

A correlation study between types of obesity and hypertension

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Received: August 19, 2018; Accepted: September 03, 2018

ABSTRACT


Background: Obesity and hypertension are considered as silent pandemics gaining momentum rapidly in our urbanizing and developing countries. Early detection and intervention may help our population to keep away from unwanted consequences like cardiovascular diseases. This study will be an eye-opener for addressing the risk factors of non-communicable diseases. **Objectives:** The objective of this study was to describe the demographic profile and anthropometric measurements of obese patients attending non-communicable disease outpatient department for screening and to correlate mean blood pressure values between types of obesity. **Materials and Methods:** The main study was conducted in non-communicable disease outpatient department (OPD) in Government Villupuram Medical College and Hospital. Subjects with obesity attending the non-communicable disease OPD during the study period will be included in the study after obtaining written consent. Expected difference in mean blood pressure between types of obesity is 10 mmHg, and the sample size was calculated to be 45 in each category of obesity, thus arriving to sample size of 135. However, as much as, samples were collected to increase strength of the study. Ethical clearance was obtained from the institutional ethical committee. **Results:** The mean systolic blood pressure of combined obesity subjects (CO) was higher than abdominal obesity (AO) and generalized obesity (GO), and the difference was statistically significant ($P < 0.01$). The mean diastolic blood pressure of CO, AO, and general obesity (GO) subjects shows mild differences, and the difference was not statistically significant. Individual having AO and GO is at more risk of developing health hazards of hypertension. **Conclusion:** Early screening and intervention on high-risk individuals can reduce the incidence of cardiovascular events.

KEY WORDS: Combined Obesity; Abdominal Obesity; Generalized Obesity; Systolic Blood Pressure; Diastolic Blood Pressure

INTRODUCTION

India is gaining weight. Traditionally known for malnutrition, Indians now report more and more frequently with overweight, obesity, and their consequences. Obesity can be seen as the first wave of a defined cluster of

non-communicable disease called “New World Syndrome,” creating an enormous socioeconomic and public health burden in poorer countries.^[1] High prevalence of abdominal obesity (AO) is a characteristic feature of Asian Indians, in particular, South Asians. Furthermore, AO can occur even in the absence of elevated body mass index (BMI). Unlike other populations, AO has been reported even as BMI < 20 Kg/m² and is seen even at a younger age.^[2-9] At any given BMI or waist circumference, compared to Europids, South Asians have more abdominal visceral fat, higher degree of insulin resistance, hyperinsulinemia, hypertension, and diabetes, all of which are implicated in the pathogenesis of premature coronary artery disease.^[7,10,11]

Access this article online	
Website: http://www.ijmsph.com	Quick Response code
DOI: 10.5455/ijmsph.2018.0825103092018	

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In addition, elevated blood pressure is a major public health problem in India, and its prevalence is rapidly increasing among both urban and rural populations. Recent studies show that for every individual with hypertension, there are two individuals who are either undiagnosed hypertensive or prehypertensives.^[11] Early detection and intervention would help our population stay away from unwanted consequences such as cardiovascular diseases. This study hopes to be an eye-opener for addressing the risk factors of non-communicable diseases.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study.

Sample Size Calculation

The expected difference in mean blood pressure between types of obesity is 10 mmHg. Using 95% confidence level and 80% power, the sample size is calculated to be 45 in each category of obesity using open Epi. Thus, total sample required arrives to 135. However, sample as much as possible was collected throughout the study period to increase the strength of the study. Hence, our total sample arrived at 223 participants.

Study Period

The present study was completed in 3 months period. From March to May 2018, this study was conducted at Institutional NCD Clinic, Government Villupuram Medical College and Hospital.

Inclusion Criteria

Adults ≥ 18 years with obesity attending non-communicable disease clinic for screening were included after obtaining informed written consent.

Exclusion Criteria

Patients on antihypertensives, contraceptives, antipsychotics, and having chronic ailments like renal diseases are excluded from the study.

Methodology

This study was conducted at non-communicable disease clinic in Government Villupuram Medical College and Hospital. Ethical clearance was obtained from the Institutional Ethical Committee. The participants were provided with the necessary information about this study and their consent taken. A semi-structured, predesigned pro forma, including sociodemographic variables, history of

comorbid illness, anthropometric measurements, and blood pressure was employed in the study population. According to ACC/AHA guidelines 2017, hypertension is classified as Stage 1 - systolic blood pressure (SBP) 130–139 and diastolic blood pressure (DBP) 80–89 mmHg, Stage 2 - SBP 140–159 and DBP 90–99 mmHg, and Stage 3 - SBP ≥ 160 and DBP ≥ 100 mmHg.

Individuals with BMI ≥ 25 kg/m² were defined as obese and included. Participants having only BMI ≥ 25 kg/m² for both the genders were defined as generalized obesity (GO). AO was defined as waist circumference ≥ 90 cm for men or ≥ 80 cm for women and combined obesity (CO) as individuals with both GO and AO.

A total of 223 obese patients (76 males and 147 females) were selected by convenient sampling. Of this, 15 (7%) subjects had GO, 87 (39%) had AO, and 121 (54%) had CO.

Data Analysis

The data were entered into the predesigned Microsoft Office Excel format which was later imported into the statistical software SPSS 13. Numerical data will be presented in mean, median along with standard deviation and interquartile ranges. Categorical data will be presented in percentages. Numerical variable like age will be compared between different groups using *t*-test. Chi-square test will be used to compare the categorical data such as gender. The results will be expressed along with 95% confidence interval. $P < 0.05$ would be considered as statistically significant.

RESULTS

In this study, a total of 223 participants were registered. The mean (\pm standard deviation) age (in years) of the participants was 56 (± 11) years. Among the participants, 147 (66%) were female and 76 (34%) were male. Majority of the participants were illiterate, 137 (61.5%) and primary, middle, high school, and graduate level were 27 (12%), 29 (13%), 20 (9%), and 9 (4%), respectively. Diabetes mellitus is the most common comorbid condition 65 (29%) among the participants. Majority, around 143 (64%) participants were homemakers, followed by farmers 53 (24%).

Among the participants, only 25 (11.2%) had regular physical activity such as walking. The participants consuming alcohol and smoking regularly were found to be 14 (6%) and 9 (4%), respectively. Demographic and socioeconomic variables are given in Table 1.

Anthropometric measurements of the study participants are given in Table 2. The mean BMI of participants was 26.3 (± 5) kg/m², waist circumference was 93.9 (± 11) cm, hip circumference was 96.3 (± 10.5) cm, and waist-hip ratio was 0.97

(± 0.06). The mean blood pressure was 142.8 (± 12.4) mmHg and 87.5 (± 7.8) mmHg for systolic and diastolic, respectively.

Table 1: Demographic and socioeconomic characteristics of the study subjects (n=223)

Variable	Frequency (%)
Gender	
Male	76 (34.08)
Female	147 (65.92)
Occupation	
Farmer	53 (23.77)
Housewife	143 (64.13)
Comorbid illnesses	76 (34.08)
Diabetes	65 (29.15)
CAD	14 (6.28)
Hypothyroid	21 (9.42)
Arthritis	10 (4.48)
Bronchial asthma	2 (0.9)
DM/Hypothyroidism	11 (4.93)
Others - TB	1 (0.45)
Others - varicose vein	1 (0.45)
Substance abuse	31 (13.9)
Smoking	
Yes	9 (4.04)
Alcohol	
Yes	12 (5.38)
Occasionally	2 (0.9)
Physical activity	
Walking	25 (11.21)
Yoga	9 (4.04)
Indoor activities	2 (0.9)
Diet	
Vegetarian	35 (15.7)
Mixed diet	69 (30.94)
Predominantly non-vegetarian	119 (53.36)

CAD: Coronary artery disease, TB: Tuberculosis, DM: Diabetes mellitus

Table 2: Anthropometric measurements of study subjects

Variable	Mean	SD	Min.	Max.	Median	IQR
Age	56.022	11.08	35	91	56	48-64
Height	154.53	9.55	110	179	154	149-160
Weight	63.03	12.77	34	96	64	54-71
BMI	26.38	5.03	16	48.7	25.7	23-29.43
Waist circumference	93.99	11.18	65	131	93.5	86-101
Hip circumference	96.33	10.55	5	126	96	90-103
Waist-hip ratio	0.97	0.064	0.82	1.12	0.97	0.93-1.02
SBP	142.83	12.43	100	180	142	134-150
DBP	87.52	7.84	60	110	88	80-90

IQR: Interquartile range, SBP: Systolic tuberculosis, DBP: Diastolic tuberculosis

Of 223 participants, 121 (54%) were categorized under CO, followed by AO 87 (39%) and GO 15(7%) [given in Table 3]. As per Table 3a, the differences in the waist-hip ratio between the three groups were not statistically significant. The mean BMI was higher in CO, followed by GO and AO. The difference in BMI among the three groups was statistically significant ($P < 0.001$). The percentage of hypertensives in

Table 3: Types of obesity

Type	Frequency (%)
AO	87 (39.01)
GO	15 (6.73)
CO	121 (54.26)

AO: Abdominal obesity, GO: Generalized obesity, CO: Combined obesity

Table 3a: Association of WHR and BMI with types of obesity

Types of obesity	Waist-hip ratio	F statistics	P value
	Mean±SD		
AO	0.974±0.06	1.05	0.3508
CO	0.974±0.064		
GO	0.949±0.087		
Types of obesity	BMI		P value
	Mean±SD	F statistics	
AO	21.84±2.329	134.37	<0.001
CO	29.67±3.98		
GO	26.2±3.42		

AO: Abdominal obesity, GO: Generalized obesity, CO: Combined obesity, SD: Standard deviation, BMI: Body mass index, WHR: Waist-hip ratio

Row mean-Col mean	Abdominal	Combined
CO	7.82	
GO	4.35	-3.47

Table 4: Association of blood pressure with types of obesity

Types of obesity	Mean SBP (SD)	F statistics	P value
AO	140.89 (12.06)	6.31	0.0022
CO	145.17 (11.69)		
GO	135.2 (15.92)		
Types of obesity	Mean DBP (SD)		P value
AO	87.49 (8.105)	2.01	
CO	88.01 (7.26)		0.1369
GO	83.73 (10.16)		

AO: Abdominal obesity, GO: Generalized obesity, CO: Combined obesity, SBP: Systolic tuberculosis, DBP: Diastolic tuberculosis, SD: Standard deviation

Systolic BP
Combined versus GO
Mean difference = -9.9755
p value=0.012

CO, AO, and GO was 93%, 88%, and 66.6%, respectively. As per Table 4, the mean SBP of CO subjects was 145.17 (\pm 11.6) mmHg. Whereas, for AO and general obesity (GO) subjects, the mean SBP was 140.8 (\pm 12.06) and 135.2 (\pm 15.9), respectively. The difference in SBP within different types of obesity was statistically significant ($P < 0.01$). In particular, the difference in SBP between combined and GO subjects was highly significant (P value - 0.012, mean difference = -9.97). The mean DBP of CO, AO, and GO subjects was 88.01 (\pm 7.2), 87.49 (\pm 8.1), and 83.73 (\pm 10.1), respectively. However, the difference in DBP within types of obesity was not statistically significant ($P > 0.05$).

DISCUSSION

This study was an attempt to correlate mean blood pressure values with three different types of obesity, i.e., combined, abdominal, and GO. Our study was one of its first kinds, very few studies made attempt to classify obesity into three types. We found that the BMI was significantly higher in CO subjects than generalized and AO subjects. It was also noteworthy to mention that our study reports the high mean SBP among CO subjects, followed by abdominal and GO ($P < 0.01$). It shows that our population was at more risk of health hazards, then we expected. Hence, meticulous efforts should be made to create awareness about healthy dietary habits and exercises to get fruitful results at community level.

In a multicentric study conducted as a part of ICMR-INDIAB, Pradeepa *et al.* reported that the overall prevalence of GO, AO, and CO in Tamil Nadu was 24.6%, 26.6%, and 19.3%, respectively.^[12] However, in our study, the prevalence of GO, AO, and CO was 6.7%, 39%, and 54.2%, respectively. This shows that the prevalence of CO was increasing considerably, which could give rise to cardiovascular events.

Ataie-Jafari *et al.* observed that the hypertension was seen in 12.3% of GO, 6.8% of AO, and 14.8% of CO subjects. Furthermore, the mean SBP of obese subjects was 110.7 mmHg and mean DBP was 69.5 mmHg.^[13] In our study population, the distribution of hypertension was 66.6% in GO, 88% in AO, and 93% in CO subjects. The mean SBP was 142.8 mmHg and diastolic was 87.5 mmHg for obese subjects. The high proportion of hypertension was noted and maybe it was due to adaption of new guidelines from American heart association, which includes ≥ 130 mmHg of SBP and ≥ 80 mmHg of DBP as hypertension.

Limitations

Since it was a hospital-based study, the generalization of findings was limited and we could not ascertain the prevalence of obesity and its types. Hence, community-based study at rural and urban areas can find out multidimensional

factors contributing to hypertension which is now common among the adolescent age group. Furthermore, we highly recommend screening for non-communicable diseases in adolescent obese individuals and combined obese individuals in particular.

CONCLUSION

The present study highlights that those individuals having both AO and GO are at increased risk of hypertension when compared to those who are having either abdominal or GO alone. Early screening and intervention for reducing obesity and promoting healthy food habits along with regular exercises can take our community toward disease-free environment.

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How to cite this article: Kumar PKK, Jebamalar J. A correlation study between types of obesity and hypertension. Int J Med Sci Public Health 2018;7(12):978-982.

Source of Support: Nil, **Conflict of Interest:** None declared.