ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at: www.mjotu.com

العـــراقية
المـجلات الاكـاديمية العلمية
IRAQI
Academic Scientific Journals

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# Measurement study of abdominal waist circumference among type 2 diabetes mellitus in Kirkuk city population.

***Keywords*:**

waist circumference,
abdominal obesity,
central obesity,

**ARTICLE INFO**

***Article history:***

Received 20 May 2017
Accepted 28 Nov 2017
Available online 01 June 2018



## *ABSTRACT:*

**Background**: Prior studies have supported that waist circumference (WC) correlates with abdominal (central) obesity and values higher than normal are associated with increased prevalence of type two diabetes mellitus (T2DM) .

**Objective**: To evaluate the association of waist circumference (WC) with increased prevalence of (T2DM) among population in Kirkuk city.

**Research design and methods**: A cross-sectional survey was conducted of 776 men and women 40-70 years of age from Kirkuk city. The relationship between (WC) and blood glucose was assessed .The(WC) was measured in centimeter , together with other data designed in the data sheet for this study , (T2DM) people were identified and recorded .Patients who had Diabetes Mellitus and coexistence of any other serious illness were excluded from the study.

**Results:** (WC) was positively correlated with blood glucose .out of 776 participants , 221(28.5%) had increased (WC) ,this included 59 (26.7%) (T2DM) ,compared with 555 (71.5%) participants with normal (WC),this included32 (5.8%) diabetics .Increasing (WC) were significantly associated with increased prevalence of (T2DM) in the Kirkuk populations($P < 0.05$).

**Conclusions:** Increasing waist circumference was significantly associated with increased prevalence of (T2DM) ,Substantial reduction in diabetes in men and women is achievable if the (WC) is decreased in these populations.

DOI: http://dx.doi.org/10.25130/mjotu.24.01.04

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## INTRODUCTION

In the Middle East the prevalence of type 2 diabetes mellitus (T2DM) ranges from 4.6% to 40% [1]. A worldwide rising prevalence of T2DM has been well documented [2,3] .In addition to the increasing morbidity and higher mortality arising directly from diabetes ,it also contributes substantially to risk of cardiovascular disease (CVD) and renal disease, which are both significant causes of excess mortality[4].

Obesity is strongly associated with diabetes, which is risk factors for cardiovascular disease (CVD) [5].The body mass index BMI is a general indicator of overt obesity, but it does not give exact information about the distribution of obesity [6,7]. And BMI does not necessarily reflect the proportion of the body that is fat [4]. Many studies found that abdominal obesity measured by waist circumference(WC)was more sensitive than total obesity measured by BMI in association with (T2DM) and in the assessment of cardio-metabolic risk [8,9,10,11] .Considerable attention has been given to waist circumference as a complementary and , sometimes , superior assessment to BMI [12,13]. Waist circumference globally used as a parameter to quantify central (abdominal) obesity(14) and it is used to screen men and women for obesity especially in Asian population [15]. Abdominal obesity assessed through waist circumference (WC) is strongly correlated with T2DM in European and Asian population. [6,7].

Waist circumference upper limit value (cut-off points) in males is 102 cm. and in females 88cm. Above these values ,the person is regarded as having increased waist circumference or suffering from abdominal(central) obesity [16,17]

The aim of the study was to evaluate correlations between WC with the prevalence of T2DM among population of Kirkuk city/ Iraq.

## Patients and methods

### Study participants

The study was done on patients and their companions attending the inpatient and outpatient clinics in Azady teaching hospital or in the private clinic in Kirkuk –Iraq ,Written informed consent was obtained from all participants ,their age ranged 42-72 years and the study was conducted from first of 10th of October 20013to 30th of June 20015.During this period, a total of 776 participated the survey.

The main data recorded were name, age , sex, weight , height , (WC), blood pressure (BP) and glycaemia state, and other relevant data .Waist circumference was defined as the distance in centimeters ( Cm); midway between the last rib and the iliac crest at mid expiratory phase of breathing (18,19).While the participant standing upright position, the waist circumference had been measured at the narrowest part of the participant's torso (the minimum circumference in (Cm) between the rib cage and iliac crest) (20), using an anthropometric measuring tape, recorded to the nearest tenth of centimeter 2 to 3 times and used the average of 2 closest measurements (within 2 cm).

In order to evaluate the association of WC with increased health risk, the participants ( male and female ) then had been classified as normal risk when WC (<80 cm), high risk when WC (80–88 cm) (21), while for males group upper limit value of WS is 102 cm. and in females groupe upper limit value of WS is 88cm, above these values ,the person is regarded as having increased waist circumference or suffering from abdominal(central) obesity [16,17]

Hypertensive patient was defined as a person with proved HT and /or on treatment, if not he/she measured his or her blood pressure 3 times in sitting position with 10 minutes rest in the between . Type-2 diabetes mellitus was defined as non-ketosis diabetes by medical history, age more than 40 year and current treatment with oral agent, when he/she was already on treatment, if not then the diagnosis was confirmed by measuring fasting plasma sugar ≥7.0 mmol/L or random plasma glucose ≥11.0 mmol/L according to the state of the patients.

The exclusion criterion was the coexistence of any other serious illness. Pregnant female, individuals with type I diabetes, and physically or mentally disabled persons were excluded from the participation . Administration of insulin for glycemic control was considered an exclusion criterion.

**Questionnaire design**

The information on demographic and socioeconomic factors, diagnosis of diabetes , tobacco and alcohol use, physical activity and family history of diabetes and hypertension was collected with a structured questionnaire

## Statistical analysis

Descriptive data were represented as tables, The data collected were analyzed by the Chi-squared test as appropriate between variables .A P-value <0.05 was considered to be statistically significant.

## Results:

Data from a total of 776 men and women participated in this survey were included in the analysis, female 367 (47.3%), and male 409 (52.7%). Their age ranged from 42-69 years with an average of 56 year. The prevalence of abdominal obesity in females was (42.2%) compared with (16.1%) in males. The prevalence of abdominal obesity adjusted for sex was 29.2% .It was more common in female (42.2%) compared with (16.1% )in male. The difference was highly significant. P. vale (<0.001),Table (1). There is a proportional increase in the number of cases of (T2DM) as the WC value increased in both sexes ,Table (2 and 3).For the females, out of367 female; 155(42.2%)had increased WC (>88cm).This included 23(14.8%) women with type two DM, compared with 212 (57.8%) females with WC ≤88cm ,this included 12 (5.7%) women with DM P < .005 .Table(1,2) .

Out of 409 males: 66(16.1%) had increased WC (>102cm), this included 13(19.7%)(T2DM) patients; compared with343(89.9) males with normal WC (≤102 cm), which included 20(5.8%)diabetic patients P < .005.Table (1 and 3).

Out of 776 participants ,221(28.5%) had increased waist circumference ,This included 59 (26.7%) diabetics ,compared with555 (71.5%)participants with normal waist circumference and included 32 (5.8%) diabetics. Increasing waist circumference were significantly associated with increased prevalence of type 2 diabetes in the Kirkuk populations (P < 0.05).Table (4).

The number of patients with increased WC of both sexes was 221 distributed in such a way that as the age increased the WC also increased until the age group 50-59 when this process seemed to be stopped. P >0.05 Table (5). Most of patients with increased WC were of poor socioeconomic state and of low educational level. Out of 155 female with increased WC ,110 were of poor socioeconomic state and 45 of medium to high socioeconomic state ,83% of them were of low educational level and 11% of medium educational level ,while in males ,out of 66 male with increased WC ,43 patients of poor socioeconomic state ,23 patients of medium to high socioeconomic state ,41% of low educational level and 42% of medium educational level. Table (6)

## Tables:

**Table (1): Prevalence of abdominal obesity .**

| Sex | Total No. | No. of patients with increased W.C | Prevalence rate% | P value |
|---|---|---|---|---|
| Females | 367 | 155 | 42.2 | <0.001 |
| Males | 409 | 66 | 16.1 | |
| Average prevalence adjusted for sex | | | 29.2 | |

- .No.=number .WC=waist circumference .Significant whenever P value < 0.05

**Table (2): The relation of waist circumference to diabetes mellitus in female patients .**

| Waist circumference | | Patients No.(%) | patients with no DM No. (%) | Diabetic patients No. (%) | P value |
|---|---|---|---|---|---|
| ≤ 88 Cm | | 212(57.8) | 200 (94.3) | 12 (5.7) | <0.05 |
| >88 Cm | Total | 155(42.2) | 132 (85.2) | 23 (14.8) | |
| | 89-100cm | 104 | 92 (88.5) | 12 (11.5) | <0.05 |
| | >100cm | 51 | 40 (78.4) | 11 ((21.6) | |
| Total | | 367 | 332 | 35 | |

- .No.=number .WC=waist circumference
- .Significant whenever P value < 0.05 HT =hypertension
- DM=diabetes mellitus

**Table (3): The relation of waist circumference to hypertension and diabetes mellitus in male**

| Waist circumference | | Patients No. | patients with no DM No. (%) | Diabetic patients No. (%) | P value |
|---|---|---|---|---|---|
| ≤ 102Cm | | 343(83.9) | 323(94.2) | 20(5.8) | <0.05 |
| >102 Cm | Total | 66(16.1) | 53(80.3) | 13(19.7) | |
| | 103-110cm | 48 | 39(81.2) | 9(18.8) | <0.05 |
| | >110cm | 18 | 14(77.8) | 4(22.2) | |
| Total | | 409 | 376 | 33 | |

**Table (4): The relation of waist circumference to diabetes mellitus in all participant t(men and women)**

| Waist Circumference | Patients No. | patients with no DM No. (%) | Diabetic patients No. (%) | P value |
|---|---|---|---|---|
| **Increased** | **221(28.5)** | **162( 73.3)** | **59(26.7)** | **<0.05** |
| **Normal** | **555(71.5)** | **523(94.2)** | **32(5.8)** | |
| **Total** | **776** | **685** | **91** | |

- No.=number . * WC=waist circumference.
- Significant whenever P value < 0.05 * HT =hypertension
- DM=diabetes mellitus

**Table (5): The relation of age and sex with the increased waist circumference**

| Age group in years | No. of females with increased WC | No. of males with increased WC |
|---|---|---|
| **40-49** | **79** | **34** |
| **50-59** | **59** | **22** |
| **60-69** | **15** | **10** |
| **70** | **2** | **0** |
| **Total No.** | **155** | **66** |

**P >0.05** No.=number

- .WC=waist circumference
- .Significant whenever P value < 0.05

**Table (6):** The relationship between abdominal obesity, sex, socioeconomic and educational level

| sex | Total No. | Poor socioeconomic state(%) | Medium to high socioeconomic state | Educational level % | | |
|---|---|---|---|---|---|---|
| | | | | Low | Medium | High |
| **Female** | **155** | **110(70.1%)** | **45** | **83%** | **11%** | **6%** |
| **Male** | **66** | **43(65.2%)** | **23** | **41%** | **42%** | **17%** |

## Discussion:

Waist circumference is used to assess the patient's abdominal fat. Increased WC is an indicator of excess abdominal fat (central obesity), and consequently increased risk of having type two DM ( 22, 23, 24, 25,26).

this study showed that There is sex deference regarding the prevalence of visceral (abdominal) obesity with clear female preponderance 42.2% compare with only 16.1% in male. the fact that female have higher prevalence of abdominal obesity supported by Jensen Michael on obesity[(17)] and Pyeritz Reed on eating disorders and prevalence of obesity [(27)] .

This study shows proportional increase in the number of cases of T2DM as the WC value increased. This is consistent with a study done by Okosun et al, assessed the association of waist circumference and risk of type 2 diabetes in populations from African origins which showed that waist circumference was significantly and positively associated with fasting blood glucose, regardless of origin [(28)]. Also consistent with astudy done by Wang Yufa et al, showed that WC was a better measure of central obesity for predicting the risk of type two DM (11).And another Comparable study was done on Mexican Americans aged 25-64 years showed that WC was the only significant predictor of non-insulin dependent DM (9).Another study on Caribbean's showed; WC appeared to be the major indicator associated with diabetes mellitus (29).

This study shows proportional increase in WC (abdominal obesity) in late middle age then it begins to decrease in later years ,this finding is showed in both sexes this is consistent with a study done by Dellon et al and Kuk et al showed that; WC is positively associated with age [(29, 30)].also consistent with study by Jensen Michael ,reported that ,the prevalence of obesity tends to rise steady from age 20 to 60 years, then it doesn't increase, or begins to decrease in later years [(17)].

In this study the majority of women and men are of poor socioeconomic state and they are much more likely to be obese, this is consistent with Jensen Michael writing that there is an inverse relationship between socioeconomic status and obesity ,especially among women [(17)].

This study also shows that a majority (83%) of women with abdominal obesity have a low educational level compared with(41%)of males have a low educational level ,this finding confirmed by a Caribbean study done by Caribbean and Dutch researchers showed that women with a low educational level had a higher prevalence of central obesity in the Caribbeans [(29)] .

This study has limitations. it used a cross-sectional design, which prevents causal inferences ,the results suggest a relationship between waist circumference and CVD risk factors, specifically diabetes , one must be careful in making causal attributions from a cross-sectional study, but our results suggest that , maintaining a normal waist circumference may reduce cardiovascular health risks (T2DM). The attributable risk of T2DM associated with substantially increased waist circumference suggests that risk of developing type tow diabetes could be reduced considerably by reducing waist circumference ; however, more researches are needed in this area.

Suggestions for farther future researches include first using a prospective design to study the degree to which waist circumference is predictive of disease incidence,and second examining whether reductions in waist circumference predict reductions in health risk, like diabetes over time.

There are several strengths in this study, including, anthropometric measurement according to a standardized protocol and fasting and postprandial blood glucose tests for the participants.

**Conclusions and recommendations:**

There is a strong association between measures reflecting abdominal obesity and the development of type 2 diabetes mellitus .Increasing waist circumference were significantly associated with increased prevalence of (T2DM) , and reducing WC may reduce the risk of developing type 2 diabetes.

Substantial reduction in type tow diabetes in men and women is achievable if the waist circumference is decreased in these populations. Intervention programs designed to reduce waist size through lifestyle modification, including exercise program and diet, may have significant public health significance in reducing the incidence of adult-onset diabetes (T2DM) in these populations.

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