

## Physical Activity and Obesity Indicators: National Cross Sectional Study on Lebanese Adults

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### ABSTRACT

Association between higher levels of physical activity and lower rates of obesity has been shown. The aim is to assess the relation between the prevalence of physical activity and the Physical Activity Index (PAI) of 300 Lebanese healthy adults, with age, gender, occupation, body mass indices and waist circumferences (WC). The cutoff points of WC for both genders were determined using the values of Body Mass Index (BMI). A cross-sectional study using self-reported valid questionnaire was conducted randomly on 150 men and 150 women, between 18 and 74 years, from Beirut region. Association between variables was performed using chi<sup>2</sup>, T-Test and ANOVA. Linear regression determined the WC cutoffs based on BMI. 22% of the population was obese with WC mean level of 92.47±14.4cm (87.71±14.4 cm for women and 97.24±12.96 cm for men). The prevalence of physical activity was 34% in overall population (27% in women and 40% in men). There was no significant association between BMI values and PAI ( $p < 0.085$  for men and  $p < 0.300$  for women). However there was an inverse association between WC values and PAI in both genders ( $p < 0.043$  in men and  $p < 0.036$  in women). Linear regression showed WC cut-off point in Lebanese women with BMI  $\geq 25$  kg/m<sup>2</sup> and  $\geq 30$  kg/m<sup>2</sup> of 86 cm and 100 cm respectively, whereas for men it was 92.12 cm and 105 cm respectively. The prevalence of physical activity in Beirut is low with differences among genders. The highest physical activity index is associated with the decreased values of waist circumference.

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## 1. INTRODUCTION

Over the past 3 decades the obesity epidemic has spread inexorably across societies in all parts of the globe [1]. Obesity, an excess of body fat, has been well documented as key risk factor for a wide range of non-communicable diseases [2],[3]. Anthropometric measures have been widely used for body weight classification in humans. While Body Mass Index (BMI) has been shown to predict abdominal fat and abdominal subcutaneous fat, waist circumference has been shown to predict visceral fat, thus reinforcing the use of both BMI and waist circumference in clinical practice [4].

Physical activity appears to be the most variable component of energy expenditure and therefore has been the target of behavioral interventions to modify body weight. There is now a large body of evidence on the importance of physical activity in disease prevention [5]-[7].

In Lebanon, based on two national obesity surveys; results showed that 53% of people over 20 were overweight in 1997; a figure that continues to grow [8]. Another study was carried out in 2015 among the Lebanese population, revealed that 26.1% of the Lebanese people are obese [9]. One possible explanation is that the decline in the physical activity and the transition in the type of leisure activities seems a prime suspect in the growth of obesity in Lebanon. This survey aimed to assess the prevalence of physical activity and the physical activity index among healthy adults in Beirut region in relation to several factors; including age, gender and occupation. We also aimed to investigate the extent to which physical inactivity and sedentary lifestyle are associated with increased BMI and WC, and determining the cutoff points for the WC for both Genders based on BMI levels.

## **2. RESEARCH METHOD**

### **2.1. Sampling frame**

300 healthy Lebanese adults aged between 18 and 74 were randomly recruited from Beirut region. Sampling was done at three primary health care centers (Karagheusian center for child care, Mother and Child welfare, and Al Horj al Makassed center). The sites were chosen to reach the target community as much as possible trying to cover all categories of adult population of both genders with different educational levels. Adults were face to face interviewed and invited to participate in a self-reported questionnaire. If inclusion criteria were met, the questionnaire was handed to them to be completed. Individuals included in this study were healthy, aged between 18 and 74 years old, and only from the Lebanese nationality. Subjects could not be included in this study if they were taking medications affecting the appetite, those who have chronic diseases, also subjects with renal, liver, pancreatic insufficiencies, or any chronic inflammatory or infectious disease, hypertension, cardiovascular disease, diabetic, demented individuals, pregnant and lactating women were all excluded. Subjects who have active thyroid disease, or who were receiving thyroid hormone substitution were also excluded.

### **2.2. Study Design**

This cross-sectional study was conducted at various hours of the week days between March and May, 2016.

### **2.3. DATA Collection**

As the questionnaire contained personal information such as age groups, gender; Anthropometric data such as the weight, height, and waist circumference; confidentiality and complete anonymity were highly guaranteed. Each participant completed a self-reported questionnaire; age was classified into two categories: adults (18-64 years), and elderly (65-74 years). Anthropometric measurements were taken using standardized techniques and calibrated equipment's. The height was measured without shoes and recorded to the nearest 0.5 cm using a stadiometer. The weight was measured by a portable calibrated scale with bare feet. The waist circumference was measured using a measurement tape.

The General practice physical activity questionnaire (GPPAQ) was developed to provide a simple, 4-level Physical Activity Index (PAI) reflecting an individual's current physical activity, for use in general practice to decide when interventions to increase physical activity might be appropriate. Questions concerning walking, housework/childcare and gardening/DIY have been included, however they have not been shown to yield data of a sufficient reliability to contribute to an objective assessment of overall physical activity levels and are not included in the calculation of the PAI. Patients are classified into four categories (Active, Moderately active, moderately inactive and Inactive) based on the original EPIC index from which the GPPAQ was developed [10]. This questionnaire is a validated screening tool for use in primary care (GPPAQ 2008) [10] that is used to assess adults from 18 to 74 years old physical activity levels; provides a simple four level physical activity index (PAI) categorized participants as: active, moderately active, moderately inactive, and inactive.

This questionnaire is composed of three basic parts: the first one consisted of occupational activity (unemployed, office work, standing, hard work, and heavy lifting work). The second part consisted of questions regarding the previous week performed activities according to the type (sports such as swimming, biking, walking, housework, and gardening) and duration of the activity (none, less than one hour, one to three hours, and more than three hours). The third and final part was made up of a question on the type of the walking speed (slow, moderate, fast and very fast). This study was approved by the Ethical committee of the Lebanese University. The proposal of this cross sectional study was approved by the ethical committee at the Lebanese University. Study subjects were consented before participating. Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## 2.4. Statistical analysis

Continuous variables were analyzed using one way anova,  $\chi^2$  and Independent sample T-test analysis for associations between different variables. Also, regressions with odds ratios and 95% confidence intervals for the degree of association between variables were also used. Then, a stepwise backward logistic regression analysis was applied to test further the observed significant variables while controlling for co-linearity. Linear regression test was used to determine the waist circumference cutoffs based on the BMI. A  $p$ -value below 0.05 denoted significance in differences. Data were analyzed using SPSS Version 23.

## 3. RESULTS

### 3.1. Demographic and anthropometric characteristics

The characteristics of our population are presented in Table 1. A total of 300 participants, 150 men and 150 women, randomly recruited in the study, in which 89.6% were aged between 18 and 64 years. The mean of the BMI of the studied population was  $26.42 \pm 4.7$  kg/m<sup>2</sup> (50.67% of women and 64% of men had a BMI  $\geq 25$  kg/m<sup>2</sup>). The overall waist circumference mean value was  $92.47 \pm 14.4$  cm ( $87.71 \pm 14.4$  cm for women and  $97.24 \pm 12.96$  cm for men). Men were older than women ( $p < 0.006$ ). Their anthropometric values (BMI and WC) were reported higher than in women ( $p < 0.023$  and  $p < 0.001$  respectively). In addition, more than 50% of women were unemployed and the majority of men recruited had an occupational work of standing or walking type. Using the PAI, only 27% of women were active compared to 40% of men ( $p < 0.003$ ).

Table 1. The Demographic, Anthropometric and Physical Activity Characteristics of The Population

Study variables	Overall (N= 300)	Women (N= 150)	Men (N= 150)	P-value†
Age	40.66 $\pm$ 16.70	38.00 $\pm$ 15.20	43.29 $\pm$ 17.70	<0.006
Anthropometric Measurements				
Height (m)	1.67 $\pm$ 0.09	1.60 $\pm$ 0.061	1.76 $\pm$ 0.07	<0.001
Weight	74.85 $\pm$ 15.80	66.69 $\pm$ 13.70	83.00 $\pm$ 13.40	<0.001
BMI (kg/m <sup>2</sup> )	26.42 $\pm$ 4.70	25.80 $\pm$ 5.10	27.05 $\pm$ 4.10	<0.023
BMI Categories				
Underweight	2.7%	4%	1%	
Normal	40%	45.3%	35%	<0.089
Overweight ‡	35.3%	30.7%	40%	
Obesity §	22%	20%	24%	
Waist Circumference (cm)	92.47 $\pm$ 14.40	87.71 $\pm$ 14.40	97.94 $\pm$ 12.90	<0.001
Physical activity				
Occupational activity				
Unemployed	41%	56.7%	25.3%	
Office work	23.6%	17.3%	30%	<0.001
Standing/Walking	26.3%	18%	34.7%	
Hard work	7.7%	8%	7.3%	
Heavy lifting	1.4%	0%	2.7%	
PAI*				
Active	20.3%	14%	26.7%	
Moderately active	13.7%	13.3%	14%	<0.003
Inactive	43%	52.7%	33.3%	
Moderately inactive	23%	20%	26%	

Continuous variables are summarized as mean $\pm$  Standard Deviation with statistical comparison using T-test. Categorical variables are summarized as count (%) with statistical comparison using Chi-square.

†P value for difference between genders

‡Overweight BMI between 25 to 29.9 kg/m<sup>2</sup>

§Obesity if BMI $\geq$ 30 kg/m<sup>2</sup>

\*Physical Activity Index PAI is calculated by combining the duration of exercise (sports and cycling) of participants per week with the type of occupation

### 3.2. Variables association

Table 2 shows a summary of the tests used to show associations between BMI or WC and occupational activities or PAI in overall subjects and by genders. In overall population, there was no significant association between occupational activities and WC ( $p < 0.200$ ). However, when stratifying the data by gender, we observed that the highest WC and BMI were in men who works in offices ( $p < 0.006$  and  $p < 0.05$  respectively). Analyses in women show that the highest WC and BMI was observed in women who work hardly but data was only significant for BMI ( $p < 0.290$  and  $p < 0.03$  respectively). Post hoc analyses in

men shows that those who have an office work had a high WC compared to those who have a hard work ( $p<0.006$ ). Also, subjects who have hard work had a low mean of WC compared to those the type of their work is standing or walking ( $p<0.021$ ). When testing the association between the PAI and WC in both genders, analyses show that the highest WC was observed in inactive men and women ( $p<0.043$  and  $p<0.039$  respectively). Post hoc analyses show that inactive men and women had the highest WC compared to active men and women ( $p<0.001$ ) (Data not shown). However, there was no association between PAI and BMI in overall population and when stratifying data by genders ( $p>0.05$ ).

Table 2. Summary of Study Variables Associations

Study variables	Overall (N=300)	P value*	Men (N=150)	P value*	Women (N=150)	P value*
	WC (cm)		WC (cm)		WC (cm)	
Association between the Occupational activity and the WC						
Unemployed	90.66±15.00	0.200	96.34±14.00	0.006	88.12±14.80	0.290
Office work	95.00±14.00		100.29±10.50		85.85±14.70	
Standing/walking	93.95±14.70		98.44±13.60		85.30±13.20	
Hard work	90.04±11.10		85.45± 7.40		94.25±12.50	
Heavy lifting	88.25±12.00		88.25±12.00		0	
Association between Occupational activity and the BMI						
Unemployed	26.16±4.90	0.900	26.87± 4.00	0.050	25.84±5.30	0.030
Office work	26.64±4.20		27.70± 3.30		24.79±4.90	
Standing/walking	26.67±4.80		27.43± 4.90		24.92±4.70	
Hard work	26.86±4.80		23.80± 2.40		29.67±4.90	
Heavy lifting	25.19±2.80		25.19± 2.80		0	
Association between PAI and the WC						
Active	88.97±12.30	0.100	92.78±11.40	0.040	81.71±10.90	0.030
Moderately active	92.29±13.40		96.43±12.90		87.95± 4.70	
Moderately inactive	92.14±15.80		98.15±15.10		84.33±13.30	
Inactive	94.36±14.70		100.44±11.40		90.52±15.40	
Association between PAI and the BMI						
Active	25.55± 4.10	0.100	25.81± 3.70	0.080	25.05± 4.80	0.300
Moderately active	26.25± 4.50		26.63± 3.40		25.84± 5.50	
Moderately inactive	26.00± 5.00		27.25± 5.20		24.51± 4.30	
Inactive	27.00± 4.80		28.04± 3.60		26.47± 5.40	

\*p value was obtained by using ANOVA test.

### 3.3. Waist circumference cut off points

Using a linear regression test, the WC cutoff points were determined based on  $\text{BMI} \geq 25 \text{ kg/m}^2$  and  $\geq 30 \text{ kg/m}^2$ . WC cut-off point of 86 cm in women was the most sensitive to identify most subjects with a  $\text{BMI} \geq 25 \text{ kg/m}^2$ , whereas in men it was 92.12 cm. The WC cut-off points corresponding to  $\text{BMI} \geq 30 \text{ kg/m}^2$  were 100 cm in women and 105 cm in men as shown in Table 3.

Table 3. The WC Cut-Off Points for The Study Subjects Based On  $\text{BMI} \geq 25 \text{ kg/m}^2$  and  $\text{BMI} \geq 30 \text{ kg/m}^2$

Group (N=300)	WC (cm)		p-value*
	Abdominal obesity $\text{BMI} \geq 25 \text{ kg/m}^2$	Abdominal obesity $\text{BMI} \geq 30 \text{ kg/m}^2$	
Male (N=150)	92	105	<0.001
Female (N=150)	86	100	<0.001

\*P value was obtained using linear regression test

## 4. DISCUSSION

The results of the current study indicate a relatively high BMI (mean of  $26.42 \pm 4.7 \text{ kg/m}^2$ ) and a considerable prevalence of obesity (22%) among the Lebanese adults which was high in men compared to women. This result is in the same direction with a previous study that show an increasing prevalence of obesity between 1997 and 2009 (17.4% and 28.2%), respectively [8].

The prevalence of physically active participants was relatively low (34%) and men were more active than women. This result is in accordance with the WHO report published in 2010 which shows that, globally, the 23% of adults aged over 18 years were insufficiently active (men 20% and women 27%). The prevalence of insufficiently active people was 31% in the Eastern Mediterranean Region and 32 % in the region of the

America's while the prevalence was low in the South East Asia (15%), and African regions (21%). Across all regions, women were less active than men, with differences in prevalence between man and woman of 10% and greater in the Eastern Mediterranean region and the region of America's (WHO) [11]. Also, our result is parallel to another study published in Lebanon which shows that 45% of the Lebanese adults were inactive [12]. This insufficiency in physical activity is influenced by several problematic behaviors, mainly marital status, obesity, smoking, health and mobility issues, personal motivation and social environments in which people live [13]. Inactivity among women was shown to be highest than in men that is likely to be rooted in the social norms and gender roles in traditional Arab societies, where women are seen mainly as child bearers. Confined to their homes, either because of social traditions or their pressing household duties women have little chance for sporting activities [14].

The relationship between the differences in occupational physical activity and the degree of obesity is still controversial. Our study shows that the highest WC and BMI were observed in men who work in offices and who are physically inactive. However, highest WC and BMI were found to be high in women who occupationally work hard and who are inactive. Our findings came hand in hand with many studies that show an inverse association between BMI, physical activity and occupational activity [2],[15]-[18]. This may be due to the occupational stress that may have a negative impact on individual eating behavior [19]-[21] leading to an increase in body weight and waist circumference accordingly. In one hand, other studies showed a decrease in the BMI with the increase in intensity of work [22]. On the other hand, Gutierrez-F. et al found no association after controlling for a number of obesity confounding factors [23].

Many anthropometric measures have been used to assess adiposity including BMI and WC. The WHO defines overweight as  $BMI \geq 25 \text{ kg/m}^2$ , obesity as  $BMI \geq 30 \text{ kg/m}^2$  and central adiposity as  $WC \geq 102 \text{ cm}$  in men and  $WC \geq 88 \text{ cm}$  [24]. However, such recommendations are derived mainly from the western populations, which cannot be applied to Arab population in the Middle East. This is the first national study to benchmark gender-specific cut-off points for waist circumference based on BMI for Lebanese adults.

In the present study, the WC cut-off points corresponding to BMI values of  $30 \text{ kg/m}^2$  in both gender were reported to be higher (100 cm in women and 105 cm in men) than other studies conducted in Iran (99.5 cm for men and 94.25 cm for women) [25], and other countries such as Turkey (100 cm for men and 90 cm for women) [26]. In addition, the waist circumference cut-off for  $BMI \geq 25 \text{ kg/m}^2$  of the Lebanese studied sample was also higher (92 cm for men and 86 cm for women) compared to Tunisian population cutoff (85 cm for men and 79 cm for women) [27] and Turkish population (90 cm for men and 80 cm for women) (Alper S et al 2013) [26]. These differences correspond to the heterogeneity among different populations and ethnics groups. The target WC associated with increased CV risk and normal levels should be defined for each population.

#### 4.1. Strengths and Limitations

To our knowledge, this is the first national study reporting the WC cutoffs in Lebanese men and women based on their BMI. Also, it is the first national study describing the association between physical activity and occupational activity pattern in association with obesity indicators. However, our study has a number of limitations as the cross-sectional nature of the study and the relative low sample size. Also, it is not a population-based or representative study. Understanding exercise motivation and how motivation can change among individuals over time would be better comprehended if a longitudinal design was employed. This study did not take into account the different socio-economical levels that might have impacted participant motivation to exercise. The data are limited to the Lebanese population and may not represent the WC cutoff values required for definition of abdominal obesity in other Middle Eastern countries. The present study did not have direct measures of body fatness or fat distribution. The outcome of this study relied on self-report, thus the extent to which participants were inclined to provide socially desirable responses is not fully known.

## 5. CONCLUSION

The findings of the present study provide alarming evidences for health professionals and policy makers about the high prevalence of abdominal obesity in Lebanon despite the raising concerns regarding the obesity problem in the country, adding that our population is almost inactive. Preventive and treatment strategies, notably in women, are urgently needed to prevent overweight and obesity and promote weight maintenance and weight loss and address the health burden of obesity. In view of the fact that unhealthy lifestyle habits, notably, the sedentary lifestyles in our community, are among the major threats contributing to the challenge, more severe efforts should be incorporated with the existing health promotion programs in order to decrease the possible epidemic of obesity and obesity-related chronic diseases in the near future.

## LIST OF ABBREVIATIONS

BMI: Body Mass Index  
 WC: Waist Circumference  
 GPPAQ: General Practice Physical Activity Questionnaire  
 PAI: Physical Activity Index  
 WHO: World Health Organization  
 CV: Cardiovascular

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