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Original Article

Variation of Systolic Blood Pressure in Relation to Biological Variables and Risk Factors

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Abstract

Background; To evaluate the effect of various risk factors on systolic blood pressure.

Methods: In this descriptive study 750 participants with no history of clinical hypertension were recruited. Data was collected by direct face to face interview using standard proforma. Blood pressure was measured of all study subjects using mercury sphygmomanometer. BMI was calculated. Data was analyzed by SPSS version 22.

Results:Significant *p* value (< 0.05) was obtained for male gender, poor socioeconomic status, obesity and smoking when compared between hypertensives and normotensives.

Conclusion: Male gender, poor socioeconomic status, smoking and obesity significantly increase the risk of development of hypertension.

Key Words: Systolic blood pressure, Obesity, Hypertension, Socioeconomic status

Introduction

Hypertension is an established risk factor for renal and cardiovascular disorders.[1] The prevalence of hypertension has increased and is expected to rise further by 60% in the first half of 21st century worldwide. The prevalence of systolic blood pressure (SBP) ≥ 140 mmHg has been raised from 17,307 to 20,526 per 100,000 between 1990 and 2015 globally. Almost 874 million adults had SBP ≥ 140 mmHg in 2015.[2,3]

Hypertension is the leading cause of enormous disabilities if not treated properly. It is associated with stroke, congestive heart failure, chronic kidney disease and coronary artery disease.[4] In developing countries it is under-detected and under-treated as a result of ignorance and poverty. Therefore, complications occur that lead to chronic disabilities and premature deaths.[4] Studies have reported that a reduction in SBP and/or diastolic blood pressure (DBP) by 5 mmHg is clinically significant as it decrease cardiovascular risk by 20 % , the risk of stroke by 20 % and mortality risk by 7 %.[5]

Need of the hour is therefore to evaluate the risk factors associated with the development of hypertension such as advancing age, lifestyle changes which include poor dietary habits, alcohol abuse, cigarette smoking, stress, poor socio-economic status, obesity and physical inactivity. Obese individuals with physical inactivity are having twice the risk of development of cardiovascular diseases as compared to normal weight persons.[6]

In obesity certain adipokines secreted from the visceral adipose tissue affect blood pressure. Conversely, there are reports showing that obesity and blood pressure are positively correlated only among subjects with normal BP while there is no significant correlation between blood pressure and obesity among hypertensives.

Subjects and Methods

In this descriptive cross-sectional study 750 participants were enrolled. Study population consisted of faculty of AIMH, Sialkot, faculty of KMSMC, Sialkot and students of KMSMC, Sialkot. Sampling Technique was non-probability convenience sampling. Mercury sphygmomanometers were used to measure the subject's blood pressure. Patients were seated in a comfortable position with the back supported, legs uncrossed, and BP taken after 3 to 5 minutes of rest. Three blood pressure readings were taken per subject with the 10 min interval between the measurements, and the mean value was recorded. The dependent variable in this study was hypertension. Participants were classified as normotensives if recorded BP value was <130/90 mm Hg. Participants were classified as hypertensive if recorded BP value was

≥130/90 mm Hg. The independent variables included: age, gender, smoking, exercise, socioeconomic status, consumption of vegetables and fruits and body mass index. Heights of the subjects were measured with vertical measuring rod. The subjects were required to stand on bare feet for all height measurements. Weight was measured using a calibrated digital balance. For weight measurements, the subjects were required to be on bare feet and wearing light clothing. Body mass index (BMI) was calculated of all participants. BMI was defined as the weight in kilograms divided by height in meters squared.The data was represented as means and standard deviations. Statistical analysis was done using SPSS version 22. *p* value < 0.05 was considered significant.

Results

A total of 750 people participated in the study. Majority of the study subjects were aged above 40 years and were women (Table 1).

Table 1: Demographic characteristics and risk factors of the study subjects

Risk factors	Hypertensives % (n=500)	Nomotensives % (n=500)
Age (years)		
<40	45	41.6
>40	55	58.4
Gender		
Male	38	44
	62	56
BMI		
18.5-24.5	12	10
25-29.9	24	25
= or >30	56	55
>40	08	10
Socioeconomic status		
Low	11.6	28.0
Middle	68.4	53.2
High	20	18.8
Smoking		
Non-smokers	40.8	55
Smokers	59.2	45
Exercise		
No	59.6	57.2
Yes	40.4	42.8
Dietary history		
Vegetarian	56	39
Non-vegetarian	44	61

Older subjects have a greater risk of having a higher blood pressure than younger subjects (p < 0.05). Males have a greater risk of higher blood pressure than females (p < 0.05). Higher mean systolic blood pressure values were observed in elderly men as compared to elderly women.Those belonging to lower socioeconomic status have a greater risk of high blood pressure than those of middle or upper socioeconomic class (p < 0.05). Smokers have a greater risk of higher systolic blood pressure than non-smokers (p < 0.05). Obese individuals have more risk of hypertension than non-obese (p < 0.05). Subjects who do not perform exercise are not having risk of hypertension than those who do perform exercise (p > 0.05). Meat eaters are at increased risk of hypertension than vegetarians but it is not significant (p > 0.05) (Table 2).

Table 2: Mean ± Standard Deviation of risk factors of the study subjects

Risk factors	Systolic Blood Pressure		P value
	Hypertensives (n=500)	Normotensives (n=250)	
Age (years)> 40	141 ± 7.7	119 ± 8.1	< 0.05
Gender (Male)	149 ± 5.4	121 ± 6.7	< 0.05
BMI(= or > 30)	147 ± 9.6	114 ± 4.4	< 0.05
Socioeconomic status(Poor)	142 ± 2.6	120 ± 3.5	< 0.05
Smoking	152 ± 5.8	110 ± 4.9	< 0.05
Exercise	133 ± 3.5	120 ± 5.5	N.S
Dietary history	132 ± 5.0	121 ± 4.9	N.S

Discussion

In present study, the mean systolic blood pressure is higher in those subjects who have associated risk factors particularly smoking and obesity. Biological variables also seem to be associated with high systolic blood pressure as older subjects showed higher readings of systolic blood pressure, with male subjects having high systolic blood pressure than females.Those with a lower socioeconomic status also showed a higher mean systolic blood pressure. This may be associated with the stressful lifestyle of these respondents as compared to those from higher socioeconomic status.

Dorresteijn et al. observed in his study that overweight and obesity causes hypertrophy and hyperplasia of adipocytes with increased secretion of adipokines and free fatty acids in the body eventually leading to hypertension.[8] Boateng GO et al in his study also found significant positive association between obesity and elevated systolic blood pressure[9]. Wenqing Ding et al in his cohort study illustrated a significant and positive association between abnormal adipokines and an increased risk of hypertension among obese children and adolescents in China.[10] De Oliveira CM et al also had similar results showing that obesity was more prevalent among hypertensive individuals and

hypertensive individuals had higher values of BMI than normotensives.[11]

Socioeconomic status is a complex term combining a number of variables, including employment status, educational level, income, and wealth as well as place of residence. It is a well-established cardiovascular risk factor. Cuschieri S et al. conducted a cross-sectional study in Malta in which he observed significant difference between hypertensives and normotensives on comparing the sociodemographic characteristics and lifestyle factors.[12] Larkins NG et al carried out a cross-sectional study in which he concluded that body mass index is the most important predictor of BP, followed by low socioeconomic status.[13] Viego V et al on the other hand reported opposite results showing negative association between socioeconomic status and prevalence of hypertension.[14]

Smoking has deleterious effects on many organs resulting in premature mortality. Numerous toxic chemicals are present in the tobacco smoke. Nicotine is known to increase blood pressure levels. [15]Liu X et al showed that smokers had a high rate of uncontrolled systolic blood pressure than non-smokers.[16] Consistent results were shown by Gao K et al. who observed positive association between smoking and hypertension among study subjects.[17] Opposite results were observed by Kim BJ et al. showing inverse relation between smoking and hypertension in Korean adults.[18] Inconsistent results were documented by M B Mehboudi et al. He showed inverse association between smoking and hypertension in an elderly population in Iran.[15]Studies revealed male gender and poor socioeconomic status possess high risk of hypertension and its comorbidities.[19,20]

Zhou H et al. showed that difference was not statistically significant in age-standardized prevalence between females and males, which is not consistent with our study and some previous studies which showed that the hypertension prevalence in males was different with that of females. Study revealed that overweight and obesity are higher risk factors for hypertension in both genders. Regardless gender difference, the higher BMI was directly linked with the higher prevalence of hypertension. This finding is consistent with several studies including our study. He also found that factors positively associated with hypertension prevalence were past smoking and diabetes mellitus in both genders. Consumption of fresh vegetables and fruits were related to the prevalence of hypertension only in females.[21]

Mahadev D. Bhise et al found that the prevalence of high blood pressure was higher among elderly population (40%), among males (28%), in the urban areas (27%) and in the richest wealth quintile (28%). The prevalence was also higher among cigarette smokers (31%), alcohol consumers (30%) and people with obesity (38%) as compared to their counterparts. The results of the multilevel analysis showed that the older and obese persons were at four-time higher risk of hypertension. Again, age, sex, marital status, place of residence, wealth status, unhealthy habits (i.e. smoking and alcohol consumption) and BMI were significantly associated with hypertension.[22] Petermann F et al. observed women had a lower risk of developing hypertension than men ($p < 0.01$). In both men and women, the risk is greater over the age of 25 years ($p < 0.01$). The risk is greater in subjects who were overweight ($p < 0.01$), obese ($p < 0.01$), or had central obesity ($p < 0.01$). Subjects with a family history of hypertension and diabetes also have a higher risk.[23] Owolabi EO et al. reported ageing, being married, male sex, concomitant diabetes, lower monthly income, being unemployed and central obesity were the significant and independent determinants of prevalent hypertension.[24] Pilakkadavath Z et al. in his study in India also documented that obesity, lack of physical activity, inadequate fruits and vegetable intake, diabetes, smoking, and alcohol use were significantly different in proportion among cases and controls.[25]

Conclusion

Male gender, poor socioeconomic status, smoking and obesity significantly increase the risk of development of hypertension. Hypertension prevalence increased with age and was more prevalent among men than women.

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Key for Contribution of Authors : A= Conception/ Study/ Designing /Planning; B= Experimentation/Study conduction;C=Analysis/Interpretation/ Discussion; D= Manuscript writing;E= Critical review;F= Facilitated for reagents/Material/Analysis