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BMI and Waist Circumference as a Combined Indicator for Risk Factors for Cardiovascular Disease

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Abstract

Background and Objective: *Obesity has emerged as a worldwide phenomenon affecting wealthy and middle income groups as well as residents of countries previously considered to be poor. Based on epidemiological data, the higher the BMI, the greater is the risk of developing chronic health problems like Hypertension, Diabetes mellitus, Coronary artery disease, certain cancers, arthritis, central obesity and Cerebrovascular disease. The major weakness of BMI is that it indicates excess body weight and not fat, and more importantly, does not count for the variation in the distribution of fat within the body. Central obesity in patients, predisposes them to major metabolic problems, cardiovascular events, dyslipidemia, and it cannot be measured by BMI alone. Hence, waist circumference (WC) becomes better indicator for central adiposity.*

Aims & Objectives: *To study whether body mass index (BMI) and waist circumference as combined indicators have a better correlation with cardiovascular risk factors in obese individuals than their individual correlation with the risk.*

Methodology: *The study was conducted on 150 patients attending Medicine OPD in a tertiary care hospital. Data in the form of history, clinical examination and blood investigations, mainly lipid profile was collected. Both quantitative and qualitative data were analyzed statistically to study the correlation of combined use of BMI and WC to predict cardiovascular disease.*

Results: *This is a cohort study having statistically significant correlation of combination of BMI and Waist Circumference and their impact on development of risk factors (dyslipidemia and hypertension) for cardiovascular disease. The mean total cholesterol level (p-value<0.01), mean TG levels (p-value~0.01), mean HDL level (p-value~0.12), Dyslipidemia (p-value<0.05) and Hypertension (p-value<0.01) were statistically significant in the study population.*

Conclusion: *The study was based on, calculating BMI and WC together and correlating the risk factors for cardiovascular disease. It is found that cardiovascular disease risk is greater in individuals with higher BMI and waist circumference (WC). The combined use of BMI and WC appeared to be more predictive of cardiovascular disease. Patients with no previous co-morbidities but with increased BMI and WC, had hypertension and dyslipidemiaas compared to those with normal BMI and WC.*

Introduction

Obesity is a state of excess adipose tissue mass affecting children as well as adults. Obesity is now so common that it is replacing the more traditional public health concerns including under nutrition and infectious diseases as one of the most significant contribution to ill health.[1]

Obesity has emerged as a worldwide phenomenon affecting wealthy and middle income groups as well as residents of countries previously considered to be poor.[2] A link between obesity and ill health iswell-established.[3]Obesity is important as an independent long term risk factor in producing morbidity and mortality from coronary heart disease. Hypertension and hyperlipidemia are also associated with obesity[4] and there is s growing consensus that reduction in even small amount of weight may confer health benefits.[5]

It has been observed that Asians have a higher percentage of body fat than Caucasians, of the same age, sex and BMI. The occurrence of DM-II is more in lower BMI than the WHO cut off limit of 25kg/m^2. Thus WHO recommended that for many Asians the limits for public health action should be 23kg/m^2. Hence the suggested categ-ories of BMI are :<18.5 kg/m^2 as underweight, 18.5 – 23 kg/m^2as normal; 23 – 27.5 kg/m^2as overweight and 27.5 kg/m^2 or higher as obesity.[6]

Epidemiological data has provided evidence that a BMI >27 kg/m^2 or presence of central obesity, predispose individuals for cerebrovascular dise-ase, Hypertension, Diabetes mellitus, Coronary artery disease, certain cancers and arthritis.[7] It has been observed that alarming number of people fall in the overweight as well the obese category in India and surprisingly women (16%) are more in numbers than men (12.1%).[8] The prevalence of obesity in India is more in urban population than the rural population and that can be attributed to the lifestyle of the urban population.[9]

Aim and Objectives

To study whether body mass index (BMI) and waist circumference (WC) as combined indicators have a better correlation with cardiovascular risk factors in obese individuals than their individual's correlation with the risk.

Material and Methods

In order to see the combined effect of BMI and waist circumference on the prevalence of hypertension and dyslipidemia, a study of selected obese patient was carried out in MGM Medical College and Hospital's Medicine Out Patient Department; using both quantitative and qualitative methods.

The Qualitative Methods Were

-Questionnaires and Interview with the Participants

The Quantitative Methods Were

-Anthropometry (i.e. BMI AND WC)
-Blood Biochemical Analysis
-Clinical Assesment Including Blood Pressure Measurement

Obesity was defined by BMI, according to latest guidelines for Indian population by WHO as given in table 1. BMI was calculated as weight divided by, height square and expressed as kg/m^2.

Table 1. WHO guidelines for Indian population for BMI cut off values to define obesity.

WHO guidelines for BMI (kg/m^2) cut off	Normal	Overweight	Obese
International population	20-24.9	25-28.9	>30
Indian population	18.5-22.9	23-24.9	>25

The waist circumference was measured by a stretch resistant tape, at the end of several consecutive natural breaths, at the level parallel to the floor, midpoint between top of iliac crest and lower margin of last palpable rib in mid-axillary line.

The cut off values for WC (for assessing central obesity) used in the study were 85 cm for men and 80 cm for women.

Study Design

This was a cross sectional study, conducted for a period of one and a half years. The study population consisted of subjects aged 18-70 years, attending, medicine OPD, either as a patient or as a companion/relative of the patient. A total of 150 patients were selected and were divided into three groups i.e. Group A, Group B & Group C

- Group A – 50 patients were selected and their BMI was calculated using the guidelines from WHO for Indian population and correlated with hypertension and dyslipidemia.
- Group B – Waist circumference of 50 patients was taken into consideration according to guidelines for Indian population and correlated with hypertension and dyslipidemia.
- Group C – Both BMI and Waist circumference was taken in these 50 patients and correlated with hypertension and dyslipidemia.

Results

Table 2. Distribution Of Total Cholesterol Levels In Study Group

Total Cholesterol	N	%
</= 200	112	74.7%
> 200	38	25.3%
Total	150	100.0%

Hypercholestrelemia was present in 38 (25.3%) patients, while rest of the patients 112(74.7%) had normal cholesterol levels, as seen in Table 2.

Table 3 Distribution of Triglycerides in study groups

Triglycerides	N	%
≤ 150	84	56%
> 150	66	44%
Total	150	100.0%

Table 3 shows that 84(56%) patients had normal triglycerides levels, while 66(44%) patients had hypertriglyceridemia.

Table 4. Distribution of HDL Levels

HDL	N	%
< 40	69	46.0%
≥40	81	54%
Total	150	100.0%

Low HDL levels were seen in 69(46%) patients, whereas normal HDL levels were observed in 81(54%) individuals.

Table 5 Distribution of Hypertension In Study Groups

Hypertension	N	%
Yes	28	18.6%
No	122	81.3%
Total	150	100.0%

Hypertension was noted in total of 18.6% individuals, while 81.3%of them did not have hypertension.

Table 6. Distribution Of Mean Total Cholesterol, Triglycerides and HDL Levels in study Groups:

		TOTAL CHOLESTEROL		**Triglycerides**		**HDL**	
	N	MEAN	SD	Mean	SD	Mean	SD
BMI (A)	50	162.45	51.25	131.43	44.07	41.50	8.22
WC (B)	50	176.74	35.19	156.45	43.05	41.68	6.27
COMBINED(C)	50	191.42	52.49	164.00	37.83	38.45	10.92
TOTAL	150	176.97	48.11	150.76	43.72	40.56	8.73
p value		*<0.01*		*~0.01*		*~0.12*	

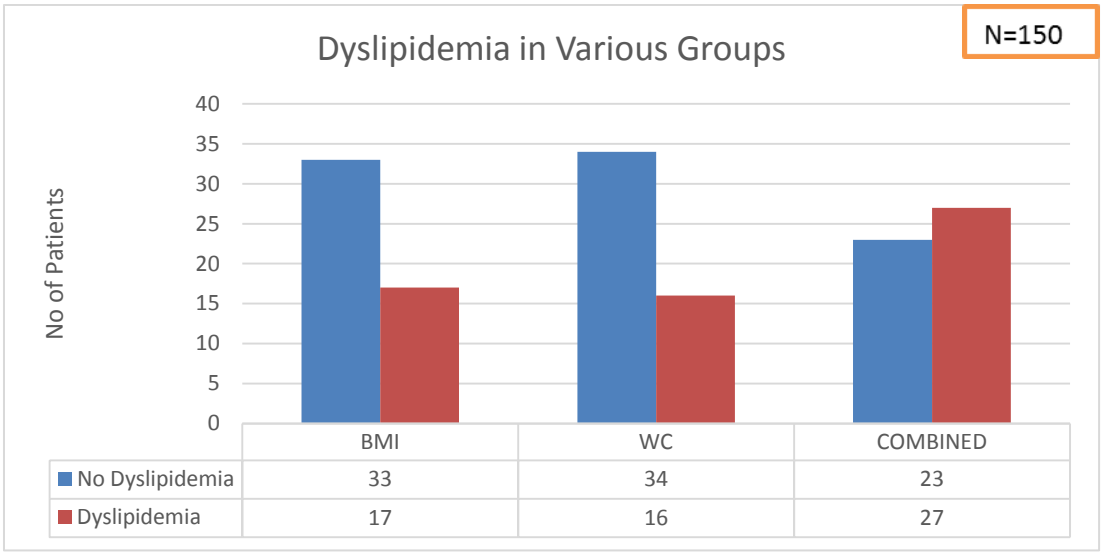
As seen in Table 6,

Mean cholesterol level was higher when both BMI and WC were taken as combined indicators.

According to our results hypertriglyceridemia was observed in group C i.e in which both BMI and WC were taken.

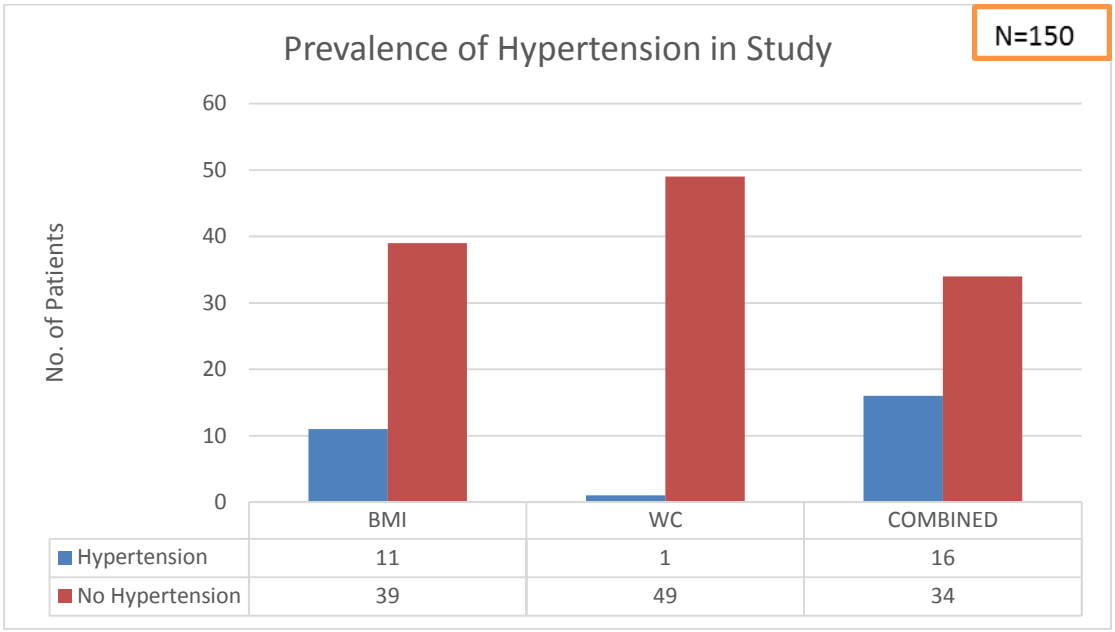
Mean values of HDL were almost equal in group A, B, while group C showed lower mean levels of HDL.

Graph 1. Dyslipedimia in Various Groups



Dyslipedemia was noted in 27 patients in group C, which was significantly higher than the other two groups. p- value < 0.05

Graph 2. Mean distribution of Hypertension in Study Groups



As seen from Graph 2. Hypertension was present in 16 patients in group C, followed by group B with 11 hypertensive patients. p- value < 0.01

Discussion

This was a cross sectional study conducted in tertiary care center, with prior approval from the Ethical committee of the institute. A total 150 subjects attending Medicine OPD, either as patients or their relatives were randomly selected, after applying the inclusion and exclusion criteria. Patients requiring hospitalization, having history of any co-morbidities or major illness, or patients taking any form of medication were excluded from the study. Three groups were madeas discussed previously.

Obesity in India has reached epidemic proportions. The 2007 National Family Health Survey, ranks Delhi (45.5% males and 49.8% females) followed by Punjab and Kerala as the states with highest number of overweight and obese population. 15.9% of males and 18.1% of

females in Maharashtra are either overweight or obese.[8]

Due to genetic tendency of Indians towards abdominal obesity and its associated risk of related lifestyle disease, ministry of health and family welfare along with Indian council of medical research released updated guideline (in 2012) that a BMI over 23 kg/$m^2$and > 25 kg/m^2 is considered as overweight and obese respectively. Obesity is a major risk factor for cardiovascular diseases.

The 2 most commonly used methods to assess obesity are BMI and Waist Circumference. Our study utilized BMI & Waist Circumference together to study their impact on risk factors for cardiovascular disease. The mean age of the study population was, 39.1 ±10.0 in Group A , 36.3 ± 8.6 in Group B and 40.5 ± 11.4 in Group C. Young population was found to be more obese , with the maximum subjects falling in the age group of 21-40 years.

According to American Heart Association the risk of developing diabetes, hypertension and atherosclerotic disease, increases in subjects with high triglycerides and cholesterol levels. Most of the patients have developed cardiovascular complication without any previous co-morbidities and pre-existing disease.[10,11]25.3% and 44% of our subjects had hypercholesterolemia and hypertriglyceridemia respectively. The highest levels of both hypercholesterolemia and hypertriglyceridemia was observed in group C with a mean cholesterol level of 191 ±52 and mean triglyceride level was 167 ± 37 (p value <0.001).

According to some studies raised cholesterol and triglyceride levels with normal HDL levels, can occur, in hypertension or diabetes. Although as stated earlier, low HDL levels are a risk factor for cardiovascular disease. 46 % of the study population had low HDL levels. Group C had a mean HDL level of 38.45 ± 10.92 which was statistically significant (p value – 0.12).

Subjects in which BMI and WC were taken separately did not show much difference in terms of hypertension, in our study. Hypertension with 140/90 mm Hg was noted in subjects in whom BMI was either raised or borderline high. Interestingly hypertension was noted in 40% of the study population and majority of them belonged to group C (16 out of 50 i.e 32%) (p value – 0.001).

Conclusion

It is found that cardiovascular disease risk is greater in individuals with higher BMI and waist circumference (WC). The combined use of BMI and WC appeared to be more predictive of cardiovascular disease. Also patients with no previous co-morbidities but with increased BMI and WC are shown to have hypertension and dyslipidemia than those with normal BMI and WC.

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