

Blood Pressure and its Association with Body Mass Index Among the People Attending in a Hospital

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ABSTRACT

Introduction: Systolic and diastolic hypertension has been increasing trend and different factors are associated such as body mass index, diabetes etc. Obesity and overweight are generally associated with high blood pressure. This study aims to identify the prevalence of blood pressure level and its association to body mass index among people attending in civil service hospital, Kathmandu.

Methods: A cross-sectional descriptive study was conducted among all 1002 study subjects aged above 20 years. Information were obtained from people coming for Master health check-up during study period. Blood pressure and weight were taken by WHO certified tool.

Results: Half of the respondents were overweight and obese. Prevalence of systolic and diastolic hypertension was found to be 171 (17.1%) and 310 (30.9%) respectively. There is significant difference between body mass index to sex. Females are 1.5 times more likely to have high blood pressure who have high body mass index. Age group (40-59) years are more than two times likely to have overweight, systolic and diastolic blood pressure than other age group. Systolic blood pressure is more than six times more likely to be high in 60+ age group. But it is only 2.6 times in diastolic blood pressure and in body mass index, it is reduced to 1.4 times but it was still statistically significant. Overweight people are 1.4 and 1.6 times more likely to have high systolic and diastolic BP than another category.

Conclusions: Half of the respondents were overweight and obese. Male had high overweight and obesity than female. Overweight people more likely to have high systolic and diastolic BP than others.

Keywords: *Body mass index; blood pressure; civil service hospital; Nepal.*

INTRODUCTION

Overweight and obesity have increased dramatically¹ with adverse public health implications. Body mass index (BMI) is associated with decreased functional ability² and increased risk of hypertension, which often cause further decrements in health.³ An increase in body fat is associated with the risk of high blood pressure (BP).⁴ Drug therapy helps to control BMI if it is considered to >27 with co-morbidities and diet therapy and physical activities may help in controlling BMI if it is ≥ 25 with co-morbidities and without co morbidities.⁵ The number of people with diabetes and hypertension is increasing globally.^{6,7} Despite being preventable disease, diabetes and hypertension fall among top 10 leading causes of death globally.⁸ Raised blood pressure is estimated to

claim 7.5 million deaths attributing 12.8% of all deaths worldwide.⁷ The prevalence of hypertension increased from 22.9% in 2010 to 23.3% in 2014.^{7,10}

There has been very less study to determine the level of BP and BMI in Nepal. The result of this study regarding the important relationship between BMI and blood

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pressure will help the improvement of health status and act as a reference for the study on general population of Nepal.

Objectives of this study is to identify the prevalence of blood pressure level and its association to body mass index among people attending civil service hospital in Kathmandu, Nepal.

METHODS

A cross-sectional descriptive study was conducted among the respondents visiting in Family Medicine Outpatient Department for general health check-up (Master health check-up) civil service hospital. All clients including civil servants, their family member and general population usually come for master health checkup. From them, all together 1002 study subjects aged above 20 years both male and female were obtained from September 2015 to August 2016. The information was collected from the respondents regarding age, marital status, weight, height and blood pressure by consecutive sampling methods. The ethical clearance was obtained from institutional review board of Civil Service Hospital. Verbal consent was taken from each respondents and confidentiality has been maintained.

Blood pressure (BP) was taken three times and average score used to calculate blood pressure level after half an hour rest of their arrival. BP and weight was measured by WHO certified tools. Reading was classified in to normal as up to 119 mm Hg, 120-139 as pre-hypertension, 140-159 stage I hypertension and above that was considered as stage II. Diastolic BP was also classified as 80-89 as normal, 90-99 as pre-diastolic hypertension and above 100 was considered as high diastolic.⁹ BMI was classified by conventional BMI cutoff points to classify the study populations into underweight ($BMI < 18.5 \text{ kg/m}^2$), normal BMI ($18.5 \leq BMI < 25 \text{ kg/m}^2$) and overweight ($BMI \geq 25 \text{ kg/m}^2$). After data collection, all variables were checked for accuracy and completeness, coded and entered in to a SPSS 16 version. Relation between different socio-demographic variable to BMI and systolic and diastolic blood pressure were checked from chi-square test and logistic regression was applied to check the strength of association and 0.05 is considered as significant level. All respondents who come for their master health check-up were only included in the study. All of the patients who come for checkup in hospital, age below 20, pregnant women and persons who were not willing to participate were excluded in this study.

RESULTS

The mean age of respondents was 48.2 with standard deviation 13.4 years. Among all 1002 respondents, more than 577 (57%) were male and 425 (42%) were female, 301 (30%) were from the age group of 45-54 years followed by 257 (25%) from 35-44 years. Only 127 (12.7%) were from elderly group (Table 1).

Table 1. Age and sex distribution of respondents.

Age Range	Male n (%)	Female n (%)	Total n (%)
15-24	21 (2.1)	17 (1.7)	38 (3.8)
25-34	67 (6.7)	37 (3.7)	104 (10.4)
35-44	147 (14.7)	110 (11.0)	257 (25.6)
45-54	180 (18.0)	121 (12.1)	301 (30.0)
55-64	85 (8.5)	90 (9.0)	175 (17.5)
> 65	77 (7.7)	50 (5.0)	127 (12.7)
Total	577 (57.6)	425 (42.4)	1002 (100)

Only 4.3% were lean and thin. Total 28.9% male and 15.9% female had normal weight for height but 23.5% and 3.4% male, 17.2 and 6.9% female had obesity and overweight respectively (Table 2). So, prevalence of overweight and obese was 40.6% and 10.3% respectively. Association between sex and BMI found to be statistically significant ($P \leq 0.01$). Among all respondents, 44.7% respondents had normal systolic blood pressure (below 120 mm Hg) and 14% respondents had high systolic BP (140-160) and remaining 2.6% had very high systolic blood pressure. So, prevalence of systolic blood pressure was 17%. Similarly, more than 69% had normal diastolic blood pressure and remaining people had high systolic blood pressure. So, prevalence of diastolic hypertension was 3.9 (30.9%) (Table 3). Mean systolic and diastolic blood pressure was also calculated that denoted the average blood pressure level among sexes. Mean systolic and diastolic blood pressure was found to be 121 mm Hg and 82 mm Hg among male and more than 117 mm Hg and 79 mm Hg in female respectively (Table 4).

There is significant association between BMI to sex but it was not seen in systolic and diastolic blood pressure. Females were 1.5 times more likely to have high blood pressure than men ($P=0.002$). Age group 40-59 years was more risky age group for BMI and Blood pressure. This age group are more than two times likely to have overweight, systolic and diastolic blood pressure than other age group ($P \leq 0.001$). Systolic blood pressure (SBP) is six times more likely to be high in 60+ age group ($P \leq 0.001$) but it is only 2.6 times in diastolic blood pressure (DBP), SBP reduced to 1.4 times but it is still statistically significant. Married were 6 times and 3 times likely to have more BMI and systolic blood pressure than unmarried and vice versa in

diastolic blood pressure (Table 5). There is no significant association between systolic and diastolic blood pressure to underweight. Logistic regression analysis shows overweight people are 1.4 and 1.6 times more likely to have

high systolic ($P=0.046$) and diastolic ($P=0.001$) blood pressure than another category (Table 6).

Table 2. BMI according to sex.

Sex	Body Mass Index (%)				Total (%)
	< 18.5	18.5-25.0	25.0-30.0	30.0-35.0	
Male	18 (1.8)	290 (28.9)	235 (23.5)	34 (3.4)	577 (57.6)
Female	25 (2.5)	159 (15.9)	172 (17.2)	69 (6.9)	425 (42.4)
Total	43 (4.3)	449 (44.8)	407 (40.6)	103 (10.3)	1002 (100.0)

Table 3. Systolic and diastolic Blood pressure of respondents.

Systolic BP	n (%)
Up to 119	448 (44.7)
120-139	383 (38.2)
140-160	145 (14.5)
160 and above	26 (2.6)
Diastolic BP	n (%)
80-89	692 (69.1)
90-99	271 (27.0)
100 and above	39 (3.9)
Total	1002 (100)

Table 4. Mean blood pressure according to sex.

Sex	Mean		
	Systolic (SD)	Diastolic (SD)	BMI(SD)
Male	121.05 (16.13)	82.02 (9.4)	24.62 (3.34)
Female	117.8 (17.5)	79.6 (9.8)	25.72 (4.34)
Total	119.7 (16.7)	81.03 (9.6)	25.17 (3.84)

Table 5. Logistic regression analysis of demographic factors, Blood Pressure and BMI.

Parameters	BMI			Systolic			Diastolic			
	BMI < 25 and > 25			Normal and High			Normal and High			
	AOR	95%CI	P value	AOR	95%CI	P value	AOR	95%CI	P value	
Sex	Male	1		1			1			
	Female	1.5	1.16-1.93	0.002	1.14	.81-1.60	0.02	0.78	.59-1.03	0.084
Age	20-39	1		1			1			
	40-59	2.64	1.94-3.6	0.0001	2.59	1.5-4.47	0.001	2.08	1.45-2.97	0.000
	60+	1.46	1.01-2.14	0.048	6.83	3.84-12.14	.0001	2.67	1.75-4.07	.0001
Marital status	Unmarried	1		1			1			
	Married	6.64	3.25-14.8	.0001	3.83	1.18-12.41	0.025	0.29	.13-.66	0.003

Table 6. Logistic regression analysis between blood pressure and BMI.

BMI	Systolic BP			Diastolic BP		
	Normal and high			Normal and high		
	AOR	95% CI	P value	AOR	95% CI	P value
Normal	1			1		
Underweight	.616	.213-1.78	0.371	.566	0.24-1.30	.18
Overweight	1.41	1.00-1.99	.046	1.62	1.22-2.13	.001

DISCUSSION

In this study, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were associated with BMI, the magnitude of association for DBP is high ($P=0.0001$). Study conducted in other countries also found association between blood pressure (SBP and DBP) with BMI.¹¹⁻¹⁵ Prevalence of high SBP and DBP is 17% and 30.9% respectively. Another study conducted in India found that 21.8% and 33.8% prevalence of high SBP and high DBP respectively¹⁶ which was quite higher than this study.

Only 4.3% were lean and thin i.e. BMI having less than 18.5kg/m² and 44.8% of the respondents had normal BMI (18.5-25) and 10.3% were obese, where female are more vulnerable than male and BMI is strongly associated with sex. BMI in female is 1.5 times more likely ($P=0.002$) to be higher than men. However, percentage of thin were just 3.5 in Iran which is lower than this study findings and BMI also associated with sex but magnitude of association was strong in Iran, female were more vulnerable than male¹⁷ which is similar to this study findings. These findings suggest that female is more chance of being obese and be careful and focus on diet and physical activities which limit the obesity.

Mean systolic and diastolic blood pressure are 121 mm Hg and 82mmHg among male which is more than female. The mean SBP and DBP were 125.7 mm of Hg and 81.5 mm of Hg which was higher SBP and slightly lower DBP than this study findings.¹⁰ BMI for male and female are 24.62 kg/m² and 25.17 kg/m² respectively in this study. BMI for male and female were 19.41 kg/m² and 19.17 kg/m² in Ethiopia, 19.51 kg/m² and 19.53 kg/m² in Vietnam, 21.17 kg/m² and 22.65 kg/m² in Indonesia respectively.¹⁸ The BMI in Nepalis higher than the other country and the male and female mean BMI also around overweight. This revealed that the obesity among male and female both are high and people should aware about it. This study already finds the association between obesity and hypertension, however the conse-

quences of obesity and overweight are not only limited to the hypertension, but also play role for the causation of other non- communicable disease such as cardiovascular disease, diabetes, musculoskeletal disorders, cancers. The health system focus on this problem and individual people also be aware about it¹⁹ and modifying weight which help to modify the hypertension rate.²⁰

The SBP and DBP are associated with BMI, where DBP is more strongly associated. However study conducted in India identified that SBP were more strongly associated with BMI than DBP.¹⁰ People having high BMI have more chance of having Systolic and diastolic hypertension. Logistic regression analysis shows, due to high BMI, it is 1.4 and 1.6 times more likely to have systolic hypertension and diastolic hypertension respectively. This reflects that high BMI impacts more on the DBP than SBP.

The limitation of this study was the sampling and a hospital based study. A population based study would provide more statistically significant picture.

CONCLUSIONS

In our study, half of the respondents were overweight and obese. More numbers of male were overweight and obese than female. Association between systolic and diastolic blood pressure and BMI was seen. Half of the respondents have more weight per meter square. So high blood pressure individual should be control their BMI and vice versa.

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