Overweight and Obesity among Schoolchildren in Sana'a City, Yemen. *Annals of Nutrition and Metabolism*, 49, 342-345.
- Rose, G. (1991). Population distributions of risk and disease. *Nutrition, Metabolism and Cardiovascular Diseases*, 1, 37-40.
- Sacks, G., Swinburn, B., & Lawrence, M. (2009). Obesity Policy Action framework and analysis grids for a comprehensive policy approach to reducing obesity. *Obesity Reviews*, 10(1), 76-86.
- Shehab, F., Belbeisi, A., & Walke, H. (2003). Prevalence of selected risk factors for chronic disease--Jordan, 2002. *Morbidity and Mortality Weekly Report*, 52(43), 1042-1044.
- Sibai, A. M., Hwalla, N., Adra, N., & Rahal, B. (2012). Prevalence and Covariates of Obesity in Lebanon: Findings from the First Epidemiological Study. *Obesity Research*, 11, 1353-1361.
- Sibai, A. M., Nasreddine, L., Mokdad, A. H., Adra, N., Tabet, M., & Hwalla, N. (2010). Nutrition Transition and Cardiovascular Disease Risk Factors in Middle East and North Africa Countries: Reviewing the Evidence. *Annals of Nutrition and Metabolism*, 57, 193-203.
- Sobal, J., Rauschenbach, B. S., & Frongillo Jr, E. A. (1992). Marital status, fatness and obesity. *Social Science & Medicine*, 35(7), 915-923.
- Solomon, C. G. & Manson, J. E. (1997). Obesity and mortality: a review of the epidemiologic data. *The American Journal of Clinical Nutrition*, 66(4), 1044S-1050S.
- Soualem, A., Ahami, A. O. T., Aboussaleh, Y., Elbouhali, B., & Bonthoux, F. (2012). Eating behavior of young adolescents in urban area in northwestern Morocco. *Mediterranean Journal of Nutrition and Metabolism*, 5(2), 157-161.

Stevens, G. A., Singh, G. M., Lu, Y., Danaei, G., Lin, J. K., Finucane, M. M., Bahalim, A. N., McIntire, R. K., Gutierrez, H. R., Cowan, M., Paciorek, C. J., Farzadfar, F., Riley, L. & Ezzati, M. (2012). National, regional, and global trends in adult overweight and obesity prevalences. *Population Health Metrics* 2012, 10(22), 1-16.

Sturm, R. (2002). The effects of obesity, smoking, and drinking on medical problems and costs. *Health Affairs*, 21(2), 245-253.

Sweileh, N., Schnitzler, A., Hunter, G. R., & Davis, B. (1992). Body composition and energy metabolism in resting and exercising Muslims during Ramadan fast. *The Journal of Sports Medicine and Physical Fitness*, 32(2), 156-163.

UNDP (2012). *International Human Development Indicators – GDP per capita*. Retrieved on 10.10.2013 from <http://hdrstats.undp.org/en/indicators/20206.html>.

UNDP (2013). *Jordan Country Profile: Human Development Indicators*. Retrieved on 10.10.2013 from <http://hdrstats.undp.org/en/countries/profiles/JOR.html>.

USAID (2011). *Jordan Fiscal Reform Project II. Health Public Expenditures Working Paper*. Retrieved 2.02.2014 from <http://www.frp2.org/english/Portals/0/PDFs/Health%20PEP%20Working%20Paper.pdf>

Waite, L. J. (1995). Does marriage matter?. *Demography*, 32(4), 483-507.

Wolf, A. M., & Colditz, G. A. (1998). Current estimates of the economic cost of obesity in the United States. *Obesity research*, 6(2), 97-106.

World Health Organisation (2014). *Table of key indicators, sources and methods by country and indicators. Jordan - National Expenditure on Health*. Retrieved 02.02.2014 from http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMPLATE_WEB_VERSION&COUNTRYKEY=84645

World Health Organisation (2013a). *Obesity and Overweight – Fact sheet N°311*. Retrieved on 10.10.2013 from www.who.int/mediacentre/factsheets/fs311/en/index.html.

World Health Organisation (2013b). *Mortality and global health estimates: Adult mortality by country*. Retrieved 2.2.2014 from <http://apps.who.int/gho/data/node.main.11?lang=en>

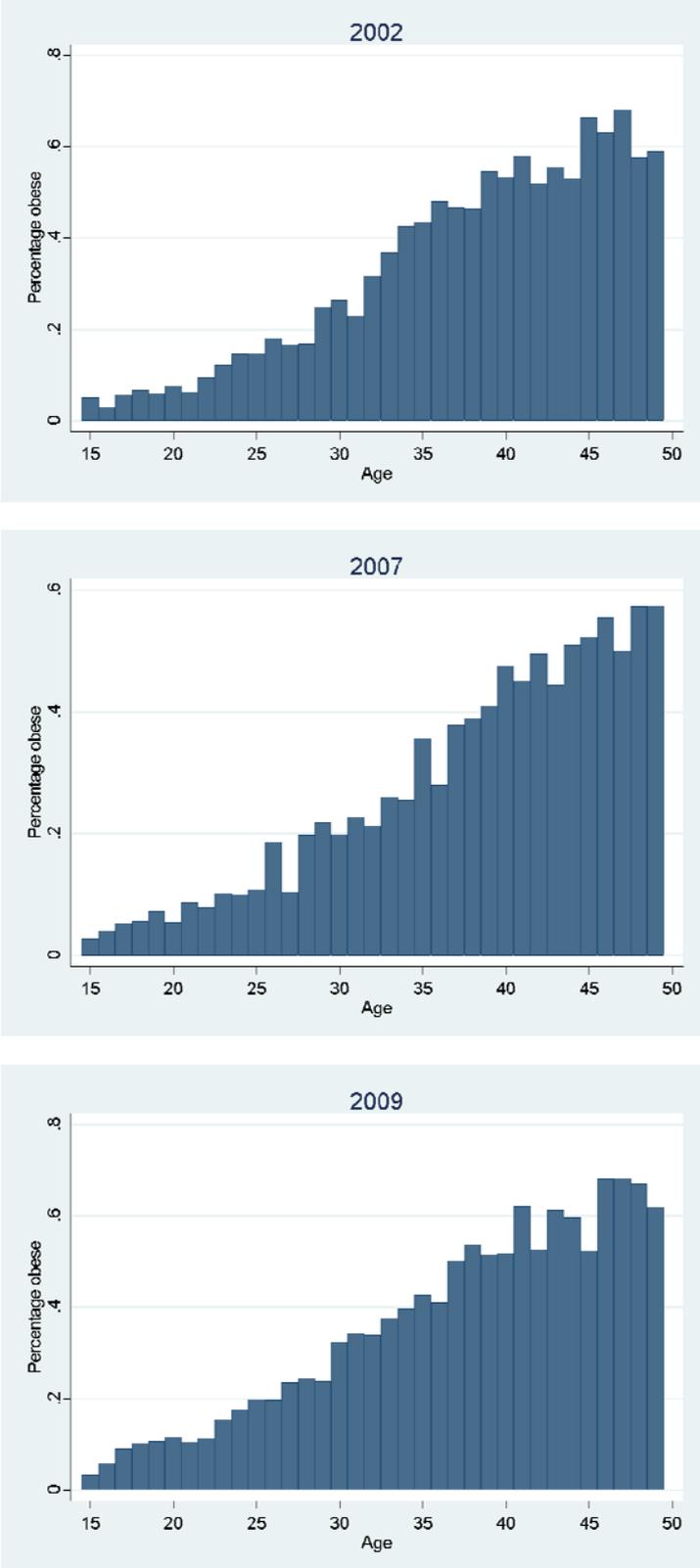
World Health Organisation (2000). Obesity: preventing and managing the global epidemic. *World Health Organization Technical Report Series*, 894.

Ziaee, V., Razaee, M., Ahmadinejad, Z., Shaikh, H., Yousefi, R., Yarmohammadi, L., Bozorgi, F., & Behjati, M. J. (2006). The changes of metabolic profile and weight during Ramadan fasting. *Singapore Medical Journal*, 47(5), 409.

Zindah, M., Belbeisi, A., Walke, H., & Mokdad, A. H. (2008). Obesity and diabetes in Jordan: findings from the behavioral risk factor surveillance system, 2004. *Preventing Chronic Disease*, 5(1), A17-A24.

8. Annex

Figure 7: Percentage of female obese population by age



The UNU-MERIT WORKING Paper Series

- 2014-01 *The medium-term effect of R&D on firm growth* by Marco Capasso, Tania Treibich and Bart Verspagen
- 2014-02 *Diverse and uneven pathways towards transition to low carbon development: The case of diffusion of solar PV technology in China* Michiko Iizuka
- 2014-03 *User innovators and their influence on innovation activities of firms in Finland* by Jari Kuusisto, Mervi Niemi and Fred Gault
- 2014-04 *Migration, remittances and household welfare in Ethiopia* by Lisa Andersson
- 2014-05 *Path-breaking directions of nanotechnology-based chemotherapy and molecular cancer therapy* by Mario Coccia and Lili Wang
- 2014-06 *Poor trends - The pace of poverty reduction after the Millennium Development Agenda* Richard Bluhm, Denis de Crombrughe, Adam Szirmai
- 2014-07 *Firms' adoption of international standards: Evidence from the Ethiopian floriculture sector* by Mulu Gebreeyesu
- 2014-08 *School choice, segregation, and forced school closure* by Cheng Boon Ong and Kristof De Witte
- 2014-09 *Gender difference in support for democracy in Sub-Saharan Africa: Do social institutions matter?* by Maty Konte
- 2014-10 *Why are women less democratic than men? Evidence from Sub-Saharan African countries* by Cecilia García-Peñalosa and Maty Konte
- 2014-11 *Tipping points? Ethnic composition change in Dutch big city neighbourhoods* by Cheng Boon Ong
- 2014-12 *Technology life cycle and specialization patterns of latecomer countries. The case of the semiconductor industry* by Giorgio Triulzi
- 2014-13 *Patents as quality signals? The implications for financing constraints on R&D* by Dirk Czarnitzki, Bronwyn H. Hall and Hanna Hottenrott
- 2014-14 *Assessment of effectiveness of Chinese aid in competence building and financing development in Sudan* by Samia Satti Osman Mohamed Nour
- 2014-15 *Education, training and skill development policies in Arab Gulf countries: Macro-micro overview* by Samia Satti Osman Mohamed Nour
- 2014-16 *Structure of labour market and unemployment in Sudan* by Samia Satti Osman Mohamed Nour
- 2014-17 *Overview of knowledge transfer in MENA countries - The case of Egypt* by Samia Satti Osman Mohamed Nour
- 2014-18 *The impact of ICT in public and private universities in Sudan* by Samia Satti Osman Mohamed Nour
- 2014-19 *End-user collaboration for process innovation in services: The role of internal resources* by Mona Ashok, Rajneesh Narula and Andrea Martinez-Noya
- 2014-20 *Public investment and regional politics: The case of Turkey* by Mehmet Guney Celbis, Denis de Crombrughe and Joan Muysken
- 2014-21 *Infrastructure and the international export performance of Turkish regions* by Mehmet Guney Celbis, Peter Nijkamp and Jacques Poot
- 2014-22 *Discovering and explaining work-family strategies of parents in Luxembourg* by Nevena Zhelyazkova
- 2014-23 *Parental leave take up and return to work of mothers in Luxembourg: An application of the model of nested dichotomies* by Nevena Zhelyazkova

- 2014-24 *Millennium Development Goals: Tool or token of global social governance?* by Mueid Al Raee, Elvis Amoateng, Elvis Koroku Avenyo, Youssef Beshay, Mira Bierbaum, Charlotte Keijser and Rashmi Sinha
- 2014-25 *One Europe or several? Causes and consequences of the European stagnation* by Jan Fagerberg and Bart Verspagen
- 2014-26 *The harmony of programs package: Quasi-experimental evidence on deworming and canteen interventions in rural Senegal* by Théophile Azomahou, Fatoumata Diallo and Wladimir Raymond
- 2014-27 *Country Terms of Trade 1960-2012: Trends, unit roots, over-differencing, endogeneity, time dummies, and heterogeneity* by Thomas Ziesemer
- 2014-28 *The structure and comparative advantages of China's scientific research - Quantitative and qualitative perspectives* by Lili Wang
- 2014-29 *Transition to knowledge-based economy in Saudi Arabia* by Samia Satti Osman Mohamed Nour
- 2014-30 *Challenges and opportunities for transition to knowledge-based economy in Arab Gulf countries* by Samia Satti Osman Mohamed Nour
- 2014-31 *Migration of international students and mobilizing skills in the MENA Region* by Samia Satti Osman Mohamed Nour
- 2014-32 *Beyond product innovation; improving innovation policy support for SMEs in traditional industries* by René Wintjes, David Douglas, Jon Fairburn, Hugo Hollanders and Geoffrey Pugh
- 2014-33 *The impact of innovation support programmes on SME innovation in traditional manufacturing industries: an evaluation for seven EU regions* by Dragana Radicic, Geoffrey Pugh, Hugo Hollanders and René Wintjes
- 2014-34 *Beliefs dynamics in communication networks* by Théophile T. Azomahou and Daniel C. Opolot
- 2014-35 *Stability and strategic diffusion in networks* by Théophile T. Azomahou and Daniel C. Opolot
- 2014-36 *Epsilon-stability and the speed of learning in network games* by Théophile T. Azomahou and Daniel C. Opolot
- 2014-37 *Afghan unaccompanied minors in the Netherlands: Far away from home and protected?* by Carla Buil and Melissa Siegel
- 2014-38 *Multinational production and trade in an endogenous growth model with heterogeneous firms* by Hibret B. Maemir and Thomas Ziesemer
- 2014-39 *The political economy of research and innovation in organic photovoltaics (OPV) in different world regions* by Serdar Türkeli and René Kemp
- 2014-40 *Towards the societal system of innovation: The case of metropolitan areas in Europe* by Serdar Türkeli and René Wintjes
- 2014-41 *To return permanently or to return temporarily? Explaining migrants' intentions* by Özge Bilgili and Melissa Siegel
- 2014-42 *Catching up and lagging behind in a balance-of-payments-constrained dual economy* by Alejandro Lavopa
- 2014-43 *An introduction to the economics of rare earths* by Eva Bartekova
- 2014-44 *The unequal effect of India's industrial liberalization on firms' decision to innovate: Do business conditions matter?* By Maria Bas and Caroline Paunov
- 2014-45 *Insurgents in motion: Counterinsurgency and insurgency relocation in Iraq* by Pui-hang Wong

- 2014-46 *Successive leadership changes in the regional jet industry* by Daniel Vertesy
- 2014-47 *Demand, credit and macroeconomic dynamics: A microsimulation model* by Huub Meijers, Önder Nomaler and Bart Verspagen
- 2014-48 *Accessibility analysis as an urban planning tool: Gas station location* by D.A. Escobar , C. Cadena-Gaitán, F.J. Garcia
- 2014-49 *China's economic embrace of Africa - An international comparative perspective* by Tobias Broich and Adam Szirmai
- 2014-50 *Mapping regional social enterprise ecosystems in India: Framework and indicators* by Lina Sonne
- 2014-51 *Does shelter assistance reduce poverty in Afghanistan?* By Craig Loschmann, Christopher R. Parsons and Melissa Siegel
- 2014-52 *How important is innovation? A Bayesian factor-augmented productivity model on panel data* by Georges Bresson, Jean-Michel Etienne and Pierre Mohnen
- 2014-53 *Does too much work hamper innovation? Evidence for diminishing returns of work hours for patent grants* by Mehmet Güney Celbi , Serdar Türkeli
- 2014-54 *Globalization, the rise of biotechnology and catching up in agricultural innovation: The case of Bt technology in India* Michiko Iizuka and Ajay Thutupalli
- 2014-55 *Where are innovation indicators, and their applications, going?* by Fred Gault
- 2014-56 *Productivity in services in Latin America and the Caribbean* by Elena Arias-Ortiz, Gustavo Crespi, Alejandro Rasteletti and Fernando Vargas
- 2014-57 *Optimal public investment, growth, and consumption: Fresh evidence from African countries* by Augustin Kwasi Fosu, Yoseph Yilma Getachew and Thomas H.W. Ziesemer
- 2014-58 *International R&D alliances by firms: Origins and development* by Rajneesh Narula and Andrea Martínez-Noya
- 2014-59 *Appropriability mechanisms, innovation and productivity: Evidence from the UK* by Bronwyn H. Hall and Vania Sena
- 2014-60 *The size of patent categories: USPTO 1976-2006* by François Lafond
- 2014-61 *Asset recombination in international partnerships as a source of improved innovation capabilities in China* by Simon C. Collinson and Rajneesh Narula
- 2014-62 *The viability of sustained growth by India's MNEs: India's dual economy and constraints from location assets* by Rajneesh Narula
- 2014-63 *The effect of unconditional cash transfers on adult labour supply: A unitary discrete choice model for the case of Ecuador* by Andrés Mideros and Cathal O'Donoghue
- 2014-64 *Giving in South Africa: Determining the influence of altruism, inequality aversion and social capital* by Nyasha Tirivayi
- 2014-65 *The impact of food transfers for people living with HIV/AIDS: Evidence from Zambia* by Nyasha Tirivayi and Wim Groot
- 2014-66 *Size and economies of scale in higher education and the implications for mergers* by Nyasha Tirivayi, Henriette Maasen van den Brink and Wim Groot
- 2014-67 *Widowhood and barriers to seeking health care in Uganda* by Nyasha Tirivayi
- 2014-68 *An individual-centered approach to multidimensional poverty: The cases of Chile, Colombia, Ecuador and Peru* by Andrea Franco Correa
- 2014-69 *Innovation and productivity in services: Empirical evidence from Latin America* by Gustavo Crespi, Ezequiel Tacsir and Fernando Vargas
- 2014-70 *Analysing global value chains using input-output economics: Proceed with care* by Önder Nomaler and Bart Verspagen

- 2014-71 *The deposit financing gap: Another Dutch disease* by Huub Meijers, Joan Muysken and Olaf Sleijpen
- 2014-72 *Do remittances and social assistance have different impacts on expenditure patterns of recipient households? The Moldovan case* by Jennifer Waidler, Jessica Hagen-Zanker, Franziska Gassmann and Melissa Siegel
- 2014-73 *The role of industry and economic context in open innovation: Evidence from Nigeria* by Abiodun Egbetokun, Omolayo Oluwatope, David Adeyeye and Maruf Sanni
- 2014-74 *Means to improve access to justice and legally empower victims of domestic violence: An empirical legal study on legislation and legal offices in Buenos Aires, Argentina* by Julieta Marotta
- 2014-75 *Do remittances not promote growth? A bias-adjusted three-step mixture-of-regressions* by Maty Konte
- 2014-76 *Structural modernization and development traps: An empirical approach* by Alejandro Lavopa and Adam Szirmai
- 2014-77 *Democratizing intellectual property systems: How corruption hinders equal opportunities for firms* by Caroline Paunov
- 2014-78 *Can internet infrastructure help reduce regional disparities? Evidence from Turkey* by Mehmet Guney Celbis and Denis de Crombrughe
- 2014-79 *Obesity of women in Jordan - Prevalence and associated factors: Making a case for a comprehensive obesity policy* by Sebastian Göllner and Zina Nimeh