Bull. Fac. Agric., Cairo Univ.,59 (2008):295-300.

THE RELATIONSHIP BETWEEN SOME ANTHROPOMETRIC INDICES AND THE INCIDENCE OF HYPERTENSION IN STUDENTS OF RIYADH UNIVERSITY FOR WOMEN

(Received: 23.4. 2008)

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ABSTRACT

Hypertension is a risk factor for cardiovascular disease that is typically obesity-related. Decrease in adiposity is one of the most effective preventive measures not only in decreasing the overall cardiovascular risk but also the blood pressure. The performance of different anthropometric measurements and indices in predicting obesity-related outcomes has been included in this study. To investigate the association between several anthropometric measurements of obesity with the incidence of hypertension. Ninety nine females with mean age of 21±1.8 years were included in this study. Along our sample population, two blood pressure readings and several anthropometric measures were recorded. Both body mass index (BMI) and waist circumference (WC) were significantly ($p<0.05$) associated with systolic and diastolic blood pressure (SBP and DBP). The prediction of obesity-related health risks is significantly improved by the inclusion of WC in addition to BMI percentile. This observation supports the notion that WC should be included in the evaluation of obesity along with BMI percentage to identify those at increased health risks (*i.e*. hypertension) due to excess of abdominal fat.

Key words: *anthropometric, hypertension,student females.*

1. INTRODUCTION

Normal weight, overweight, and obesity are defined according to the magnitude of BMI, expressed as weight in kilograms divided by the square of height in meters. According to the World Health Organization (WHO, 1997) definition, overweight is classified as a BMI ≤ 25 kg/m2, and obesity is defined as a BMI ≤ 30 kg/m2 for both men and women (WHO, 1997).

Although BMI was found to correlate well with measures of adiposity (Heymsfield *et al*., 1995) and associated with both mortality (Allison *et al*., 1999) and some chronic diseases (Michels *et al*. (1998) and Baumgartner *et al.* (1995), other factors might contribute independently to risk (U.S. Department of Health and Human Service, (2000) and Janssen *et al.* (2002)). Specifically, many studies had reported that after controlling BMI, increased intra-abdominal adipose tissue was strongly associated with metabolic and cardiovascular risk and a variety of chronic diseases (Larsson *et al.* (1984) , Vague *et al.*, (1988) , Despres *et al.* (1990) , Stevens *et al.* (1992), Björntorp (1993), and Folsom *et al.* (1993) Reeder *et al.* (1997)).

BMI could not account for the wide variation in body fat distribution that might exist at any level of relative body size. Waist circumference (WC), however, would compensate this limitation of BMI, by bringing regional fat into consideration (Ross *et al.*, 1992), Pouliot *et al.* (1994), Han *et al.* (1995), Lean *et al.* (1995 &1996), and (Onat, 1999). Janssen *et al*,(2002,a&b) show that WC had an independent association with cardiovascular disease, indicating the potential utility of using WC in addition to BMI in clinical practice and suggesting that a combination of BMI and WC might be preferable to BMI alone for obesity risk assessment. Such a combination measure would require little extra cost or equipment and could increase the clinician's ability to identify individuals at high risk for diseases that might correlate with excess adiposity (hypertension).

However, a more recent study brings into question the potential utility of a combination measure (Janssen *et al.,* 2004). They reported that, with the exception of hypertension in men, BMI would not independently contribute to predicting cardiovascular disease risk once WC would be taken into account. Thus, although it has been demonstrated frequently that WC showed an independent contribution when added to BMI, initial observations suggest that the converse has not been investigated carefully (Rosmond and Biomtorp ,1998).

The aim of the present study was to investigate whether a combined measure of BMI and WC could be preferable to BMI or WC alone for the identification of cardiovascular disease risk factors in a specific subsample, of Saudi Arabian adult females.

2. MATERIALS AND METHODS

2.1 Materials

The study included 99 students of healthy adult females aging 22±1.2 years randomly selected from the Faculty of Home Economic of Riyadh University for Women. All studits were subjected to complete medical history and students physical examination.

2.2Methods

2.2.1 Blood pressure

During the rest state of the subject, two blood pressure readings, ten minutes apart were taken using standard mercury sphygmomanometers with appropriate cuff sizes (KBM/SM-300). Mean of these two readings was used for analysis.

2.2.2 Anthropometric measurements

Height and weight were recorded using standard equipment and the values were rounded off to the nearest 0.5 cm and 0.2 Kg respectively (Gibson, 1991). Height was measured without shoes and the subject standing erect with the abdominal relaxed, the arms at the sides and feet together. Weight was measured with wearing minimal clothes. Hip circumference was measured at the level of greater trochanters of femur and waist circumference was measured at a point midway between the ribcage and iliac crests. Waist circumference was taken as reference measure of abdominal obesity, according to the National Institute of Health (1998) Guidelines on the Identification, evaluation and treatment of overweight and obesity. BMI was calculated as Kg/m2. Continuous variables were expressed as mean ± 1 SD The diagnosis of Diabetes Mellitus (DM) and other comorbids were based on medical history.

2.3 Statistical analysis

The data were analyzed using SPSS® version 11.0 for windows (SPSS Inc., Chicago, IL, USA)... Statistical significance was considered at $p < 0.05$ for all analysis.

3. RESULTS

The mean age of the student females was 21±1.8 years. The auther investigated some anthropometric indices that were most strongly associated with elevated blood pressure in a representative population sample of middle-aged Saudi Arabian adult females.

The characteristics of the studied population are shown in Table (1). Data demonstrated that, there is a strong association between the increase in the body weight and increase in systolic blood pressure (SBP) and diastolic blood pressure (DBP) ($P<0.05$). The BMI and WC showed strong association as good indicators for obesity degrees. The age is universal in our study (21±1.8 years), so there is no significant association with increase in body weight ($P>0.05$). Surprisingly, the family history of hypertension was not significantly associated with increase in body weight ($P>0.05$) while DM was strongly associated with body weight ($P<0.05$). Other anthropometric measures (Hip circumference, Waist to height ratio and Waist to hip ratio) showed insignificant relation with the increase in body weight ($P>0.05$). Table 2, shows the effects of anthropometric variables on systolic and diastolic blood pressure. WC was significantly associated with both SBP and DBP ($P<0.05$). While BMI was only significantly associated with SBP. Also, it was found that, there was a significant association between waist to height ratio (WHTR) and SBP and between weight and DBP ($P<0.05$). Data in Table (3) described univariate correlations among age, blood pressure (SBP and DBP), and anthropometric variables. The prevalence of elevated blood pressure increased across the quintiles of BMI (marker of total adiposity) and WC (marker of central adiposity), $P<0.001$ for each. Waist and height adjusted for each other were independently related to the prevalence of elevated blood pressure. The age adjusted no correlations between systolic and diastolic blood pressure measurements and the measurements of BMI, weight, WC, Waist to height ratio (WHTR) and Waist to hip ratio (WHR) were close and significant, $P<0.001$ for each. The ranking and significance of the correlations were hardly affected by excluding the treated hypertensive people.

4. DISCUSSION

Excess body weight and obesity are well recognized risk factors for blood pressure (Kannl *et al.* (1990) and Stamler *et al.* (1999)). In particular, central body fat accumulation is associated with hypertension (Johnson *et al.*, 1995) and Okosun *et al.* (2004)). We evaluated the relative role of central fat accumulation on the relationship between excess body weight and high blood pressure in a random sample of middle-aged females of Riyadh University for Women.

In previous studies, body mass index and waist to hip ratio have been the two anthropometric measures often used as expressions of overweight and the pattern of body fat distribution, respectively (Michels *et al.*, 1998). Cambien *et al.*, (2004). However, waist circumference has been found to be a better marker

(Table 1): Characteristics of the studied population*.

*	Underweight N=9	Normal N=54	Overweight N=22	Obesity I N=8	Obesity II N=2	Obesity III N=4	Total N= 99	*P*
Age (years)	22 ±1.2	21±1.6	21±1.9	21±2.7	24±0.0	23±1.1	21±1.8	>0.05
SBP(mmHg)	110±14	115±13	119±11	126±14	130±13	140±16	119±13	<0.05
DBP (mmHg)	70±9	72±11	72±11	75±9	81±16	91±17	74±11	<0.05
Height (cm)	161±6	159±6	161±7	160±13	152±8	153±6	159±7	>0.05
Weight (kg)	46±4	55±6	71±7	84±13	85±7	91±8	64±13	>0.05
BMI (kg/m2)	17±0.4	22±2	27±1.5	32±1.8	36±1	41±0.5	26±4.5	<0.05
Waist circumference (cm)	62±6.6	71±10.5	88±9	90±10.6	92±12	93±12.6	80±12	<0.05
Hip circumference (cm)	63±6.6	73±10.6	87±11	89±6.5	93±5.7	95±6	77±13.3	>0.05
Waist to height ratio	0.42±0.04	0.49±0.07	0.55±0.06	0.56±0.04	0.56±0.05	0.57±0.06	0.5±0.07	>0.05
Waist to hip ratio	0.78±0.08	0.8±0.1	0.82±0.08	0.77±0.15	0.78±0.19	0.76±0.16	0.8±0.1	>0.05
Family history of hypertension(%)	1 (0.09)	5 (2.7)	9 (1.98)	4 (50)	1 (50)	4 (100)	24(23.8)	>0.05
Diabetes Mellitus (%)	0 (0)	3 (5.6)	2 (9.1)	3 (37.5)	0 (0)	2 (50)	10 (10.1)	<0.05

* Middle aged Saudi Arabian adult females.

of abdominal fat content than is waist to hip ratio and the use of waist circumference for the assessment of abdominal fat content has been recently recommended by the National Institutes of Health Guidelines on the Identification (National Institutes of Health, 1998).

The study demonstrated that, the waist circumference represented a better correlate of blood pressure than body mass index itself. Thus, the inexpensive and easy to perform measurement of waist circumference may be a practical relevance in the assessment of the risk associated with the different components of the metabolic syndrome, as recently confirmed by Lemieux *et al.* (2000). Also published results of the National Health Survey of Pakistan (1990-1994) showed a high prevalence (25%) of overweight and obesity in the Pakistani population. Female gender was independently associated with being overweight or obese (Jafa *et al.*, 2006). A higher prevalence of coexistence of cardiovascular risk factors in Pakistani females and increasing age and higher BMI were among the factors that were independently associated with the coexistence of risk factors (Jafa, 2006).

Surprisingly, the family history of hypertension was not significantly associated with increase in body weight while Enas *et al.* (2004), found strong association between blood pressure and family history of obesity. The hypothesis, DM was strongly associated with body weight in controversial to the study of Cooper *et al.*(1997), they found no relation between the studied factors. The age is a universal non-modifiable variable, and hence its effect was inevitable in the obtained results.

Several pathogenic models have been proposed to explain the association between central adiposity and blood, including neuroendocrine abnormalities identified in abdominally obese subjects (Rosmond and Biomtorp, 1998)) and enhanced sympathetic nervous system activity (Grassi *et al.*, 2004). Enhanced sympathetic activity induces vasoconstriction and increases cardiac output. It may also promote renal tubular sodium reabsorption (Seidell *et al.*, 2001).

In contrast to our study, Siani *et al*. (2002), found no association between any anthropometric variable and increasing blood pressure in females. In conclusion, the simple measure of waist circumference as an index of central obesity is a

Table (2): The effects of the anthropometric variables on SBP and DBP.

	SBP (mmHg)			DBP (mmHg)		
	F value	**X^2**	**P value**	**F value**	**X^2**	**Pvalue**
Age (years)	0.143	0.966	>0.05	0.733	0.571	>0.05
Height (cm)	2.046	0.094	>0.05	0.38	0.76	>0.05
Weight (kg)	2.36	0.076	>0.05	0.75	0.008	<0.05
BMI (kg/m2)	3.57	0.009	<0.05	2.73	0.133	>0.05
Waist circumference (cm)	2.046	0.004	<0.05	1.64	0.168	<0.05
Hip circumference (cm)	2.36	0.076	>0.05	0.672	0.613	>0.05
Waist to height ratio	2.49	0.048	<0.05	0.867	0.487	>0.05
Waist to hip ratio	2.18	0.0955	>0.05	0.333	0.855	>0.05
Family history of hypertension (%)	2.01	0.076	>0.05	0.721	0.261	>0.05
Diabetes Mellitus (%)	3.51	0.046	<0.05	1.66	0.76	>0.05

Table(3): Univariate correlations among age, blood pressure, and anthropometric variables.

variable	SBP	DBP	BMI	WC	HC	WHR	WHTR	DM
Age	0.227	0.111	0.008	0.110	0.098	0.152	0.208	0.132
SBP		0.679	0.111	0.230	0.204	0.214	0.116	0.211
DBP			0.123	0.271	0.258	0.204	0.202	0.234
BMI				0.247	0.246	0.155	0.266	0.175
WC					0.776	0.448	0.462	0.324
HC						0.734	0.674	0.765
WHR							0.677	0.608
WHTR								0.756

key feature of the haemodynamic abnormalities (Hayashi *et al.*, 2004). This observation has important implications for the prevention of the excess cardiovascular risk associated with central adiposity and its related haemodynamic abnormalities. These results provide supportive evidence for the need to reduce overweight by increased physical activity.

In conclusion, anthropometric measurements should be a part of the National health surveys so that high risk non-diseased population groups can be identified to target preventive efforts.

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العلاقة بين بعض القياسات الجسمية وضغط الدم للطالبات في جامعة الرياض

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ملخص

يهدف البحث معرفة العلاقة بين بعض القياسات الجسمية وضغط الدم. أجريت الدراسة على تسعة وتسعين طالبة من طالبات كلية التربية للاقتصاد المنزلي ، جامعة الرياض تتراوح أعمارهن بين 21 و 24عاما وقد تم اخذ التاريخ المرضي لكل طالبة و مع قياس ضغط الدم لهن باستخدام جهاز قياس ضغط الدم الزئبقي ، وقد تم أخذ متوسط قرائتين لكل من الضغط الدم الانقباضي والضغط الانبساطي . كما تم أخذ قياسات تحليلية لأجسام الطالبات مثل الطول والوزن وكتلة الجسم ومحيط الخصر وغيرها . دلت النتائج أن محيط الخصر (WC) ومؤشر كتلة الجسم (BMI) تزيد معنويا بزيادة الوزن ، أما محيط الحوض (HC) ، ومحيط الخصر / الطول (WHTR)، محيط الخصر / محيط الحوض (WHR)، كانت زيادتها غير معنوية . كما أظهرت النتائج علاقة قوية بين الزيادة في الوزن وزيادة ضغط الدم الانقباضي والانبساطي و السكري . وعند المقارنة بين المقاييس الجسمية وتأثيرها على ضغط الدم ، تبين من النتائج أن هناك علاقة معنوية بين كل من ضغط الدم الانقباضي والانبساطي وبين محيط الخصر بينما كانت العلاقة معنوية بين ضغط الدم الانقباضي و مؤشر كتلة الجسم ومحيط الخصر/ الطول (WHTR) وكذلك السكري (DM) .لذلك يجب الاهتمام بمحيط الخصر ومحيط الخصر/ الطول (WHTR) وضرورة ربطهما مع مؤشر كتلة الجسم كمؤشر للإصابة بالإمراض المزمنة .