ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 6, pp. 17772-17779, June, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

IMPACT OF SOCIO-DEMOGRAPHIC STATUS ON THE OBESITY PREVALENCE AMONG MOROCCAN ADULT POPULATION WITH TYPE 2 DIABETES

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DOI: http://dx.doi.org/10.24327/ijrsr.2017.0806.0420

ARTICLE INFO

Article History:

Received 05th March, 2017
Received in revised form 08th April, 2017
Accepted 10th May, 2017
Published online 28st June, 2017

Key Words:

Abdominal Obesity, General Obesity, Socio-Economic Status, Type 2 Diabetes

ABSTRACT

Prevalence of diabetes and obesity has been shown to be socially and economically associated. This cross-sectional study examined this association among morocco adults with type 2 diabetes. Age, sex, Educational attainment and occupational class were used as indicators of socio-demographic status. Body mass index (BMI), waist circumference (WC) and waist -hip ratio (WHR) were evaluated separately for men and women. Analysis by sex showed that the prevalence of general and abdominal obesity was significantly higher in women than in men ($p < 0.001$). Analysis by Educational attainment and occupational class showed that general obesity was significantly elevated in women compared to males only in illiterate patients ($p = 0.001$) and in low socioeconomic status patients ($p < 0.001$). In contrast, abdominal obesity was significantly elevated among women regardless of educational attainment and economic status. The prevalence of general obesity has affected all age groups above 40 years with a significantly high maximum peak in the age group 50 to 59 years ($p = 0.044$), whereas in women the prevalence of obesity has affected all age groups from 30 years. Compared with abdominal obesity, the mean values of WC and WHR exceed the threshold of abdominal obesity in all age groups of women but, in men, only the mean values of waist circumference have exceeded the norms in all the age groups above 50 years. Our findings have major implications for research and to understand the reasons for gender and age differences in the prevalence of type 2 diabetes and for health policies

INTRODUCTION

Currently, the number of obesity cases has increased alarmingly in many countries. According to recent estimates by the World Health Organization (WHO), over 1.9 billion adults (aged 18 years and over) are overweight. Of this total, more than 600 million are obese. The severity of overweight and obesity stems mainly from complications related to the abnormal or excessive accumulation of body fat that negatively affects the human health (WHO, 2015). Similarly, excess body fat, particularly abdominal fat, is associated with an increase in blood pressure and in the risk of hyperinsulinemia (or insulin resistance), leading to the development of chronic diseases such as Diabetes (Spolidoro *et al*., 2013). This disease, which is increasing in incidence (NCD-RisC /AWG,2016), is a major public health issue given its importance as a cause of mortality, morbidity and the costs of the health system worldwide (GBMRFCD, 2014). It is answered in both developed and developing countries. According to WHO, the prevalence of diabetes in adults over 18 years worldwide has increased from

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4.7% in 1980 to 8.5% in 2014 (WHO, 2016). It translates into a significant increase in the number of people with diabetes, from 108 million in 1980 to 422 million in 2014 and reach 366 million in 2030 (Wild *et al*., 2004). It is most prevalent among adults over 40 years of age, and its prevalence is increasing at an alarming rate in all regions of the world and more rapidly in low- and middle-income countries. From a global societal perspective, changes in environmental factors, such as sedentary lifestyle or poor nutrition, which embody the westernization of our societies, have led to an explosion in the prevalence of obesity and type 2 diabetes (DT2) (Peze *et al*., 2015). DT2 is favored by a decrease in sensitivity of cells to insulin or insulin resistance also resulting from a sedentary lifestyle favoring obesity, reason why DT 2 which was a disease diagnosed most often at an age Which is close to 65 years old, is now a pathology that affects all age groups. Morocco, with regard to the countries in transition in epidemiology, is not exempt from this global trend; about 1.5 million Moroccans over 20 years of age are diabetics, 50% of whom are unaware of the disease (NSPFH, 2011), Type 2 diabetes accounts for almost 95% of diabetes cases (NSPFH, 2011). Moreover, the results of the National Survey on Population and Family Health (NSPFH) conducted in 2003-2004 (SPFH, 2005) demonstrated that the prevalence of diabetes is 10.4% with an urban-rural disparity of 12.2% and 7.1%, respectively. This prevalence tends to triple to 33.6% in 2012, as for obesity, it is 13.2% (NSPFH, 2012). Similarly, the National Survey also noted that the prevalence of diabetes varies from one region to another (NSPFH, 2012). According to the same source, the region of Rabat-salé Zemmour-Zaer, due to its geographical location and other specific characteristics of its own, has major constraints such as the high concentration of the population in the urban environment, a tendency to depopulate the countryside and, illiteracy which spares no age group of the population aged 10 years and over. As for the level of education of the whole population at the time of the general population and housing census in 1994, almost 49% went to the Koranic school, 38.9% have a primary or secondary education and only 6.2% have a higher education level. In addition, diabetes is more prevalent in this region of Morocco. Thus, there are 65 203 diabetics attending basic health care facilities, a prevalence of 2.4%. However, so far, no studies have studied the anthropometric parameters in this vulnerable population such as people with diabetes and especially those with type 2 diabetes. In this study we will first examine the impact of socio-demographic status on the prevalence of obesity in adults with type 2 diabetes aged 18 years and over and secondly identify the age and gender groups that present an increased risk of obesity.

MATERIAL AND METHODS

Type of study

This is a cross-sectional, descriptive, and analytical study designed to determine the anthropometric profile in adults with type 2 diabetes aged 18 years and over

Location of study

This study was conducted between June 2016 and September 2016 at the Sidi Lahcen Temara Provincial Hospital in Morocco. The reasons for this choice a) The site is part of the region most affected by diabetes (NSPFH, 2011) b) accessibility for the researcher, c) the existence of the laboratory of biochemistry and hematology, charged in practice Routine biological examinations for the diagnosis of various pathologies; (D) no studies have yet determined the anthropometric profile of diabetics attending the Sidi Lahcen Temara Provincial Hospital

Target population

Patients with type 2 diabetes aged 18 years and older attending the Sidi Lachen hospital.

The inclusion criteria

We included in this study all patients with type 2 diabetes over the age of 18.

Exclusion criteria

We excluded from the study:

- Hospitalised diabetic
- Gestational diabetes
- Children with diabetes

Data Collection

Data collection was based on the administration of the questionnaire and anthropometric measurements. The questionnaire included different parts to collect socio-demographic and socioeconomic profile information, diabetes data (duration of diabetes, nature of treatment, blood glucose control, regularity of follow-up). In addition to the questionnaire, we measured the weight, height, waist circumference and hip circumference for each patient. These indices make it possible to assess general obesity (defined by BMI) and abdominal obesity (defined by the WC: waist circumference, WHR: waist / hip ratio).

Socio-demographic variables

The socio-demographic variables collected from patients with diabetes are

- Gender: categorized as female and male.
- Age: Quantitative variable has been classified into different age groups (20 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 years and over).
- Marital status: categorized into four groups: married, single, widowed and divorced.
- Place of residence: categorized as a residence in urban or periurban areas.
- Employment status: categorized into 4 groups: unemployed, housewife, irregular work, regular work and retired,
- Economic status (income): Diabetics patients were coded into 2 groups according to a 2007 study by the High Commission for Planning, the income is considered low if it is less than 3000 dirhams per month and is considered average if it is more than 3000 dirhams months.
- Educational level: it describes the level of education which acceded participating; and therefore included 4 classes; a first class concerns illiterate (patient who can neither read nor write); a second class concerns patient who accessed the primary school, a third class concerns patient who accessed the secondary school

and fourth class gathering patient with university level.

Diabetes-related variables

The information collected was

- The duration of diabetes (seniority): this numerical variable was expressed in number of years. It has been classified into two groups: the first group whose seniority is less than or equal to five years and the second group whose seniority is greater than five years.
- The type of diabetes treatment: It has been categorized in patients treated with oral antidiabetics only; in patients treated with insulin only and in patients treated with insulin combined with oral antidiabetics.

Biological variables

For each patient, we noted fasting glucose and glycated hemoglobin values (HbA1c). To be consistent with most studies of glycemic control, HbA1c as an explanatory variable was categorized as good glycemic control (HbA1c ≤ 7.0%) and poor glycemic control (HbA1c> 7%).

Anthropométric variables

Various anthropometric measurements were taken among the participants involved in the study:

- The weight was measured using a regularly personal scale calibrated and expressed in Kg;
- Size was measured using a measuring rod and expressed in cm;
- Waist circumference (WC) was measured slightly above the navel using a tape measure and expressed in cm.
- The hip circumference (HC) was measured using a tape measure at the pubis to obtain the highest hip circumference and expressed in cm

From the measurements of weight, size and waist size, the following indicators were calculated:

- The body mass index (BMI), which was calculated by dividing the weight (in kg) by the square of the size (in meters), expressed in Kg/m². This indicator is commonly used to estimate overweight and weight Obesity in adult populations and individuals. Obesity was defined for a BMI≥30Kg / m2 (WHO, 1999).
- The waist hip ratio (WHR) was calculated by dividing the waist circumference by the hip circumference.
- Based on the World Health Organization recommended thresholds for general obesity and abdominal obesity, we have classified our participants into different categories.

For general obesity, patients were classified into four groups according to BMI (WHO, 2000):

- Patients with underweight whose BMI is less than 18.5 kg / m2;
- Patients in a normal range with a BMI of 18.5 kg / m2 and 24.99 kg / m2;
- Overweight patients with a BMI between 25 kg / m2 and 29.99 kg / m2;
- Obese patients with BMI greater than or equal to 30 Kg / m².

For abdominal obesity, the size / hip ratio and waist circumference were used to identify participants with this type of obesity when the first index (waist / axle ratio) exceeded 0.8 for women and 1 for men and the second (waist circumference) is ≥102cm in men and ≥88cm in women (Lean *et al*., 1995).

Statistical analysis

The IBM SPSS Statistics version 21 software was used for data analysis. Qualitative variables are expressed as frequency and percentage. Quantitative variables are expressed as mean ± SD or median and interquartile range (IQR). The normality hypothesis was evaluated by the Kolmogorov-Smirnov test, but rejected at a p <0.05 value. The comparison of quantitative variables with normal distribution was carried out by the student t test and when the parametric hypotheses were not satisfied, the Kruskal-Wallis test and the Mann-Whitney test were performed. The BMI groups were also compared using the Chi-Square test for qualitative variables, as well as the Fisher test. A threshold value of significance p of 0.05 was adopted for all statistical analyzes

Ethical Statement

The collection of field data began only after obtaining the authorisation issued by the administration of the Sidi lahcen Prefectural Hospital in Temara. In addition, it was essential to obtain the informed consent of the participants who participated in this study, while informing them of the objective of this study.

Table 1 Socio-demographic characteristic of diabetic population

Variables	Diabetic population N=344
Age group	
20 to <30	6(1.7)
30 to <40	22(6.4)
40 to <50	56(16.3)
50 to <60	136(39.5)
60 to <70	84(24.4)
70 and over	40(11.6)
Sex	
Female	260(75.6)
Male	84(24.4)
Place of residence	
Urban	292(84.9)
Periurban	52(15.1)
Employment status	
Unemployed	72(20.9)
House wife	40(11.6)
Irregular work	24(7)
Regilar work or retired	208(60.5)
Education attainment	
Illeterate	252(73.3)
Primary school	80(23.3)
Secondary school	12(3.5)
Higher level of education	0(0)
Marital status	
Single	12(3.5)
Married	276(80.2)
Widowed	14(4.1)
Divorced	42(12.2)
Economic status	
Low	224(65.1)
High	120(34.9)

Values are expressed in count and percentage

Similarly, the right to self-determination has been respected, all participants have been informed that they are free to participate

or not to participate in the study as they may refuse to participate and / or withdraw at any time. Without being able to justify it. The right to anonymity and confidentiality is respected since the tools used will not contain any indication that could identify the participants

RESULTS

Sample characteristics (Table 1)

344 adults with type 2 diabetes were included in this study. The median age was 56 [50-61] with extremes of 22 and 81 years. The distribution by age group revealed that the age group 50 to 59 was the largest. The gender distribution revealed a female preponderance with a gender ratio of 0.32. Most of the participants live in urban areas (84.9%), with a low socioeconomic level (65.1%). At the level of education, more than two-thirds are illiterate, that to say 73.3%. In addition, 20.9% does not have any professional activity. Overall analysis of diabetes-related parameters (Table 2) showed that diabetes was imbalanced in 2/3 of our patients and more than half (54.1%) survived with T2D for a period of 5 years. Compared with the treatment, more than half of the participants combine antidiabetics and insulin, and the rest uses either oral antidiabetics or insulin. At the same time, medical follow-up was regular in the majority of patients (84.3%).

Table 2 diabetes-related parameters in the diabetic population

Variables	Diabetic population N=344
Fasting glycemia (mmol/l)	10.83 [6.88-14.69]
glycated hemoglobin(%)	7.6 [6.77-8.95]
Glycemic balance	
Balanced	116(33.7)
Inbalanced	228(66.3)
Duration of diabete	
Less than 5 years	158(45.9)
Greater than 5years	186 (54.1)
Type of diabetes treatment	
Oral antidiabetics	96(27.90)
insulin	48(13.95)
Oral antidiabetics and insulin	200(58.13)
Medical monitoring	
Irregular	54(15.7)
Regular	290(84.3)

Values are expressed as médiane and interquartils or count and percentage

Study of the prevalence of general obesity and abdominal obesity in the population

If we compare the results of the anthropometric parameters with those of the theoretical reference population, we notice a perturbation of these parameters (Table 3).

Compared with general obesity, the BMI of our patients exceeded the threshold of overweight (27.32 ± 4.43). As for abdominal obesity, mean waist circumference and W / H ratio also exceeded Threshold

Prevalence of general obesity and abdominal obesity in the population by sex

The study of the overall distribution of anthropometric variables by sex in our diabetic patients (Table 4) showed that the prevalence of general and abdominal obesity was significantly higher in women than in men (28.5% versus14.3 %, P <0.001) and (84.6% versus 57.1%, p <0.001) respectively.

Prevalence of general obesity and abdominal obesity in the population by educational attainment and socioeconomic level

In addition, we investigated the distribution of general and abdominal obesity by educational attainment and socioeconomic status of both sexes. For general obesity, bivariate analysis (Table 5) showed that obesity was significantly elevated in women compared to males only in illiterate patients (26.5% versus 8.3%, p = 0.001) and in patients whose Socioeconomic level status is low (31.5% versus 17.4%, p <0.001). In contrast, abdominal obesity was significantly elevated among women compared to men regardless of educational attainment and economic status.

Analysis of anthropometric parameters among diabetic population

Body mass index (BMI)

Analysis of BMI by sex

The median BMI of patients was 26.57 [24.34-29.99] with extremes of 16.74 and 47.61Kg / m2. Figure 2 shows that the median BMI was significantly higher in women than in men (26.75 [24.97-30.47] versus 25.40 [23.35-28.62] p <0.001).

Analysis of BMI by age

The analysis of Figure 1, representing the population distributions according to the measured BMI, highlighted that the mean BMI values exceeded the overweight threshold in all age groups with a statistically unrelated difference Significant (p = 0.122)

Analysis of BMI by age and sex

Analysis of the overall BMI population distribution by age and sex (Figure 3) revealed no statistically significant differences between age groups for this parameter in women (p = 0.083) Than in men (p = 0.630).

Table 3 Global anthropometric description of the diabetic population surveyed (N=344)

Anthropometric Variables	Mean±SD	ES of mean	95% CI	25th Percentile	Median (50th Percentile)	75th Percentile
Weight (Kg)	73.84±12.27	0.66	72.54-75.14	65	73	81.75
Height (cm)	164.53±8.42	0.454	163.64-165.42	159.25	164	170
BMI(Kg/m^2)	27.32±4.43	0.239	26.88-27.83	24.34	26.57	29.99
WC (cm)	104.36±14.78	0.797	102.80-105.93	96	104	114.95
HC (cm)	112.11±15.52	0.836	110.47-113.76	101	110	120
WHR	0.93±0.086	0.004	0.92-0.94	0.91	0.93	0.97

Notes: BMI: body mass Index, WC: waist circumference*, HC:* hip circumference, WHR: waist-to-hip ratio *SD: standart deviation, SE: standart error, CI: confidence interval*

Table 4 Global distribution of anthropometric variable by gender among diabetic population

Anthropometric variable	Diabetic patient N=344 Women n= 260	Men n=84	*p*
BMI groups			**<0.001**
Low	2(0.8)	0(0)	
Moderate	64(24.6)	40(47.6)	
Overweight	120(46.2)	32(38.1)	
Obese	74(28.5)	12(14.3)	
Waist circumference	104.35±15.30	104.42±13.11	0.964
hip circumference	113.03±16.05	109.28±13.43	0.036
waist-to-hip ratio	0.92±0.09	0.95±0.05	0.001
Abdominal obesity			<0.001
No	40(15.4)	36(42.9)	
Yes	220(84.6)	48(57.1)	

Notes: Values are expressed as count and percentage. For body mass index (BMI) groups: low BMI =<, 18.5 kg/m2; normal
BMI = 18.5 to<25 kg/m2; overweight BMI = 25 to <30 kg/m2; obese BMI = >30 kg/m2.Abdominal obesity was defined for waist circumference ≥102cm for men and ≥88cm for women. Significance threshold P < 0.05.

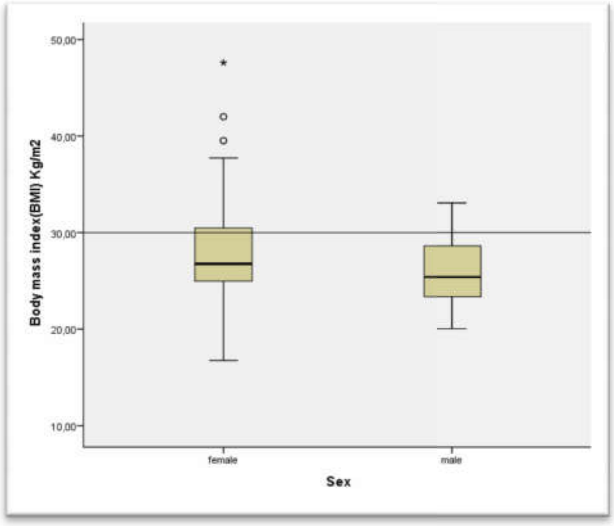

Figure 1 Distribution of population by body mass index and sex

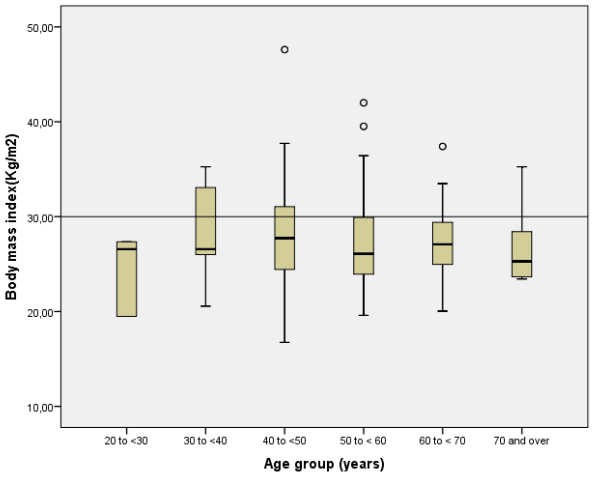

Figure 2 Distribution of population according body mass index and age group

Analysis of BMI categories by age and sex

The analysis of the distribution of the different categories of BMI by age and sex (Table 6) reported the following findings: Among men mean BMI values exceeded the threshold of overweight (set at 25 kg / m2 According to WHO) in the age

Table 5 Correlation between general obesity, abdominal obesity and education attainment, economic status in women and men of diabetic population

Variable	general obesity			abdominal obesity		
	Women	Men	*P*	Women	Men	*p*
Education attainment						
Illeterate	54(26.5)	4(8.3)	0.001	174(85.3)	30(62.5)	<0.001
Primary school	18(37.5)	6(18.6)	0.122	38(79.2)	16(50)	0.006
Secondary school	2(25)	2(50)	0.547	8(100)	2(50)	0.028
Higher level of education	0(0)	0(0)	-	0(0)	0(0)	-
Economic status						
Low	56(31.5)	8(17.4)	<0.001	253(86)	29(63)	<0.001
Intermediate	18(22.0)	4(10.5)	0.338	67(81.7)	19(50)	<0.001
High	0(0)	0(0)	-	0(0)	0(0)	-

Notes: Values are expressed as count and percentage. Significance threshold P < 0.05.

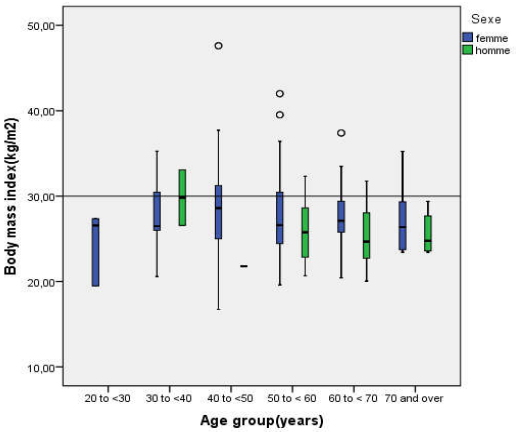

Figure 3 Distribution of population according body mass index, age group and sex

groups of 40 years or over with a maximum peak for the age range 50-59 years (29.82 ± 3.75). The prevalence of overweight and general obesity based on the values of BMI also concerned all age groups that are over 40 years with a peak in the age range 50 to 59 years. In this age group, the prevalence of obesity was significantly high (p = 0.044). In fact, 50% were overweight and the rest was obese. In women the mean BMI values exceeded the threshold of overweight in all age groups of 30 years or more, with a peak in the age rang 30-39 years and 40-49 years. Similarly, the prevalence of overweight and general obesity has affected all age groups over 30.

Waist circumference, hip circumference and waist-to-hip ratio

The analysis of Table 7 representing the distribution of the population according to the other anthropometric parameters (WC,HC, W / H ratio) measured by age and sex showed that in women the mean waist circumference values exceeded the threshold of abdominal obesity in all age groups with a maximum peak for the age range of 40 to 49 years. In this age group, the mean waist circumference was significantly elevated in women compared to men (107.18 ± 16.26 versus 98 ± 0.00, p <0.001). In men, mean waist circumference values exceeded the threshold of abdominal obesity only in age groups of 50 years or over. As for the hip ratio, we found that this parameter exceeds the norms only in women for all age groups.

Table 6 Body mass index category prevalence compared by age group and gender in diabetic population

Agegroup (years)	diabetic patient N=344							
	MeanBMI(Kg/m²)± SD (SEof mean BMI)	Prevalence BMI>=15 and <18.5 Kg/m² (SEof mean BMI)	Prevalence BMI>=18.5 and <20Kg/m² (SEof mean BMI)	Prevalence BMI>=20 and <25 Kg/m² (SEof mean BMI)	Prevalence BMI>=25 and <30 Kg/m² (SEof mean BMI)	Prevalence BMI>=30 and <35 Kg/m² (SEof mean BMI)	Prevalence BMI>=35 and <40 Kg/m² (SEof mean BMI)	Prevalence BMI>=40 Kg/m² (SEof mean BMI)
Women(n=260)								
20 to <30	24.46±3.87 (1.58)	0%(0)	33%(0.033)	0% (0)	66,70%(0,192)	0%(0)	0% (0)	0%(0)
30 to <40	28.11±4.49 (1.06)	0%(0)	0%(0)	11.10%(0.074)	55.60%(0.117)	22,20%(0,097)	22.20%(0.074)	0%(0)
40 to <50	28.49±5.92 (0.8)	3,70%(0.026)	3.70%(0.026)	14.80%(0.048)	40.70%(0.067)	29,70%(0,062)	29.70%(0.026)	3.70%(0
50 to <60	27.62±4.34 (0.45)	0%(0)	2.10%(0.015)	29.80%(0.047)	38.30% (0.05)	23,40%(0,043)	23.40%(0.025)	0%(0)
60 to <70	27.79±3.41 (0.42)	0%(0)	0%(0)	18.20%(0.047)	57.60% (0,06)	21,20%(0.05)	21.20%(0.05)	0%(0)
70 and over	27.03±3.56(0.758)	0%(0)	0%(0)	36.5%(0.10)	45.5% (0.10)	9%(0.061)	9%(0.061)	0%(0)
Men (n=84)								
20 to <30	-	-	-		-	-	-	-
30 to <40	21.79±0(0)	-	-	100%(0.21)	0%(0)	0%(0)	-	-
40 to <50	25.97±3.45 (0.53)	-	-	42.9%(0.076)	42.9%(0.076)	14.20%(0.054)	-	-
50 to <60	29.82±3.75(1,88)	-	-	0%(0)	50%(0.25)	50%(0.25)	-	-
60 to <70	25.64±3.94 (0.93)	-	-	55.60%(0.12)	22.20%(0.097)	22.20%(0.097)	-	-
70 and over	25.57±2.30 (0.54)	-	-	55.60%(0.12)	44.4%(0.12)	0%(0)	-	-

Values are expressed as mean and standard deviation (standard error) or count and percentage
Notes: BMI: body mass index, SD: standard deviation, SE: standard error

Table 7 Waist circumference, hip circumference and waist-to-hip ratio compared by age groups and by sex in diabetic population

Age groups	Waist circumference N=344			hip circumference N=344			waist-to-hip ratio N=344		
	Women n=260	Men n=84	*p*	Women n=260	Men n=84	*p*	Women n=260	Men n=84	*p*
20 to <30	101.66±14.76	-	-	107.33±16.62	-	-	0.95±0.08	-	-
30 to <40	103.11±16.72	101.50±4.04	0.720	109.66±14.91	109±10.39	0.912	0.93±0.06	0.93±0.05	0.900
40 to <50	107.18±16.26	98±0.00	<0.001	115±20.63	104±0.00	<0.001	0.94±0.12	0.84±0.00	<0.001
50 to <60	104.89±16.35	104.42±15.94	0.876	115.85±16.62	109.85±14.62	0.037	0.91±0.09	0.94±0.05	0.004
60 to <70	102.66±12.88	105.66±13.13	0.398	110.09±11.50	110.88±16.20	0.847	0.93±0.05	0.95±0.06	0.146
70 and over	101.81±14.31	104.55±6.59	0.430	109.27±10.91	107.00±8.45	0.463	0.93±0.10	0.98±0.35	0.047

Notes: Values are expressed as mean ± standard deviation. Significance threshold $P < 0.05$.

DISCUSSION

This study on the impact of socio-demographic status on the anthropometric profile of patients with type 2 diabetes (DT2) is the first conducted in Morocco and particularly in the prefecture of Temara using the new WHO standards. We found that women were the most affected by T2D (75.6%) than men. At the national level, these results corroborate with the results of the National Family Health Survey (NSPFH, 2011) which advocate that women are more affected by diabetes than men with respective rates of 3.7 vs. 2.8. Compared to other studies conducted in different contexts, the results are controversial and different from one country to another. Studies in Europe have always shown a higher prevalence of diabetes in men. (Gale and Gillespie, 2001; Wandell and Carlsson, 2014). In contrast, studies in South America and Africa have shown a preponderance of females (Tull and Roseman, 1995; Natacha *et al*., 2015). This result may be explained by the high longevity in women and the increase in the prevalence of diabetes in women after menopause (Tufano *et al*., 2004). The decline in the prevalence of obesity among young women as compared to older women may also reflect the change in the perception of "obesity" that was traditionally seen as a sign of beauty and prosperity among women at a symbol of underdevelopment, especially among younger women with a higher level of education who are more concerned with behaviors that have a lower risk for obesity (Lahman *et al*., 2008). In fact, the female gender is considered a social determinant for type 2 diabetes in some countries of America. Concerning the socioeconomic level of the participants, this study highlights a situation of precariousness with a glycemic imbalance, this corroborates with the remarks of the study that report that diabetic patients with a high precariousness score present a higher risk of bad Glycemic control (HbA1c> 8%) (Peze *et al*., 2015). Taking into account the results of this study, we can make the links with our results which showed that the glycemic imbalance was more increased in our population (66.3%, table 2).In terms of demographics, the distribution of age-related diabetes in the study population reveals that the most affected age group of type 2 diabetes, of all sexes, is between 50 and 59 years (Table 1). These findings are in line with the latest national estimates, which have reported a prevalence of more than 14% in age groups beyond 50 years compared to a prevalence of 9% among all those aged over 20 years. Similarly, our results remain comparable to those found in the majority of diabetic populations in both the Maghreb and the West (Dali-Sahi *et al*., 2012; Bonaldi *et al*., 2006). Moreover, in this study, it seems that in urban areas the rate of diabetes remains higher than in rural areas. The same results are consistent with those of NHSF 2011. In addition, the Temara region is one of the fastest growing urban regions. This urbanization is accompanied by lifestyle changes that promote obesity, in particular, which is one of the most important risk factors for type 2 diabetes (Correia and Golay, 2016). For this "obesity" parameter, the results of this study showed that the prevalence of general and abdominal obesity was significantly higher in women than in

men (28.5% versus 14.3%, p <0.001 And 84.6% versus 57.1%, p <0.001) (Table 4). Specifically for general obesity, our results corroborate those studied in surveys in the Caribbean between 2007 and 2013 for people with type 2 diabetes. These results confirmed that men tend to have lower mean BMI values than Women, which is true for all studies reporting this statistic in the population (Natacha *et al*., 2015). According to the same source, this degree of excess weight is partly responsible for the higher prevalence of type 2 diabetes in women compared to men found in several studies.

As for abdominal obesity, the results of the study showed that in women the mean waist circumference values exceeded the threshold of abdominal obesity in all age groups with a maximum peak in the 40 to 49 age group. In this age group, the mean waist circumference was significantly elevated in women compared to men (107.18 ± 16.26 versus 98 ± 0.00, p <0.001). On the other hand, in men, mean waist circumference values have exceeded the threshold of abdominal obesity only in the age groups greater than or equal to 50 years. As regards the ratio of hip size we have found that this parameter exceeds the norms only in women for all the age groups. These results are consistent with those of a meta-analysis that studied abdominal gender and obesity, as measured by waist circumference and / or waist-to-hip ratio. These results have consistently reported higher rates of abdominal obesity in women than men (Natacha *et al*., 2015).

CONCLUSION

This study aims at highlighting, on one hand, the impact of socio-demographic status on the prevalence of obesity in our diabetic patients and on the other hand, that general and abdominal obesity are simultaneously associated with a prevalence of type 2 diabetes in our population, in particular in women, in the age groups above 30 years for general obesity and in all age groups for abdominal obesity. More research and longitudinal national studies are needed to fully understand the biological mechanisms involved in the relationship between general and abdominal obesity and the prevalence of T2D in different age groups of both sexes. Nevertheless, the promotion of a lifestyle including the prevention of obesity remains a primary means in the prevention of DT2 particularly in Morocco where diabetes and obesity are still very widespread pathologies

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How to cite this article:

Fatima Zahra Laamiri *et al*.2017, Impact of Socio-Demographic Status on The Obesity Prevalence Among Moroccan Adult Population With Type 2 Diabetes. *Int J Recent Sci Res.* 8(6), pp. 17772-17779.
DOI: http://dx.doi.org/10.24327/ijrsr.2017.0806.0420

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