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Research Article

RELATIONSHIP BETWEEN WEIGHT AND BLOOD PRESSURE IN HYPERTENSIVE PATIENTS

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A R T I C L E I N F O

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A B S T R A C T

Aim: To determine the relationship between weight & blood pressure in hypertensive patients.
Objective: This study intends to generate relevant information that helps to understand the patterns of high BPin lean populations as well as in populations where the prevalence of obesity is growing rapidly. Such information would thus be relevant to the prevention and control of hypertension in developing countries

INTRODUCTION

Elderly population contributed to 7% of the total population in India in 2001 & it will rise to 9% by 2016, a majority of this population will be living in rural areas. According to an estimate they will constitute one third of the total population of the world of 2050 AD (Park, 2008). Life expectancy in India has increased from 37 years (1951) to 67 years (2011) due to overall socioeconomic and health care developments, so is the co-morbidity like overweight and obesity. Body mass index is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, diabetes mellitus, and other chronic diseases. Not much data is available regarding the association between obesity and hypertension in the elderly. Few studies have shown a correlation between body mass index (BMI) and systolic and diastolic blood pressures in the elderly (Joshi, 2007). Hypertension has been reported in 40-48% geriatric patients in India. Hypertension is a threat to life at all ages and in both sexes. It is one of the leading cardiovascular disorder and an important risk factor for coronary artery disease, cerebrovascular diseases and cardiac failure in elderly subjects (Gupta, 2004). Unfortunately, studies in India regarding the correlation between blood pressure and BMI in elderly people are lacking. The knowledge of the effect of increased BMI especially obesity on hypertension is very important as it is a modifiable risk factor. Our aim of this study is to find out the association between body mass index and blood pressure in the elderly population.

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The specific research questions for this study was that among cases aged 60 years or more a) does correlation exists between body mass index and systolic and diastolic blood pressure; b) do those who were in the highest group of BMI as compared to those within the lowest group, have a higher prevalence of hypertension.

Globally, high blood pressure (BP) is estimatedto cause 7.1 million deaths, about 13% of thetotal. About 62% of cerebrovascular disease and 49% of ischemic heart disease are attributable to suboptimal BP (systolic 4115mm Hg). Overweight and obesity increase the risks of high BP, coronary heart disease, ischemic stroke, type IIdiabetes mellitus and certain cancers. Worldwide about 58% of diabetes mellitus and 21% ofischemic heart disease are attributable to BMI above 21 kg/m2.1 Developing countries are increasingly faced with the double burden of hypertension and other cardiovascular diseases, along with infection and malnutrition. Hypertension places an excessive financial burden on populations and health systems, consuming scarce resources.4 Population-based preventive approaches are, thus, central for the management of elevated BP in developing countries, where clinic-based care for complications is nota feasible option (Kamal *et al*., 1997; Huang *et al*., 2007; Amador *et al*., 2006). Body mass index (BMI) is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type IIdiabetes mellitus and other chronic diseases.8 In Caucasian populations, a strong association has-been depicted between BMI and mortality (Gupta, 1995). A similar association has also been demonstrated among Asian populations. The relationship between BMI and BP has long been the subject of

epidemiological research (Amador *et al*., 2007; Anil Kumar *et al*., 2008)

METHODS

The present study was conducted at three demographic surveillance sites (DSS) in Vellore, Arcot and Kalavai. The study was conducted in DSS in each of the three places. The DSS are composed of population cohorts, including urban and rural residents, where routine registration of vital events takes place. The DSS provided the sampling frames for data collection as well as background socioeconomic and demographic data. The population cohorts maintained by the DSS provide opportunities for future follow-up. The three DSS and the sampling method will be described in detail elsewhere.

Study Procedures

Primary study variables and their collection:

All anthropometric measurements like weight and height was performed according to WHO guide lines.[5] Weight was measured with bare foot using standardized weighing machine for all patients. Height was measured with barefoot and BMI was calculated. Blood pressure was recorded in the sitting position after 5minutes of rest using standard sphygmomanometer.

Derived variables and their calculation

Hypertension was diagnosed when systolic BP > 140mm Hg and/or diastolic BP > 90 mm Hg or a known hypertensive patient. BMI (weight in Kg)/(height in meters2) was calculated and divided in four groups like group I (<20), group II (20.1- 22.5), group III (22.6-25), and group IV (> 25.1).

Statistical Analysis

The patients were divided into four groups based on theirBMI group I (<20), group II (20.1- 22.5), group III (22.6- 25), and group IV (> 25.1). The mean systolic and diastolic blood pressure for both the male and female categories of patients was compared in the three categories of patients with students t-test. The mean blood pressure recordings between both the genders was also analyzed using students t-test. The software used for statistical analysis was strata version 11.

RESULTS

The present study, focusing on BMI and BP, have a cross-sectional descriptive design, allowing internal comparisons across the three sites, and between the major sociodemographic groups, such as males and females, and urban and rural residents. Adults in the age group 25-64 years will be randomly selected using the DSS database in each place. Pregnancy (in women) and any gross physical abnormality will be the only exclusion criteria against the physical measurements. Sample size will be calculated using the 'formula for single population proportion'. The minimum sample size (250) will be determined for the smallest unit or strata in the study, that is, for each 10-year age interval in each sex and residence.

Altogether, 100 patients more than 60 years attending geriatric camp for general check-up were included in the study. Among them 80% were male, their mean age was67.73 ± 6.11 in male and 66.75 ± 5.83 in female. Mean BMI were 19.61±3.84 kg/m2. Baseline comparison of characteristics of study subjects is shown in Table 1. More cases (n=57) were in BMI less than 20. Body mass quintile with different variable like age, sex, BMI, blood pressures, and smoking are shown in Table 2. Blood pressure and BMI in 5years age group are shown in table 3. The blood pressures were found to increase progressively with the increase in BMI in both sexes. There was a statistically significant increase in thesystolic blood pressure R value 0.2214, $p < 0.05$ as wellas diastolic blood pressure R value 0.2967, $p < 0.05$. There were also statistically significant relation betweensmokers and blood pressures shown in Table 4.

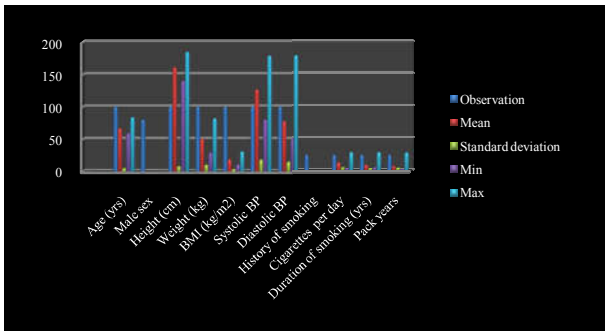

Fig 1 Baseline characteristics of patients

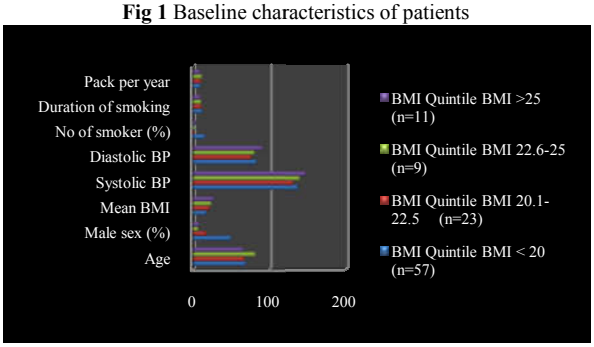

Fig 2 Body mass quintile with different variable

Table 1 Baseline characteristics of patients

Variable	Observation %	Mean	Standard deviation	Min	Max
Age (yrs)	100	66.72	5.10	59	84
Male sex	80				
Height (cm)	100	160.92	7.90	140	185
Weight (kg)	100	50.52	10.30	29	82
BMI (kg/m2)	100	18.61	3.50	10.38	30.80
Systolic BP	100	126.8	18.30	80	179
Diastolic BP	100	77.8	14.90	50	179
History of smoking	25				
Cigarettes per day	25	13.92	6.60	3.9	29
Duration of smoking (yrs)	25	10.08	3.50	5.9	29
Pack years	25	8.312	5.27	1.1	28.6

Table 2 Body mass quintile with different variable

Variable	BMI Quintile			
	BMI < 20 (n=57)	BMI 20.1-22.5 (n=23)	BMI 22.6-25 (n=9)	BMI >25 (n=11)
Age	68.53+3.12	66.83+6.90	81+7.44	65+1.14
Male sex (%)	49(85.9)	17(73.9)	6(66.6)	8 (72.7)
Mean BMI	16.98+0.54	21.16+0.32	23.4+0.60	26.88+1.16
Systolic BP	137.73+11.19	131.33+22.78	140+20.12	148+11.45
Diastolic BP	82.53+6.25	75.66+8.02	80+6.34	91.33+18.52
No of smoker (%)	15(26.3)	6(26.08)	1(11.1%)	3(27%)
Duration of smoking	11.66+2.02	10.66+3.94	10+3.78	9.33+1.32
Pack per year	9.23+2.99	9.73+5.33	11+2.22	8.3+7.44

Table 3 Mean BMI, SBP and DBP across 5 years age groups

Variable	Age Group			
	60-65 (n=50)	66-70 (n=23)	71-75 (n=15)	>76 (n=12)
Mean BMI	19.66+0.94	21.10+1.96	18.42+1.70	17.98+1.80
Mean SBP	126.2+5.44	129.21+8.94	127.73+8.60	131.83+9.90
Mean DBP	79.88+5.04	81.21+6.04	75.6+7.70	73.66+5.20

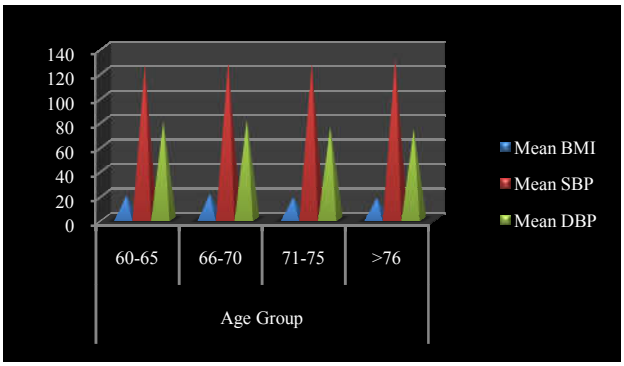

Fig 3 Mean BMI, SBP and DBP across 5 years age groups

Table 4 Correlation of BMI, Number duration of smoking and pack years with systolic and diastolic blood pressure

Variable	Systolic blood pressure		Diastolic blood pressure	
	R value	P value	R value	P value
BMI	0.2213	< 0.05	0.2967	< 0.05
Cigarette smoking per day	0.6225*	< 0.05	0.4076*	< 0.05
Duration of smoking	0.6430*	< 0.05	0.2913	> 0.05
Pack years	0.6441*	< 0.05	0.3017	> 0.05

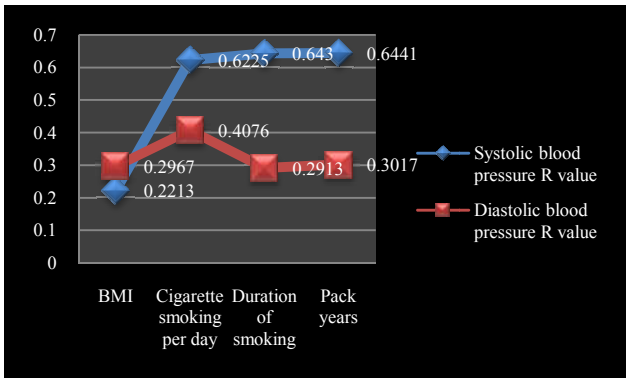

Fig 4 Correlation of BMI, Number duration of smoking and pack years with systolic and diastolic blood pressure

DISCUSSION

This study showed that BMI is significantly and independently associated with both SBP and DBP in elderly in rural teaching hospital.

Several studies revealed the close relationship between BMI and systolic and diastolic blood pressures in elderly.option (Kamal *et al*., 1997; Huang *et al*., 2007; Amador *et al*., 2006). Few study have shown relation between BMI and blood pressure was stronger in females than males.[8] However, in our study, the influence of sex on hypertension was statistically not significant for both systolic and diastolic blood pressure ($p > 0.05$).

Hypertension is one of the most common chronic conditions seen in the elderly population. If control of weight in the elderly helps in reduction of blood pressure, active lifestyle and a healthy diet are cost-effective measures in improving the quality of life in the elderly. When the mean systolic and diastolic blood pressures among different BMI categories were evaluated, it was found that mean systolic and diastolic blood pressure increased with increasing BMI from lowest BMI to the highest BMI category. Both systolic and diastolic BP increased with increase in BMI level. Positive associations between BMI and BP have also been reported in other Indian populations.option (Kamal *et al*., 1997; Huang *et al*., 2007; Amador *et al*., 2006).

Few studies have emphasized the synergism of smoking with hypertension. The pathogenetic mechanism by which smoking contributes to this is endothelial dysfunction. Nicotine damages endothelium and tobacco smoke increases smooth muscle cell proliferation and adhesion, leading to atherosclerosis and blood pressure.option (Kamal *et al*., 1997; Huang*et al*., 2007; Amador *et al*., 2006). The data obtained from our study for the association of BMI and blood pressure is limited. Further studies in a larger scale are warranted to establish the correlation between them.

CONCLUSION

The association between BMI and both systolic and diastolic pressures remained highly statistically significant in these analyses. These results show that as BMI increases blood pressure rises even in old age and suggest that it may be possible to modify rates of hypertension by changes in body weight.

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