

## **The relation between waist circumference, hypertension and type two diabetes mellitus**

العلاقة بين محيط الخصر ,ارتفاع ضغط الدم الشرياني و النمط الثاني من داء السكري

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### **Abstract:**

**Background:**Waist circumference is a useful parameter used to measure abdominal obesity .Values higher than normal are associated with increased prevalence of Diabetes Mellitus and Hypertension.

**Objective:** To evaluate the association between increased waist circumference and the increase in incidence of hypertension and type two diabetes mellitus.

**Methods:** The total number of persons examined was 1677. Their age ranged from 20-70 years with an average of 53 year.The waist circumference was measured in centimetre , together with other data designed in the data sheet for this study , hypertensive and diabetic(type two) people were identified and recorded.

Patients who had coexisted Diabetes Mellitus and hypertension were excluded from the study.

**Results:** The total number of females was 785,out of them ,379(48%)had increased waist circumference ,This included 137(36%)hypertensive, and 55(14.5%) diabetics ,compared with 406(52%)women with normal waist circumference and included 53(13%)hypertensive and 32(7.9%)diabetics.

Out of 892 males ,104(11.7%)had increased waist circumference and included 37(35.6%) hypertensive and 19(18.3%)diabetics, compared with 788 men who had normal waist circumference ,and included 81(10.3%)hypertensive and 60(7.6%) diabetics.

### **Conclusion:**

1. The prevalence of hypertension and type two diabetes mellitus was seem to be increased in proportion to the increasing in waist circumference.
2. Low educational level and socioeconomic state associated with increased prevalence of obesity and its complication.

**Keywords:** waist circumference, abdominal obesity, central obesity, cut-off points, companions

### **الخلاصة:**

**تمهيد:** محيط الخصر هو معيار نافع يستعمل لقياس سمنة البطن . القيم التي هي أعلا من الطبيعي تكون متزامنة مع زيادة الاستعداد للإصابة بداء السكري و ارتفاع ضغط الدم الشرياني.

**الهدف:** لتقييم الترابط بين زيادة محيط الخصر و الزيادة في حدوث حالات الإصابة بارتفاع ضغط الدم الشرياني و داء السكري النمط الثاني.

**الطرق :** ألف و ستمائة و سبع و سبعون شخص تتراوح أعمارهم بين عشرين إلى سبعين سنة خضعوا لهذه الدراسة. محيط الخصر لديهم قد قيس بالسنتيمتر بالإضافة إلى معلومات أخرى مثبتة في ورقة استبيان خاصة بهذه الدراسة.

الأشخاص المصابون بارتفاع ضغط الدم الشرياني و داء السكري النمط الثاني قد شخصوا و سجلوا. لقد استنتج من الدراسة المرضى الذين تزامنوا أصابهم بارتفاع ضغط الدم الشرياني مع داء السكري

### **النتائج:**

العدد الإجمالي للنساء هو 785 منهم 379 (48%) لديهم محيط خصر عالي ، وهذا يتضمن 137 (36%) مريضة مصابة بارتفاع ضغط الدم الشرياني و 55 (14.5%) مريضة مصابة بداء السكري . قورن مع 406 (52%) سيدة لديهن محيط خصر طبيعي و تتضمن 53 (13%) مريضة مصابة بارتفاع ضغط الدم الشرياني و 32 (7.9%) بداء السكري . في الذكور (العدد=892)

منهم 104 (11.7%) لديهم زيادة في محيط الخصر و يتضمن 37 (35.6%) مصابا بارتفاع ضغط الدم الشرياني و 19 (18.3%) بداء السكري قورنوا مع 788 رجل لديهم محيط خصر طبيعي و يتضمن 81 (10.3%) مصابا بارتفاع ضغط الدم الشرياني و 60 (7.6%) بداء السكري .

#### **الاستنتاج:**

1. إن نسبة حدوث حالات ارتفاع ضغط الدم الشرياني وداء السكري قد وجدت تزداد باضطراد تبعا للزيادة في محيط الخصر.
2. التدني في المستوى الثقافي و الاقتصادي يكون مصحوبا بزيادة نسبة الإصابة بالسمنة و مضاعفاتها .

#### **Introduction:**

Waist circumference is the waist girth or the distance midway between the lowest rib and the iliac crest at mid expiration <sup>(1, 2)</sup>. It is globally used as a parameter to quantify central (abdominal) obesity<sup>(3)</sup>.

Waist circumference is used to screen adults for obesity especially in Asian population <sup>(4)</sup>.

Waist circumference upper limit (cut-off points) in adult males is 102 cm. and in adult females 88cm. Above these values ,the person is regarded as having increased waist circumference or suffering from abdominal obesity <sup>(5,6)</sup>. In some Asian authorities (in India) ,modify the waist circumference cut-off to 90cm for men and 80cm for women <sup>(7)</sup> .

Development of excess abdominal fat depends on many factors, e.g gender,(men tends to store their fat in the abdomen ,while females ,their fat is mostly stored in their buttocks and upper thighs) , heredity ,age(waist circumference is positively associated with age )<sup>(8)</sup> ,and lack of exercise<sup>(9)</sup>.

The significance of increased waist circumference is that it indicates cases with central or abdominal obesity and consequently it indicates cases with high risk for obesity related disorders, among them type two Diabetes Mellitus and cardiovascular diseases <sup>(10)</sup>.

Abdominal obesity is found to be associated with a two to three folds increased risk of hypertension <sup>(11)</sup> in United States, and it was estimated that 24 million adult American men and 40 million adult American women are suffering from abdominal obesity <sup>(11)</sup>.

Many studies found that central obesity measured by waist circumference was more sensitive than total obesity measured by body mass index in association with NIDDM and in the assessment of cardio-metabolic risk <sup>(12, 13, 14, 15)</sup>.

Health authorities are directly concerned with the serious consequences of abdominal obesity and should create suitable programs e.g. obesity reduction programs .The optimal approach in weight reduction programs appears to be a combination of regular physical activity and caloric restriction<sup>(16)</sup> .

#### **Patients and methods:**

The study was done on adult companions of patients attending the out patient clinics in Al-Hussain general hospital in Kerbala –Iraq, their age ranged 20-70 years and the study was conducted from first of July 2005 to 30<sup>th</sup> of June 2007.

The main data recorded were name, age, sex, weight, height, waist circumference (WC), blood pressure (BP) and glycaemia state, and other relevant data.

Waist circumference was defined as the distance in centimetres; mid way between the last rib and iliac crest at mid expiration <sup>(1, 2)</sup>.

Hypertensive patient was defined as a person with proved HT and /or on treatment, if not he/she was allowed to rest for 10-15 minutes followed by three readings of blood pressure in sitting position with 10 minutes rest inbetween, and the patient is asked to come for another visit 6-14 days later to repeat BP check as above and the average BP was identified and recorded. The instrument used to check BP was Japan made new mercurial sphygmomanometer. A patient with a reading

at/or  $\geq 140/90$  mm Hg was regarded as hypertensive. Diabetic patient was defined when he/she was already on treatment, if not then the diagnosis was made according to Dr.BM Fried and B.M Frisher<sup>(17)</sup> by urine testing for glycosuria ,then confirmed by :

Fasting plasma sugar  $\geq 7.0$  mmol/L or random plasma glucose  $\geq 11.0$  mmol/L according to the state of the patient.

### **Results:**

The total number of patients examined was 1677(Female 785(46.8%), Male892 (53.2%). Their age ranged from 20-70 years with an average of 53 year. The prevalence of abdominal obesity in females was (48%) compared with (11.7%) in males.

The prevalence of abdominal obesity adjusted for sex was 28.8% .It was more common in female (48%) compared with 11.7% in male. The difference was highly significant. P. vale ( $<0.001$ ), .Table (1).

There is a proportional increase in the number of cases of HT and DM as the WC value increased in both sexes .Table (2 and 3).For the females ,out of 785 female; 379(48%)had increased WC ( $>88$ cm ).This included 137(36%)women with HT and 55(14.5%) with type two DM, compared with 406(52%) females with WC  $\leq 88$ cm ,this included 53(13%) lady with HT and 32(7.9%)with DM. Table(1,2) .

Out of 892 males: 104(11.7%) had increased WC ( $>102$ cm), this included 37(35.6%) HT and 19(18.3%) diabetic patients; compared with 788males with normal WC ( $\leq 102$  cm), which included 81(10.3%) hypertensive and 60(7.6%) diabetic patients .Table (1 and 3).

The number of patients with increased WC of both sexes was 483 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. Table (4).

Most of patients with increased WC were of poor socioeconomic state and of low educational level. Out of 379 female with increased WC ,277 were of poor socioeconomic state and 102 of medium to high socioeconomic state ,87% of them were of low educational level ,while in males ,out of 104 male with increased WC ,55 patients of poor socioeconomic state ,49 patients of medium to high socioeconomic state ,43% of low educational level and 49% of medium educational level. Table (5)

### **Tables:**

Table (1): Prevalence of abdominal obesity .

Sex	Total No	No. of patients with increased w.c	Prevalence rate %	P value
Females	785	379	48	<0.001
Males	892	104	11.7	
Average prevalence adjusted for sex			28.8	

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

Waist circumference		patients No. (%)	patients with no HT&/or DM No. (%)	Hypertensive patients No. (%)	P value	Diabetic patients No. (%)	P value
≤ 88 cm		406	321(79.1)	53(13.0)	<0.05	32(7.9)	<0.05
>88 cm	Total	379	187	137		55	
	89-100cm	248	135(54.4)	80(32.3)	<0.05	33(13.3 )	<0.05
	>100cm	131	52(39.7)	57(43.5)		22(16.8)	
Total		785	508	190		87	

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

Waist circumference		patients No. (%)	patients with no HT&/or DM No. (%)	Hypertensive patients No. (%)	P value	Diabetic patients No. (%)	P value
≤ 102 cm		788	647(82)	81(10.3)	<0.05	60(7.6)	<0.05
>102 cm	Total	104	48	37		19	
	103-110 cm	75	36(48)	26(34.7)	<0.05	13(17.3)	<0.05
	>110 cm	29	12(41.4)	11(37.9)		6(20.7)	
Total		892	695	118		79	

Table (4): 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
20-29	33	9
30-39	86	30
40-49	130	32
50-59	98	24
60-69	31	9
70	1	0
Total No.	379	104

P >0.05

Table (5): 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	379	277	102	87%	8%	5%
Male	104	55	49	43%	49%	8%

### **Discussion:**

There is sex deference in regard to the prevalence of visceral (abdominal) obesity; the study shows clear female preponderance. Women generally have higher rates of obesity than men and that in the eastern Mediterranean region women have higher prevalence of obesity, generally higher than women in most industrialized countries <sup>(10)</sup>. The writing of Jensen Michael <sup>(6)</sup> on obesity and Pyeritz reed on eating disorders and prevalence of obesity <sup>(21)</sup> support the fact that; female have higher prevalence of abdominal obesity.

As mentioned earlier, WC 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 and HT <sup>(10, 18)</sup>.

This study showed that "there is a proportional increase in the number of cases of HT and DM as the WC value increased.

Comparable study was done in Baghdad by Tawfeek et al who showed that ;WC was positively and significantly correlated with systolic and diastolic BP <sup>(19)</sup>. Another study was done in America ,showed that HT appeared to be associated with abdominal obesity <sup>(11)</sup>, with racial ethnic differences <sup>(5)</sup>. Another study on Caribbean's showed ;WC appeared to be the major obesity indicator associated with HT and DM <sup>(8)</sup>. A study was done on 721 Mexican Americans aged 25-64 years showed that WC was the only significant predictor of non-insulin dependant DM <sup>(12)</sup>. The American Journal of Clinical Nutrition on 12<sup>th</sup> march 2005 published a study showed that ;WC was a better measure of central obesity for predicting the risk of type two DM <sup>(14)</sup>.

This study shows that; with increased age there is an increase in WC (abdominal obesity) until late middle age when it goes down .This is showed nearly equally in both sexes .Jensen Michael reported that; the prevalence of obesity in adults tends to rise steady from age 20 to 60 years, then it doesn't increase, or begins to decrease in later years <sup>(6)</sup>. Dellon et al and Kuk et al showed that; WC is positively associated with age <sup>(8, 20)</sup>.

This study shows that 277 out of 379 women (73%) are of poor socioeconomic state compared with 55 men out of 104 (nearly 52.9%) .This means that females of low socioeconomic state are much more likely to be obese, this is consistent with Jensen Michael writing on obesity when he mentioned that 'there is an inverse relationship between socioeconomic status and obesity, especially among women <sup>(6)</sup>.

This study also shows that a majority (87%) of women with abdominal obesity have a low educational level ,while (43%) of males have a low educational level .A Caribbean study done by Caribbean and Dutch researchers confirms that women with a low educational level had a higher prevalence of central obesity in the Caribbeans <sup>(8)</sup> .

### **Conclusions and recommendations:**

1.The study shows: Abdominal obesity prevails in this country especially among females and consequently the risk of: Hypertension, Diabetes and other obesity –related disorders are increased.

- 2.Low educational level and poor socioeconomic state are associated with increased prevalence of obesity in general and abdominal obesity in particular.
- 3.The ministry of health supported by higher governmental levels can play a great role in educating patients at risk through health personals.
- 4.The mainstay solution is the advice to all persons at risk: to change their life style, by regular exercise, avoidance of unhealthy diet and caloric restriction.

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