Association Between Body Mass Index and Blood Pressure In Healthy Adults At Al-Ramadi City

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Abstract:

Objectives: To determine the association between body mass index and blood pressure among apparently healthy adults at Al-Ramadi City west of Iraq.

Methods: A Hospital-based cross sectional study of 250 apparently healthy adults was conducted during the period from the 1st of February to the 1st of October 2009 at the consultation Unit of Al-Ramadi Teaching Hospital. Tools of this study included self-administrated questionnaire, general physical examination, anthropometric and blood pressure measurement. Data were analyzed by using the statistical package for social science (SPSS program version -14). A $p<0.05$ was considered statistically significant.

Results: A highly statistically significant association between body mass index (BMI) and increasing blood pressure (BP) was observed.

Conclusion: Obesity and overweight are among the several risk factors for the development of hypertension. Findings of this study support the recommendation of life style modification and weight reduction for obese or overweight subjects

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Introduction:

Hypertension constitutes a major economic and public health problem in the world due to the high morbidity and mortality [(1)]. The majority of cases are asymptomatic and therefore, goes to a high risk of coronary artery diseases, heart failure, renal failure, and cerebro-vascular diseases[(2-3)].

Hypertension continues to be a major public health problem whose prevalence is increasing worldwide. Moreover, the number of people with uncontrolled blood pressure is also increasing, despite the therapeutic advances [(4)].

Obesity or overweight is rapidly becoming a major health problem throughout the world [(5)] Obesity is one of several factors which can contribute to the development of hypertension [(6)].

In addition, weight loss in overweightor obese persons can prevent or delay the onset of hypertension [(7)],but unfortunately, the prevalenceof obesity continues to rise [(8)].

Body-mass index (BMI, the weight in kilograms divided by the square of the height in meters) is the most commonly

used method for screening overweight and obesity in adults and it is the measurement of choice for many obesity researchers and other health professionals, and it is more accurateindicator for overweight and obesity than relying on weight alone [9].

An elevated body-mass index is associated with several risk factors for coronary heart disease (CHD), including hypertension, dyslipidemia, and diabetes [10]. Recent data suggest that both general adiposity and abdominal adiposity are associatedwith the risk of death and support the use of waist circumference or waist-tohipratio in addition to BMI in assessing the risk of death [11].

Obesity, often has a cluster of clinical and metabolic findings that is termed the metabolic syndrome.The prevalence of the metabolic syndrome increased with the severity of obesity and reached 50 percent in severely obese youngsters[13]. Higher BMI during childhood is associated with an increased risk of CHD in adulthood.The associations are stronger in boys than in girls and increase with the age ofthe child in both sexes[14].

The association between BMI and BP has been extensively documented but may still poorly understood. Therefore, this study was carried out to determine an association between BMI and BP among apparently healthy adults at Al-Ramadi City.

Methods: A Hospital-based cross sectional study of 250 apparently healthy adults was conducted during the period from the 1st of February to the 1st of October 2009 at the consultation Unit of Al-Ramadi Teaching Hospital. Tools of this study included self-administrated questionnaire, general physical examination, anthropometric and blood pressure measurement.

Anthropometric measurements were obtained at initial contact with each participant. Height and weight were measured with a sophisticated electronic device (Jookoo Digital height and weight scale, HWS-200) that is adapted by our hospital. Height was measured to the nearest 0.5 centimeter while the participant stood without shoes an upright with the head in Frankfort plane. The head piece of stadiometer is lowered so that the hair (if present) was pressed flat. Body weight was measured with a 0.1-kgm precision in light clothes and without shoes. Comparison of the digital automatic weight measuring device against the manual weight scale (Healthometer® scale, USA), which is non-electronic scales with weight and height scales in the same device, didn't reveal any clinically importance difference. BMI was calculated by dividing weight in kilograms by the square of standing height in meters.

Participants were classified according to the World Health Organization (WHO) into the following categories: underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (>30 kg/m^2). Obesity was also sub classified into three stages: 1st stage (30-34.9 kg/m^2), 2nd stage (35-39.9 kg/m^2), and 3rd stage (>40 kg/m^2) [15].

Current blood pressure (BP) classification is based on the recent recommendations of the Joint National Committee (JNC-7) on the prevention, detection, evaluation, and treatment of high BP, and the 2003 European Society of Hypertension-European Society of Cardiology Guidelines for the management of arterial hypertension [16], that after each participant had seated for 5-10 minutes, BP was measured three times in each occasion (for each occasion, at least 1 day apart) from the right arm in sitting position using

standard mercury sphygmomanometers (SK® miniature 300 B, Germany). SBP was measured at first appearance of a pulse sound (1st Korotkoff sound) and the DBP after the disappearance of the pulse sound (5th Korotkoff sound). Hypertension was defined as systolic BP ≥140 mm Hg, or DBP ≥90 mm Hg, or if there is history of taking anti-hypertensive medications [16]. All pregnant women were excluded from this study. Random blood sugar, blood urea, serum creatinine, ECG is done for each participant, and all those with diabetes, renal impairment or renal failure or those with ischemic heart diseases, or participants who are alcoholics or a heavy smokers or with history of chronic drugs use, were also excluded from this study.

Statistical analysis: All data were analyzed by using the Statistical Package for Social Science (SPSS program version-14). A $P<0.05$ was consider statistically significant.

Results:

Between the 1st of February to the 1st of October 2009, two hundred and fifty apparently healthy adults were enrolled in this study. Their age was ranging from 20-50 years old with a mean age of 27±6.8 years. There were 197 (78.8%) males and 53 (21.2%) females, giving male to female ratio of 3.7:1. According to age, the majority of our sample was in young age group (20-30) which represents (45.2%) of the sample, while age group (31-40) and (41-50) represent 37.6% and 17.2% of the sample respectively.

Table (1) shows the frequency distribution of the participants according to BMI which shows that 44.4% of them were overweight.

Table (2) shows the frequency distribution of the participants' BMI according to age, which shows that the majority of those with overweight (43.2%) were in younger age group (20-30); while the rest of obese participants were within the age group of (31-40).

Table (3) shows the frequency distribution of the participant's BMI according to gender, which shows that most of those with overweight and obesity were males.

The distribution of BMI according to SBP and DBP of the participants was shown in table (4) table (5), respectively. The trend of both mean SBP and DBP is increased with increasing BMI with highly significant association ($P<0.01$).

Table 1: Distribution of participants according to Body Mass Index

BMI group (Kg/m2)	Participants No. (%)	
Lean	5	(2%)
Normal wt.	58	(23.2%)
Over wt.	111	(44.4%)
Obese-1st stage	46	(18.4%)
Obese-2nd stage	18	(7.2%)
Obese-3rd stage	12	(4.8%)
Total	250	(100%)

Table 2: Distribution of Body Mass Index according to the age

BMI/ age	20-30	31-40	41-50	Total
Lean	5 (5%)	0	0	5 (100%)
Normal wt.	39(67.2%)	15(25.9%)	4(6.9%)	58(100%)
Over wt.	48(43.2%)	45(40.5%)	18(16.2%)	111(100%)
Obese-1st stage	15(32.6%)	20(43.5%)	11(23.9%)	46(100%)
Obese-2ndstage	1(5.6%)	9(50%)	8(44.4%)	18(100%)
Obese3rd stage	5(41.7%)	5(41.7%)	2(16.7%)	12(100%)
Total	113(45.2%)	94(37.6%)	43(17.2%)	250(100%)

Table 3 : Distribution of Body Mass Index according to the sex

BMI/ sex	Male	Female	Total
Lean(<18)	4(2%)	1(1.8%)	5(2%)
Normal wt.(18-24.9)	44(22.3%)	14(26.4%)	58(23.2%)
Over wt.(25-29.9)	92(46.7%)	19(35.8%)	111(44.4%)
Obese-1st stage(30-34.9)	37(18.7%)	9(16.9%)	46(18.4%)
Obese-2ndstage(35-39.9)	10(5%)	8(15%)	18(7.2%)
Obese-3rdstage(>40)	10(5%)	2(3.7%)	12(4.8%)
Total	197(100%)	53(100%)	250(100%)

Table 4: Distribution of mean Systolic Blood Pressure among the Body Mass Index group

BMI	No.	Mean SBP	SD	P-Value	ANOVA (F-test)
Lean	5	110	0.00	P<0.01	Sig.
Normal wt.	58	116.99	8.71.	P<0.01	Sig.
Over wt.	108	126.67	11.28	P<0.01	Sig.
Obese-1st	46	138.67	15.44	P<0.01	Sig.
Obese-2nd	18	135.83	11.3	P<0.01	Sig.
Obese-3rd	12	156.46	6.52	P<0.01	Sig.
Total	250				

Table 5 :Distribution of mean Diastolic Blood Pressure among the Body Mass Index group

BMI	No.	Mean DBP	SD	P-Value	ANOVA(F-test)
Lean	5	65	0.00	P<0.01	Sig.
Normal wt.	58	75.69	6.40	P<0.01	Sig.
Over wt.	108	83.03	8.97	P<0.01	Sig.
Obese-1st	46	88.53	10.32	P<0.01	Sig.
Obese-2nd	18	87.08	9.75	P<0.01	Sig.
Obese-3rd	12	106.46	6.86	P<0.01	Sig.
TOTAL	250				

Discussion:

Few studies exist on the prevalence of hypertension and its associated risk factors among our population and most of our knowledge about the prevalence of hypertension is derived mainly from studies conducted outside this country, hence, the need for local data is vital in evaluating hypertension as a common health problem in Iraq. Therefore, this study provides a community-based data on abnormal BP among healthy adult population.

In the current study, the association between BMI and BP (SBP and DBP) appears to be linear and exist throughout the overweight and obese participants, giving an idea that obesity and overweight are the among the main predicting factors associated with a marked increased risk of morbidity and mortality of hypertension since the increase in BP is closely related to the magnitude of weight gain, and even moderate weight gain is associated with an increased risk of developing hypertension.

This is in accordance with many researchers who recognized obesity as a major risk factor for the development of hypertension [1, 17, 18, 19]. Findings were also similar to that reported in Saudi Arabia by Al-Nozha et al [20] who found that increasing weight showed significant increase in prevalence of hypertension.

The differences of increasing rates in the association between hypertension and BMI may be attributed to several reasons such as lifestyle changes towards urbanization, physical activity, genetics, stress, adopting dietary habits that are likely to result in hypertension, increasing prevalence of obesity. However, there is a considerable inter-individual variability in BP response to weight gain, and not all obese individuals become hypertensive, at least by the standard of 140/90 mmHg [21] ; it is possible that populations with very low BMI levels could have also an increasing risk of hypertension [22].

The current study demonstrates an increasing prevalence of hypertension with increasing age groups, with more steep increase at the age group (45-50). A similar finding has been reported in different studies [20, 23]; our finding could be mainly due to obesity factor that is more prevalent at this age group. Regarding gender, it is clearly shown from our data the relationship between BP and gender as a significant association and was more common among male apparently healthy control men and women. This finding was in agreement to another studies conducted in Africa[23, 24].

Generally, risk estimates suggest that approximately 75% of cases of hypertension in men, and 65% in women, and are directly attributed to an overweight and obesity [21].

Among studied population in India, the reported overall figure on the prevalence of hypertension of 54.5% (56.3% among men and 52.3% among women) demonstrating the increasing prevalence of hypertension worldwide [25]. Other study in 2000 revealed that 26.4% of the adult population worldwide had hypertension (26.6% of men and 26.1% of women) [26].

In Saudi Arabia, Nozha et al [20] found that the prevalence of hypertension at younger ages was higher in men than in women, but among older people (>60 years), it was higher in women. Our finding could be explained by the fact that the majority of the males in our study were with a high BMI that resulted from obesity as well as overweight.

There were few limitations of the present study to be notified including the measurement ofwaist circumference, and waist-to-hip ratio and study their association to blood pressure.

In conclusion, it is obvious that hypertension is a prevalent risk factor in population with overweight and obesity and the trend of BP increased with increasing BMI. From the present study the authors recommend implementation of management guidelines in-order to halt the progression of hypertension. This may include dietary measures as well as lifestyle modifications, particularly; weight reduction to achieve normal BMI in addition, regular screening for hypertension should be initiated at early adulthood so that management can be started before complications of hypertension have taken place. Screening for pre-hypertension which is very important because most cases of pre-hypertension remained undetected and progress to hypertension.

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