RESEARCH ARTICLE

Cardio-metabolic disturbances are more correlated with waist-hip ratio (WHR) than body mass index (BMI) in patients with coronary vascular disease

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Abstract

Objective: To evaluate the correlation of body mass index, waist circumference, hip circumference and waist-hip ratio with coronary vascular diseases in patients with ischaemic heart disease.

Methods: The cross-sectional study was conducted at Al Yarmouk Teaching Hospital, Baghdad, Iraq, from March to October, 2016, and comprised patients with ischaemic heart disease. Biochemical parameters measured following overnight fasting included fasting blood glucose, total cholesterol, triglyceride and high density lipoprotein and low density lipoprotein. Anthropometric measurements included height, weight, body mass index, waist circumference, hip circumference and waist-hip ratio. Also measured were blood pressure and electrocardiography reading. Data was analysed using SPSS 21.

Results: Of the 100 patients, 59(59%) were males with a mean age of 60.7±7.27 years, and 41(41%) were females with a mean age of 59.4±8.8 (p>0.05). BMI values were also non-significant between the genders (p>0.05). Waist-hip ratio and hypertension were high in males compared to females (p<0.05), while coronary vascular disease was high in females compared to males(p<0.05).There was non-significant difference in terms of fasting blood glucose, high density lipoprotein and uric acid (p>0.05), But there was significant difference in total cholesterol, triglycerides and low density lipoprotein(p<0.05).Waist-hip ratio was more significantly correlated than body mass index with all metabolic and cardiovascular disorders (p<0.05), while high body mass index was correlated only with hypertension and diabetes.

Conclusion: Waist-hip ratio was found to be more correlated with coronary vascular disease and cardio-metabolic profile than body mass index in patients with ischaemic heart disease.

Keywords: Body mass index, Waist Circumference, Hip circumference, Waist-hip ratio, Coronary vascular diseases.
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Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as a result of being overweight or obese.[1] At its simplest level, obesity is caused when people overeat in relation to their energy needs. At the same time, as energy expenditure has dropped considerably, environmental factors have combined to make it increasingly easy for people to consume more calories than they need.[2]

Obesity may be either unspecific as indicated by an increase in body mass index (BMI) or due to abnormal fat distribution as indicated by an increased waist-hip ratio (WHR).[3]

WHR, BMI and subcutaneous fat are important indicators of obesity, cardiovascular disease and hypertension (HTN). BMI was the best overall predictor for both systolic

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and diastolic blood pressure (BP). However, epidemiological studies have suggested that WHR is also an independent risk factor of cardiovascular disease for both genders, especially in females.[4] BP is influenced by different factors, such as WHR, BMI, adiposity and environmental factors, and is the key for understanding coronary diseases. The people of South Asian origin have increased cardiovascular risk due to more centralised deposition of body fat with higher mean of waist circumference (WC) and WHR compared to the Europeans.[5]

Overweight is associated with an increased prevalence of cardiovascular risk factors, such as HTN, unfavourable blood lipid concentration and diabetes mellitus (DM). It was estimated that a 10% reduction in body-weight would correspond to a 20% reduction in the risk of developing coronary vascular diseases (CVDs).[6]

In retrospective studies assessing fat distribution by skin folds, abdominal fatness was a significant risk factor for coronary heart disease (CHD) independent of BMI. Abdominal fatness is associated with increased levels of insulin and triglycerides (TG) and decreased levels of high

density lipoprotein (HDL), which may be associated with haemostatic and fibrinolytic factors that contribute to an increased risk of myocardial infarction (MI).[7]

According to the results of a meta-analysis, a weight-loss of 1kg is associated with a decrease of 1.2-1.6mmHg in systolic and 1.0-1.3mmHg in diastolic BP.[8] Body fat distribution seems to predict HTN independent of BMI. The full impact of childhood obesity epidemic on the rate of type 2 diabetes mellitus (T2DM) in young adults has not yet been seen.[9] The total causal role of overweight in the development of non-insulin-dependent diabetes mellitus (NIDDM) is supported by evidence that weight-loss in NIDDM improves glucose tolerance and reduces the need for hypoglycaemic drugs. Moreover, experimental overweight in normal young men reduced insulin sensitivity and the effect was reversible with weight-loss.[10] Dyslipidaemia plays a major role in the development of atherosclerosis and CVD in obese individuals. All of the components of dyslipidaemia, including higher TG and decreased HDL levels, as well as increased small, dense low density lipoprotein (LDL) particles, have been shown to be atherogenic. Weight-loss and exercise improve dyslipidaemia and thus reduce CVD risk. In addition, obese individuals should be targeted for intense lipid-lowering therapy, when necessary.[11]

The current study was planned to evaluate the correlation between BMI, WHR and CVDs in obese patients.

Patients and Methods

The cross-sectional study was conducted at Al Yarmouk Teaching Hospital, Baghdad, Iraq, from March to October, 2016, and comprised patients with ischaemic heart disease who were recruited from the consultant coronary care unit (CCU). After approval from the institutional ethics committee patients were selected according to the American Association of Hypertension and Ischaemic Heart Disease.[12] Informed verbal consent was obtained from the subjects after which detailed medical history was taken and clinical examination and investigations were done.

Following overnight fasting, 5mL venous blood was collected for assessing fasting blood glucose (FBG), total cholesterol (TC), triglyceride (TG) and high density lipoprotein (HDL). Low density lipoprotein (LDL) was evaluated using Friedewald method.[13]

Height and weight were measured by graduated tape measure and digital stadiometer. BMI was equal to bodyweight (BW) (kg)/Height (m[2]).[14] Waist circumference (WC) was measured in the standing position at the midpoint between the last rib and iliac crest.[15] Hip circumference (HC) was measured in the standing position and was taken as the distance between greater trochanters.[16] BP was measured at supine position by digital sphygmomanometer from the right arm. Electrocardiography (ECG) was done by 12-lead ECG recorder (GE, Marquette, Mac 800 ECG, EKG-machine, USA).

Data was analysed using SPSS 21 and was expressed as mean ± standard deviation (SD).

Results

Of the 100 patients, 59(59%) were males with a mean age of 60.7±7.27 years, and 41(41%) were females with a mean age of 59.4±8.8 (p>0.05). BMI values were also non-significant between the genders (p>0.05). WHR and HTN were high in males compared to females (p<0.05). The difference in all the other variables was in on-significant, (Table-1).

There was non-significant difference in FBG, HDL and uric acid, but the difference was significant in TC, TG and LDL (Table-2).

WHR was more significantly correlated than BMI with metabolic and cardiovascular disorders (p<0.05). All the

Table-1: Patients' characteristics.

Variables	Male	Female	P
Age (years)	60.7+-7.27	59.4+-8.8	0.08
BMI (kg/m^{2})	28.5 +- 6.1	27.1 +- 4.6	0.08
WHR	1.424 +- 0.14	0.95 +- 0.12	0.04*
Duration smoking (years)	18.2 +- 5.7	15.9 +- 3.9	0.05
Concomitant diseases			
T2DM	13(22.00)	9(21.95)	0.07
Hypertension	17(28.81)	7(17.07)	0.02*
Hyperlipidaemia	19(32.20)	14(34.14)	0.06
CVD	40(67.79)	34(82.92)	0.01*

Data are expressed as mean ± SD, *p <0.05, WHR: Waist-to-hip ratio; BMI: body mass index, T2DM: Type 2 diabetes mellitus; CVD: coronary vascular disease.

Table-2: Gluco-metabolic changes in patients with coronary vascular disease (CVD).

Variables	Male	Female	Total
FB G(mg/dl)	103.9±29.4	99.4 ± 29.5	102.1±27.5
uric acid(mg/dl)	4.77±0.87	4.8 ± 0.62	4.79 ± 0.77
TC(mg/dl)	207.6 ±40.9	217.7± 39.3*	211.7 ±40.4
TG(mg/dl)	162.1 ±35.9	172.4 ±37.6*	166.3±36.8
HDL(mg/dl)	34.4 ±5.6	35.8 ± 8.08	34.95 ±7.04
LDL(mg/dl)	143.3 ± 32.9	155.2 ±34.9*	148.2 ±34.1

Data are expressed as mean ± SD, *p <0.05, FBG: fasting blood glucose, TC: total cholesterol, TG: triglyceride, HDL: high density lipoprotein, LDL: low density lipoprotein.

Table-3: Correlation of Waist-to-hip ratio (WHR) and body mass index (BMI) with metabolic and cardiovascular disorders.

Diseases	High WHR	High BMI
Hypertension	70.90% (r=0.84, p=0.03)	45.90%(r=0.54, p=0.5)
Diabetes mellitus	95.45 %(r=0.94, p=0.001)	77.22%(r=0.85, p=0.03)
Hypertension & diabetes mellitus	100%(r=0.99, p=0.00001)	75%(r=0.83, p=0.04)
Hyperlipidaemia	96.96%(r=0.97, p=0.0004)	69.69%(r=0.65, p=0.06)
Hyperlipidaemia and hypertension	85.71%(r=0.90,p=0.008)	42.85%(r=0.51, p=0.06)
Hyperlipidaemia & diabetes mellitus	87.50%(r=0.93, p=0.002)	37.50%(r=0.45, p=0.08)

diseases assessed were correlated with WHR (p<0.05) while high BMI was correlated only with HTN and T2DM (Table-3).

Discussion

The results confirmed a positive correlation between various anthropometric measurements and CVD, indicating a positive correlation between CVD and BMI. The finding is in accordance with literature.[17]

In Framingham Heart study, the risk of death within 26 years increased by 1% for each extra pound between age 30 years and 42 years, and by 2% between the age of 50 years and 62 years.[18] Other studies confirmed the risk of non-fatal MI among women with a BMI >29, which was 3 times higher than that in the leanest group. The correlation between CVD and high WHR in the current study was stronger than the correlation between BMI and CVD which was also reported by an earlier study.[19] Regional fat distribution is an independent factor determining the risk of developing complications associated with obesity, like CHD, stroke and DM. Although abdominal fat is more common in men, the risk of heart disease increases with the amount of abdominal fat both in men and women.[20]

Abdominal obesity is associated with increased TG, and decreased HDL. In addition, abdominal fatness may be associated with abnormal haemostatic and fibrinolytic complications, which also contribute to an increased risk of MI.[21,22]

Initial epidemiological data had identified obesity as an important risk factor for CVD by acting indirectly through elevation of BP, blood cholesterol level and DM, but more recent analyses of the data from Framingham Heart study, with longer follow-up of people in the cohort, have once again suggested that obesity is indeed a primary risk factor acting independent of other factors.[23]

Moreover, individuals with weight fluctuation scarry increased risk of CVD and death than those with relatively stable bodyweight.[24]

Conclusion

WHR was found to be more correlated with CVD and cardio-metabolic profile than BMI in patients with ischemic heart disease.

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