ISSN 2582-3140

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Influence of BMI on Blood Pressure among the Padam of Arunachal Pradesh

DHRUBA KUMAR LIMBU† & GIN KHAN KHUAL ‡
Department of Anthropology, North- Eastern Hill University
Shillong - 793022, Meghalaya, India.

†E-mail:dhruba_limbu@yahoo.co.in &
‡E-mail: gkkhual90@gmail.com
† Professor (Corresponding Author)
‡ Ph.D.Research fellow

ABSTRACT

In the present study an attempt has been made to find out the association between hypertension and obesity among the Padam (Adi) of Bolung village of Lower Dibang valley district, Arunachal Pradesh. The total number of subjects included in this study is 161 males aged 18years and above. Both the systolic and the diastolic blood pressures were increased with the increase of the BMI and the age-group. The underweight category and lower age-group subjects exhibited low mean blood pressure contrast to the obese which showed high mean blood pressure. The socio-economic conditions have also influenced the BMI and the hypertension among the studied population.

Key Words:

Obesity, Hypertension, BMI, Padam, Arunachal Pradesh

INTRODUCTION

The prevalence of obese related medical awareness has been widely noticeable across the globe. The socio-economic conditions and lifestyle of human being became less and less sedentary over the past few decades resulting rising in obesity and its related cardiovascular disease like hypertension. According to Finer (2003), an estimate of about 300 million adults is reported to be overweight worldwide in 2000. By the end of 2010, more than 1.4 billion cases of obesity are reported and about 400 million adults are overweight worldwide (WHO, 2011). Countries like Africa and India also witness increasing obesity despite considerable existence of under nutrition (Berman, 2009; Brewis, 2011).

The association of body mass index (BMI) has been stigmatized with double burden of hypertension and under nutrition related diseases among the developing nations. The estimated deaths claim about 7.1 million lives among middle and old-age group is due to high BP (WHO, 2002). The relationship between BMI and BP has long been the subject of epidemiological research. Positive association of BMI and BP have also been reported among the Asian populations. The need to retrospect each section of the society is important to frame policies undertaking to minimize the causes and affect for generation in existence.

The relevance of BMI and blood pressure on public health at both the local and national level is indispensable, however, apart from the national surveys very limited studies have been conducted in Northeast India till date. Thus, it can be observed that this kind of studies in Northeast India is still at a formative stage and hence, it should be given due importance as a crucial subject of research interest.

OBJECTIVE

The objective of the present study is to find out the prevalence of obesity and its association with blood pressure among the Padam(Adi) males of Bolung village of Lower Dibang valley district, Arunachal Pradesh.

MATERIALS AND METHODS

The present study was conducted among the Adult Padam(Adi) males of Bolung village of Lower Dibang Valley District, Arunachal Pradesh. As per 2011 Census, Lower Dibang Valley had a total population of 54,080, of which males and females were 28,053 and 26,027 respectively with literacy rate at 69.13%. A cross-sectional study was conducted randomly among 161 adult males who volunteered for the present study. The subjects were divided into five different age-groups viz., 18-29yr, 30-39yr; 40-49yr, 50-59yr, and 60-70yr. Data on anthropometric measurements such as height and body weight were collected using anthropometer and a portable weighing machine. Height(cm) was measured with the help of an anthropometer with a precision of ±1mm. Weight was recorded to the nearest 0.1 kilogram by weighing machine with minimum clothing. Body Mass Index (BMI) was calculated using the formula: weight in kilograms / (height in meter2). For the assessment of BMI, height and weight measurements were taken using standard protocols given by WHO (2000) for Asian population cut-off points (Normal BMI >18.5; Overweight BMI>23; Obese BMI>27.5). Physiological parameter like BP was measured using digital sphygmomanometer. The subjects were asked to sit relaxed in a chair with his arm supported comfortably and the pressure cuff was applied closely to the upper arm. The cuff was rapidly inflated automatically by pressing the button. The measurement was repeated twice or thrice in about five-minute interval and the average was taken for accuracy. According to the seventh report of the Joint National Committee (2003) on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, normal BP is <120/80 mmHg, prehypertension is between 120-139/80-89 mmHg, stage I hypertension as 140-159/90-99 mmHg, and stage II hypertension as ≥160/100 mmHg. This standard decorum is based for the assessment of the present data analysis. In order to test the level of significance, both t-test and chi-square tests were used. The value of $p< 0.1$ and $p<0.01$ are considered as statistically significant. Besides calculating manually, most of the analyses were done in MS-excel software (Microsoft Company, 2010 version) and IBM developed software SPSS version 20.

Padam is a sub-tribe of the Adi tribe of Arunachal Pradesh. The staple food of the Padam is rice. In addition, some other nutritious supplements are consumed as diet. Though the main source of income is from agriculture, sizable participants were in public sector services as increments. With less dense population, urbanization and economic development there has been a major shift in their occupation, improvement in socio-economic condition and lifestyle. Following the advent of Christianity in region, by now, two major religious groups, viz., the Christians and the followers of the Dony-Polo Sects have emerged.

RESULTS

The basic data and BMI of the Padam males of the five different age-groups are displayed in Table 1. The mean height was found highest among the lowest age group (18-29yr). In general, this value decreases as the age-group increases and lowest mean height was recorded among the oldest age-group (60 -70yr). The differences in the mean height are statistically significant only in 60 - 70yr. The overall mean height was found to be 160.77cm. Mean body weight observed increased steadily up to the age group 50-60yr and decreased thereafter. However, the difference was statistically significant only between 60-70yr which is similar in to that of the height. Weight was found to be highest among 50-59yr age group and lowest among 60-70yr age group. The overall mean value of all the age groups for weight was 59.63 kg.

Table 1 also shows the mean BMI for each age group. The mean value increases up to 50-59yr and then decreases at 60-70yr. The highest mean BMI is found in 50-59yr (24.22 kg/m2) and lowest in the age group 60-70yr (21.38 kg/m2). However, the mean differences were found statistically not significant in all the groups. The overall mean BMI value found is 22.95 kg/m2.

Table 1: Distribution of the Padam males according to Height, Weight, BMI and age-group

Age group (years	No.of Subjects	Height (cm)				Weight (kg)				BMI			
		Mean	S.D	S.E	t value	Mean	S.D.	S.E.	t value	Mean	S.D.	S.E.	t value
18-29	61	162.10	5.64	0.72	-	58.92	7.34	0.94	-	22.49	2.54	0.32	-
30-39	37	161.14	4.44	0.73	0.379	58. 89	8.82	1.45	0.010	22.64	3.05	0.50	0.251
40-49	37	159.77	5.55	0.91	1.712								
	61.50	9.82	1.61	1.202	24.03	3.59	0.59	1.795					
50-59	20	160.24	4.76	1.06	0.784	62.55	12.67	2.83	0.322	24.22	4.13	0.92	0.173
60-70	6	152.92	7.20	2.93	2.919*								
	50.16	7.08	2.89	3.061**	21.38	2.05	0.84	1.829					
N	161	160.77	5.56	0.43	-	59.63	9.25	0.72	-	22.95	3.05	0.24	-

*P< 0.01, **P< 0.001

Table 2 shows the distribution of blood pressure (BP) in the different age group categories. Except the 18-29yr age-group, the mean Systolic blood pressure (SBP) shows linear positive correlation with age. The lowest and the highest mean SBP is found among 30-39yr and 60-70yr age group with 121.8 mmHg and 128.9 mmHg respectively. Difference between age-groups doesn't show statistical significance and the overall mean SBP is 125.4 mmHg. In respect of the Diastolic blood pressure (DSP), though there is a positive correlation between mean of different age-groups with age, the association shows erratic pattern. The lowest and highest mean is observed in the age groups 18-29yr (79.57mmHg) and 50-59yr (87.35 mmHg) respectively. The overall mean DSP is found to be 83.24 mmHg. Only in the age group 30-39yr ,the difference was found statistically significant at p<0.01..

Table 2: Blood pressure by age-group

Age group (yr)	N	Systolic Blood Pressure (SBP) mmHg				Diastolic Blood Pressure (DBP) mmHg			
		Mean	S.D	S.E	t value	Mean	S.D.	S.E.	t value
18-29	61	125.5	11.83	1.51	-	79.57	9.78	1.25	-
30-39	37	121.8	11.82	1.94	1.503	85.11	10.25	1.68	2.634*
40-49	37	126.4	10.82	1.78	1.776	84.95	9.01	1.48	0.071
50-59	20	128.9	13.44	3.00	0.715	87.35	8.38	1.87	1.005
60-70	6	129.7	13.84	5.64	0.125	84.67	12.21	4.98	0.929
N	161	125.4	11.97	0.94	-	83.24	9.98	0.78	-

* P < 0.01

Table 3 shows the distribution of subjects in different categories of BMI and BP. Highest number of subjects are in the normal BMI category (56.53%) followed by the overweight (31.05%) and the lowest were observed in the underweight (0.03%) category. In respect of the Systolic blood pressure, highest percentage of subjects is found in high normal (prehypertension) (31.05%) category followed by optimal (29.82%) and a lowest category is among the hypertension (11.18%) category. In the Diastolic blood pressure, the highest percentage(32.29%) constitute optimal category followed by hypertension (25.46%),then the high normal (23.61%) and least in the normal (18.64%) category. The frequency distributions of the subjects are more or less homogeneously distributed in each category.

Table 3: Distribution of subjects by BMI and BP

Body Mass Index			Blood Pressure				
				Systolic		Diastolic	
Categories	Frequency	Percentage	Categories	Frequency	Percentage	Frequency	Percentage
Underweight	5	0.03	Optimal	48	29.82	52	32.29
Normal weight	91	56.53	Normal	45	27.95	30	18.64
Overweight	50	31.05	Prehypertension	50	31.05	38	23.61
Obese	15	0.09	Hypertension	18	11.18	41	25.46
Total	161	100	Total	161	100	161	100.00

Table 4 shows the distribution of mean systolic and diastolic BP against BMI categories. The highest mean SBP is found in obese category (130.66 mmHg) followed by overweight (128.9 mmHg), then the normal (122.9 mmHg) and least in the underweight (120.6 mmHg) category. In respect of the DBP, the highest mean concentrated within Obese (89.33 mmHg), followed by over weight (85.06 mmHg), then the normal (81.51 mmHg) and least in the underweight (78.0 mmHg) category.

Table 4: Systolic and diastolic blood pressure according to BMI

Body Mass Index	N	(%)	Systolic (mm Hg)			Diastolic (mm Hg)		
			ẍ	±SD	±SE	ẍ	±SD	±SE
Under weight	5	0.03	120.6	12.60	5.63	78.0	9.69	4.33
Normal	91	56.53	122.9	13.04	1.36	81.51	10.43	1.09
Over weight	50	31.05	128.9	9.24	1.30	85.06	8.88	1.25
Obese	15	0.09	130.66	8.82	2.28	89.33	7.46	1.92
Total	161	100	125.4	11.97	0.92	83.24	9.98	0.78

The state of correlation between Age, BP and BMI with level of significance is given in table 5. It shows significant ($P < 0.01$) positive correlations of BMI with both systolic and diastolic BP. It is observed that BP had increased with increase in BMI. Correlation coefficient shows that relationship of BMI with Systolic BP (0.334) was stronger than Diastolic BP (0.293).

Table 5: Correlation matrix of the BMI, BP and Age

Correlation	BMI	SBP	DBP	Age
BMI	1.000	.334*	.293*	.139
SBP	.334*	1.000	.539*	.111
DBP	.293*	.539*	1.000	.270*
Age	.139	.111	.270*	1.000

*Correlation is significant at 0.01 (2-tailed)

Table 6: Age-group wise prevalence of risk factors (overweight and obesity)

Age group (years	No.of Subjects	Overweight		Obese		Prehypertension				Hypertension			
		N	(%)	N	(%)	SBP	(%)	DBP	(%)	SBP	(%)	DBP	(%)
18-29	17	27.8	3	4.9	39	63.9	22	36.0	6	9.8	9	14.7	-
30-39	13	35.1	1	2.7	21	56.7	13	35.1	1	2.7	13	35.1	0.251
40-49	12	32.4	7	18.9	23	62.1	21	56.5	4	10.8	8	21.6	
50-59	7	35.0	4	20.0	10	50.0	8	40.0	5	25.0	9	45.0	
60-70	1	16.6	-	-	2	33.3	2	33.3	2	33.3	2	33.3	0.173
60-70	6	152.92	7.20	2.93	2.919*								
	50.16	7.08	2.89	3.061**	21.38	2.05	0.84	1.829					
N	161	160.77	5.56	0.43	-	59.63	9.25	0.72	-	22.95	3.05	0.24	-

N = frequency

Table 6 reveals the percentage distribution of the risk factors of having obesity and hypertension according the age-group. Highest percentage of overweight is found (35.1%) in the age-group 30-39yr followed by the 50-59yr (35.0%). The lowest percentage (16.6%) is observed among the oldest age-group 60-70yr. In respect of obesity, highest percentage (20.0%) of subjects is seen in age group 50-59yr and lowest (2.7%) in the age group 30-39 yr. In respect of the pre-hypertension, highest percentage distribution of systolic BP is found among the younger age-group i.e., 18-29yr and the lowest (33.3 %) is among the oldest age group 60-70 yr. However, in case of diastolic BP, the highest frequency (56.5%) is observed among 40-49yr age and the lowest among the oldest 60-70yr age-group. In case of hypertension, maximum percentage (33.3%) of systolic BP is found among the oldest age group 60-70yr and lowest percentage (2.7%) in the age group 30-39yr. The highest frequency (45.0%) of diastolic BP is found among the age-group 50-59yr and the lowest (14.7%) in the youngest age group i.e., 18-29yr.

DISCUSSION

There is an evident increasing secular trend in the mean stature from elderly to the younger age groups. This could be due to improvement in socio-economic conditions, better nutrition among the younger subjects. The reason for declining in stature in advance age could be due to thinning of intervertebral discs in the spine which dehydrates and compress. The aging spine can also become more curved, and vertebrae can collapse due to loss of bone density. Loss of muscle in the torso can also contribute to stooped posture. Even the gradual flattening of the arches of the feet can change the posture (Berkeley Wellness, 2015). Loss of collagen between spinal vertebrae can also cause the spine to bow and the height to shrink (Kapoor & Tyagi, 2002).

The Padams are small and slender mongoloid stock in comparison to the mainland Indian or the European population. The mean body weight increases with age till the age of 59 years and slightly decreased thereafter. Tendon (2006) also mentions the increase in body weight and BMI with age and decline in advanced age. Similar observation has been found among the Tangkhul Naga males of Manipur (Mungreiphy et al., 2011). Growing obesity is also witnessed among the Meitei males of Imphal valley (Singh & Dkhar, 2013). Younger generation usually have better appetite compared to the elders characterised by increased energy intake, fat rich diet, accumulation of fat and relatively less energy expenditure. The declining body weight among the older age-group may be attributed to the decrease in appetite, reduce intake of fats and various complications due to advancing age.

The present finding shows a positive correlation between weight and age and reaches its peak among the middle age-group and then started declining. Similar observation has been made in case of BMI. Age was positively correlated with both systolic and diastolic BP. The whole observation on the increasing trends shows the dependency of Systolic and diastolic blood pressures on age. Other studies also indicated that higher BP is closely associated with advancing age (James et al., 2014; Franklin, 2001). It is important to note that the association of high blood pressure with age was more evident than that of BMI with increasing age. Thought higher BMI is a good indicator of fitness, there is another possibility that the accumulation of fats in body parts could also contribute the increase risk of having higher BMI leading to high chances of developing hypertension. Positive associations between BMI and BP have also been reported in other Indian populations (Tendon, 2006).

The present study shows that the percentage distribution of risk factors such as overweight and obese are closely related to hypertension. It also shows that, older age-group with high BMI are more likely to suffer from hypertension then the underweight subjects. Similar findings have been reported in other studies. Underweight subjects are less likely to have high blood pressure than those who are in normal BMI category (Rosmarakis et al., 2005; Tendon, 2006). The prevalence of hypertension is also terraces from the influence of genetic history of a population. Overweight and obesity seems to have no difference in blood pressure levels between the subjects (Shaper and Whincup, 1997).

CONCLUSION

The present study has demonstrated the increasing prevalence of overweight and obesity among the Padam males. It also shows that body mass index is closely associated with both systolic and diastolic blood pressures. BP is noticeably associated with rising age independently. There is a positive significant correlation among BMI, systolic and diastolic BP and age, though the magnitude of correlation is different within age-group. Mean systolic and diastolic BP levels were higher among subjects with higher BMI thereby increase the chances of developing hypertension. Although populations around the world are often generalized to have normal blood pressure, however, findings of the present study reveal that the risk of developing and suffering from hypertension is eminent at a faster rate. In the present population there is a serious emerging trend of high BMI and BP which is a consequence of changes in various interrelated factors such as socio-demographic conditions, dietary habits and physical activity, increasing urbanization, changing lifestyle and occupational work patterns. These changes, in turn, are a manifestation of the continuing stage of transition from traditional to modern that, Padam population is still embroiled in and trying to adapt to. A bio-cultural approach towards a better understanding of the physical and cultural dimensions within which all these factors operate is fundamental for formulating health policies applicable for the people. If the present trend continues to dominate population regardless of our ethnic identity, it could lead to development of chronic morbidities related to overweight and obesity. In the last few decades, most of the societies experienced transition in socioeconomic condition. The impact of changes has been observed from the Padam(Adi) population too. It is important to understand the nature of developing hypertension and its characteristics feature to minimize the causes and affect in the society. As it is an economical burden to the nation and the person concerned, precaution must be taken to avoid such impasse at an individual level.

ACKNOWLEDGEMENTS

We sincerely thank to the people of Bolung village, Arunachal Pradesh for actively participating in the present study. Without their support and patience this study wouldn't have been possible. Our gratitude goes to the Department of Anthropology, NEHU, Shillong for proving financial assistance to conduct the fieldwork at Bolung village.

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