ASSOCIATION OF BLOOD PRESSURE, BMI AND AGE AMONG ADULTS ABOVE 18 YEARS OF MAKALBARI AREA OF GOKARNESWOR MUNICIPALITY IN KATHMANDU

Shrestha SR[1], Shakya B[1], Oli R[2]

[1]Department of Community Medicine, [2]Intern, MBBS, Nepal Medical College Teaching Hospital, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal

ABSTRACT

In Nepal the prevalence of hypertension is in increasing trend with an increased number of deaths from heart disease and stroke. The morbidity and mortality from hypertension, cardiovascular disease and other chronic diseases has been associated with high Body mass index (BMI). The current study aimed to study the association between BMI, blood pressure and age of the adults in Makalbari area. A community based cross-sectional study was conducted among 643 respondents. The information was obtained using self constructed structured questionnaire which included demographic information of individuals. Height, weight and blood pressure were recorded and hypertension was defined as per Joint National Committee (JNC) VII guidelines. Maximum value of mean BMI was found among 40– 49 years age group. BMI was found to be lowest among younger age group. Both the mean systolic and diastolic BP were found to be lowest among the youngest age groups. Mean Systolic BP increased steadily with age and the highest value was found among the oldest age group. Mean Diastolic BP increased with age till 40–49 years and declined thereafter. There was significant (P <0.01) positive correlation of BMI with systolic and diastolic BP. It showed that BP increased with increase in BMI. Correlation coefficient showed that relationship of BMI with systolic BP (0.231) was stronger than diastolic BP (0.167). Thus the present study provides valuable information regarding the association of BMI with systolic and diastolic blood pressure. It also showed the correlation of blood pressure with increasing age independently.

KEYWORDS

Cross sectional study, BMI, hypertension

CORRESPONDING AUTHOR

Dr. Supri Raj Shrestha
Department of Community Medicine,
Nepal Medical College Teaching Hospital,
Attarkhel, Gokarneshwor-8, Kathmandu, Nepal
Email: supriraj70@gmail.com
ORCID ID: 0000-0002-8639-5714
https://doi.org10.3126/nmcj.v21i4.27617

INTRODUCTION

In 2017, around three-quarters of the total global mortalities were because of non-communicable diseases (NCDs) and cardiovascular disease (CVD) was the leading cause of NCD-related mortalities and morbidities.[1] Uncontrolled hypertension is an important risk factor for cardiovascular disease.[2] Forty five percent of death because of heart disease and 51% of death from stroke is due to hypertension. The risk factors like ageing, unhealthy diets, regular alcohol consumption, lack of physical activity, weight gain and continuous day to day stress are the cause for the increasing prevalence of hypertension.[3]

Prevalence of hypertension is in increasing trend in the South Asian region including Nepal.[4] Body mass index (BMI) is positively and independently associated with morbidity and mortality from different diseases like hypertension, cardiovascular disease, type II diabetes mellitus, and other chronic non communicable diseases. Obesity along with its associated co-morbidities have become an epidemic in most of the developed as well as developing countries, leading to more than four million deaths annually.[5]

The relationship between BMI and blood pressure (BP) has been the topic of epidemiological research. There is also the positive association of BMI and BP among Asian populations.[6] The relation between measure of body mass and BP have been extensively documented, usually with BMI (kg/m^2).[7] There is a direct linear association of BMI and the risk of hypertension. Among males, there is increase in chances of having hypertension per unit increase in BMI as compared with females. The age at onset of hypertension is related to a lifetime risk of cardiovascular disease.[8]

Around 22% of people of 18 years and over are affected by hypertension. It has been responsible for estimated 9.4 million deaths per year.[9] Most of the people from low and middle income countries are disproportionately affected with hypertension and CVD because of the poor health systems.[10]

A three times increase in prevalence of hypertension was found in Bhadrabas area of Kathmandu from 1981 to 2006, confirming the trend of dramatic rise in CVD risk factors in Nepal. This increased prevalence of hypertension is a major challenge to the present health care system of Nepal.[11] The different types of public health measures such as changes in policy and population wide interventions supplemented with individual risk based treatment has changed the hypertension scenario in developed countries. These measures have led to marked decrease in mortality from stroke and coronary heart disease in these countries in the last 50 years.[12] Hence this study was conducted to assess the relation of BP, BMI and age.

MATERIALS AND METHODS

This is a community based cross sectional study using Simple Random Sampling Technique. It was conducted among the people of Makalbari of Kathmandu district, Nepal. Makalbari is a part of 4, 6 and 8 wards of Gokarneswor Municipality. Total population of 4, 6 and 8 ward of Gokarneswor Municipality is 54092 of which male is 27111 and female is 26981. The study period was of six months from April 2019 to September 2019. Ethical approval was taken from Institutional Review Committee (IRC) of NMCTH. The study participants were aged 18 years and above holding permanent resident status in the study areas at the time of study. Individuals <18 years, people who were abroad and pregnant ladies in that area were excluded from the study. Study participants in this study were explained about the purpose of the visit and consent was obtained. During the interview with the participants the information regarding socioeconomic characteristics, medical and family history, anthropometric measurement and clinical examinations were obtained. After measuring the height by measuring tape and weight by bathroom weighing scale, BMI was calculated as Weight(kg)/Height(m^2). BMI is based on weight and height of the individual and measured by weight in kg and height in m^2. Higher the BMI above 25, greater is the risk of morbidity according to grades.[13]

The blood pressure was measured by auscultatory method using standard aneroid sphygmomanometer. The method of blood pressure measurement and criteria for diagnosis of hypertension was done according to JNC VII guidelines SBP ≥140 mmHg and/or DBP ≥ 90 mmHg and/ or use of anti-hypertensive medicines.[14]

Sample size was calculated using formula z^2pq/d^2, where (p) was taken as 20.5%[4] and d was taken as 16% of p. By using the formula, the total sample size was 643.

Statistical analysis of the collected data was carried out using SPSS version 16. Frequency distribution of BMI, systolic and diastolic BP were calculated. Correlation analyses were performed to see the association between BMI, age, SBP and DBP.

RESULTS

The total participants were 643 in Makalbari area, in which 333 (51.8%) were female and 310 (48.2%) were male. The level of education among the participants were found as primary level 5.2%, lower secondary level 7.0%, secondary level 21.0%, higher secondary level 21.0%, bachelor's level 20.5% and master's level 7.3% and remaining 18.0% were illiterate.

Table 1: Distribution of participants according to occupation

Occupation	N	%
Unemployed	55	8.6%
Home maker	213	33.1%
Student	71	11%
Business	123	19.1%
Govt job	42	6.5%
Others	139	21.7%

As shown in table 1, out of 643 participants 213 (33.1%) were home makers, 139 (21.7%) were mechanics, drivers, painters and farmers and 123 (19.1%) were businessmen.

Table 2: Distribution of subjects in different categories of BMI (As per WHO BMI Classification)

BMI Classification	N	(%)
Underweight	24	3.7
Normal	336	52.3
Preobese	230	35.8
Obese1	45	7.0
Obese 2	6	0.9
Obese 3	2	0.3
Total	**643**	**100.0**

As depicted in table 2, maximum number of subjects were in normal BMI category 336 (52.3%) followed by those in preobese category 230 (35.8%). Lowest number of subjects were found in obese 3 category 2 (0.3%)

As shown in table 3, in different categories of diastolic and systolic blood pressure maximum number were having normal blood pressure. Following normal BP, as assessed in DBP 98 (15.2%) were in stage 1 hypertension and in SBP 156 (24.3%) were in prehypertension.

As shown in table 4, ANOVA test was conducted for the mean test. BMI was (25.9 ± 4.58) kg/m^2

Table 3: Distribution of subjects in different categories of Blood Pressure

	DBP	N	%
Hypertension	Normal (<80 mm of Hg)	458	71.2
	Prehypertension (80–89 mm of Hg)	55	8.6
	Stage1 (90–99 mm of Hg)	98	15.2
	Stage2 (≥100 mm of Hg)	32	5.0
	Total	**643**	**100.0**
	SBP	N	%
Hypertension	Normal (<120 mm of Hg)	407	63.3
	Prehypertension (120-139 mm of Hg)	156	24.3
	Stage 1 (140-159 mm of Hg)	68	10.6
	Stage 2 (≥160 mm of Hg)	12	1.9
	Total	**643**	**100.0**

($p<0.05$) was significantly higher among 40–49 yr age group. BMI was found to be lowest among 18–29 yr age group (23.1 ± 3.43) kg/m^2. Both the mean systolic and diastolic BP were found to be lowest among the youngest age groups. Mean systolic BP increased steadily with age and the highest was found among the oldest age group. Mean diastolic BP increased with age till 40–49 years and declined thereafter.

Table 5: Correlation between BMI, blood pressure and age.

Variables	SBP	DBP	BMI	Age
SBP	1	0.617**	0.231**	0.317**
DBP	0.617**	1	0.167**	0.254**
BMI	0.231**	0.167**	1	0.110**
Age	0.317**	0.254**	0.110**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation between BMI, BP, and age with level of significance is given in table 5. There was significant (p <0.01) positive correlation of BMI with both systolic and diastolic BP. It showed that BP increased with increase in BMI. Correlation

Table 4: Mean values of SBP, DBP and BMI in different age group

AGE (Years)		Min	Max	Mean	Std. Deviation	95% CI of the Difference Lower	95% CI of the Difference Upper	p value
18-29 (n=191)	SBP	100	170	117.75	8.67	116.51	118.9	
	DBP	60	100	76.28	7.76	75.17	77.39	
	BMI	15	31.74	23.13	3.43	22.64	23.62	
30-39 (n=189)	SBP	100	160	121.03	10.6	119.51	122.55	
	DBP	60	110	78.85	9.12	77.54	80.15	
	BMI	18	34.6	24.78	2.93	24.35	25.20	
40-49 (n=102)	SBP	100	180	126.86	14.37	124.04	129.69	
	DBP	60	112	83.85	9.66	81.95	85.75	0.000
	BMI	18	40.1	25.94	4.58	25.04	26.84	
50-59 (n=71)	SBP	100	160	127.58	13.57	124.36	130.79	
	DBP	60	110	82.41	10.26	79.98	84.84	
	BMI	18.3	37	25.8	4.14	24.82	26.78	
>60 (n=90)	SBP	100	190	128.74	15.89	125.41	132.07	
	DBP	60	110	82.3	8.76	80.8	84.47	
	BMI	16	37	24.25	4.35	23.34	25.16	

coefficient showed that low degree relationship of BMI with SBP (0.231) was stronger than DBP (0.167)

DISCUSSION

The study conducted by Manandhar *et al* showed hypertensive cases were in increased proportion in age > 65 years (55.49%) than in the age group < 65 years (36.32%).[15] Other studies also have shown the rise of BP with increase in age.[16,17] In this study also the BP seems to be in rising trend along with the age of the participants.

Isolated systolic hypertension, which means a linear increase in systolic but not diastolic pressure, is the most prevalent type of hypertension in those aged 50 years or over. This isolated systolic hypertension occurs in cases where there is long duration rise of both SBP and DBP.[18,19] In this study SBP increased steadily with age and the highest was found among the oldest age group. Whereas DBP increased with age till 40–49 years and then it started to decline thereafter.

In the study conducted by Rawal *et al* in which they used the Nepal Demographic Health Survey 2016 data, a total of 13,542 adults aged 18 years and above had their weight and height measured. In which 17.27% were underweight; 31.16% overweight/obese were found.[20] In our study maximum number of subjects were in normal BMI category 336 (52.3%) followed by those in preobese category 230 (35.8%). In the similar study done in South India, sample 800 participants of adult population (>19 years old) overweight, obesity class I, and obesity class II were 14.9, 16.1 and 3.3 % respectively.[21]

In the study done by Mungreiphy *et al* it showed that blood pressure increased with increasing BMI. In their study they found positive correlations of BMI with both systolic and diastolic BP. In this, correlation coefficient showed relationship of BMI with diastolic BP (0.378) was stronger than systolic BP (0.274).[6] In the present study also there are significant (P <0.01) positive correlation of BMI with both systolic and diastolic BP. It showed that BP increased with increase in BMI but Correlation coefficient showed that relationship of BMI with systolic BP (0.231) was stronger than diastolic BP (0.167). In the Cohort study done by Franklinn SS there was a parallel linear rise in SBP and DBP from age 30-49 years then after age 50-60 years, DBP declined while SBP showed a linear increase.[19]

In conclusion, the study showed that body mass index was associated with both systolic and diastolic blood pressure among the people of Makalbari. It showed maximum number of subject had normal BMI and followed by preobese. Blood pressure was also normal in most of the subjects

and appeared to increase with age. The study showed that there was positive and significant correlation among BMI, age, systolic and diastolic blood pressure.

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