Age Trends in Blood Pressure and Obesity among the Urban Bhutias of Sikkim

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INTRODUCTION

Many studies have revealed that age is an important factor with which the cardiovascular disease (CVD) risk factors are related (Eisenmann and Malina 2002; Guo et al., 1999). Fact remains that the problems of high blood pressure (essential hypertension) and obesity considered to be the major risk factors for CVD are increasingly assuming global importance (Stevenson, 1999; WHO, 2000). Clearly, essential hypertension happens to be one of the most prevalent disorders in the industrialized world. Further, according to an estimate, over 150 million individuals in the United States, India and China have at or above the WHO recommended threshold value (Reddy, 1996; National Center for Health Statistics, 1977). Many studies, most of which were conducted before 1972, have found that in some human groups blood pressure increases insignificantly or not at all. These groups were mostly traditional and non-western relatively isolated tribal/indigenous populations. Needless to say lifestyle changes have occurred in the last three decades in many different ways among majority of populations inhabiting different parts of the world. And as a consequence, increase in blood pressure with age has been a feature for many populations in developed and developing nations. The positive influences of high sodium and high fat diet, urban living, stress and so on with age could be the operational factors (Waldron et al., 1982). A few studies among the American women demonstrate that with increasing age there is an increasing accumulation of body fat and blood pressure (Wing et al., 1991; Dawson-Hughes and Harris 1992). Some cross-sectional studies have shown that among different populations age related changes in anthropometric and behavioural traits like physical activity occur (Poehlman et al., 1995; Pasquali et al., 1994). A study among the migrant Pakistani men in UK also shows the relationship between age and other anthropometric and clinical traits (Bose and Mascie-Taylor, 1997).

In Indian context, death caused by CVD is increased to 33% in 1990s from 4% in 1960s and is on the threshold of an epidemic (WHO, 1993). Like other developing countries, India is also undergoing changes owing to the forces of modernisation, which are affecting the health of many Indians adversely. In India age related changes regarding obesity and blood pressures have recently been shown by a study among the elderly Bengalees of Kolkata (Ghosh et al., 2001). Some authors have also studied different Indian populations and found age and sex variations in blood pressure and obesity measures (Majumder et al., 1994; Dalal, 1978). Most of the studies regarding age related changes in obesity, hypertension in India were conducted among the non-tribal populations while studies among the tribal groups are rare. However, a study among a tribal population, considering the age range between 18 and 75 years, of Andhra Pradesh shows an increasing trend in BMI values with increasing age (Reddy, 1998). Recently, another study conducted in the Sikkim Himalayan region among the Lepchas, a tribal community, observed age related changes in diastolic blood pressure (DBP) (Mukhopadhyay and Mukhopadhyay, 2001). In view of the above, the aim of the present paper is to examine the age related changes in blood pressure and obesity measures among the 'Bhutias', a tribal community of Sikkim.

MATERIALS AND METHODS

For the present study, the Bhutias, residing in the town of Gangtok and its neighbourhood, are considered as the study participants. The Bhutias are of Mongoloid origin. They have a language of their own which is known as '*Sikkimese*'. However they also speak in Nepali. Many Bhutias especially the educated section can speak Hindi and English as well. In the middle of 17^{th} century the Bhutias started coming to Sikkim from Tibet (Dutta, 1991). The main occupation of the Bhutias living in the rural areas is agriculture while the urban Bhutias are predominantly engaged in service and business. After the merger of Sikkim with the Indian Union in 1975, Bhutias are increasingly taking advantage of expanding developmental programs in the State. The Sikkimese Bhutias, especially our study participants are exclusively Buddhists. Monogamy is the general norm of marriage among them, but some cases of polygamous marriage are present. Polyandry and consanguineous marriages are socially not acceptable among the Bhutias.

The Bhutias are mostly non-vegetarians and thrive on carbohydrates, red meat and milk products. Beef (*langsha*) and pork (*faksha*) are consumed in large amounts. They prepare a traditional item from milk of buffalo named *'churpi'*, which is very rich in saturated fat. Irrespective of sex, consumption of alcohol is very much common among the Bhutias. They drink beer, hard drinks, indigenous beer called *'chhang'* and also home made liquor called *'jnar'*. It is prepared by millet and they consume it by adding hot water. *'Roxi'* is another local hard drink, which is used by the people who are economically at a lower level. Further, they consume tea added with salt, but as a result of urbanization, the use of sugar is now becoming common among the urban Bhutias.

The Bhutias inhabit both rural and urban areas of Sikkim. The study participants are chosen from those families, which are residing in Gangtok for more than 10 years. These families have landholdings in different districts of Sikkim and have been staying in Gangtok for livelihood reasons. Gangtok is the largest urban centre and is situated in the East district of the State. It is the capital of the Sikkim State. As the capital of the State, Gangtok has undergone enormous developmental changes in terms of health infrastructure, varied economic activities, spread of education and other developmental initiatives. It is evident that the urban way of life influenced the Bhutias of Gangtok to change their traditional lifestyle that is followed generally in the rural areas.

Bhutias of both sexes aged 20 years and above were considered for the study. A total 200 adults (100 male and 100 female) were chosen from 100 randomly selected families. One adult male and one adult female, preferably the household head and his spouse taken from each family. In the absence of such a combination, other combinations such as mother-son, father-daughter, and the like were also considered. Correct ages of the study participants, particu-larly those older ones, for whom accurate age record was absent, were estimated with the help of a traditional Bhutia calendar.

Data on socioeconomic status were collected with the help of standard questionnaires by interviewing each study subject. The male study participants are predominantly engaged in service, while the females are mostly housewives. Most of the study subjects are educated upto secondary level. The average income of the families is about Rs. 4000.00 per month. Anthropometric measurements considered for the study include stature, weight, circumferences and skinfold thicknesses. Following techniques were used for the specific anthropometric measurements considered. Lange Skinfold caliper was used to measure skinfold thicknesses in the following sites: biceps, triceps, subscapular, suprailiac, abdominal and medial calf. A flexible tape was used to measure the circumference of mid upper arm, chest, abdomen, minimum waist, maximum hip and calf. Stature was taken with the help of a GPM anthropometer, while the weight was recorded by a bathroom scale. Following standard techniques (Lohman et al., 1988) one of the authors (SS) recorded all the measurements for the males and a female investigator (a research assistant, trained by the authors) took those for the females. Minimum clothings were allowed at the time of taking anthropometric measurements. Both stature and weight were taken bare footed. Where appropriate, measurements were taken uniformly in the left side. Waist-hip ratio for each individual (WHR) [Waist circumference (cm)/Hip circumference (cm)] was calculated to observe the distribution of central adiposity. Conicity index (CI) [CI= waist circumference (m)/0.109 {weight (kg)/stature (m)}] was also calculated to understand the distribution of the body fat (Valdez et al., 1993). The body mass index (BMI) was calculated as weight/stature^2 (kg/m^2). Prevalence of obese and overweight people was identified following the classification recommended by WHO and International Diabetes Institute (IDI) (WHO and IDI, 2000). PBF as well as FM were estimated with the help of Omron body fat monitor HBF-300, manufactured by Omron Corporation, Japan.

Blood pressure (BP) measurements of each study participant were recorded for two consecutive times following standard methods i.e., systolic blood pressure (Korotkoff phase I) and diastolic blood pressure (Korotkoff phase V). A stethoscope and a mercury sphygmomanometer were used. The blood pressures were taken on the left upper arm with the subject in sitting position after a 10 minutes rest. Blood pressure readings (both SBP and DBP) were taken twice and the average is considered for analyses. Average of three consecutive measurements at each skinfold site was considered. Written consent to participate in the study was obtained from each study participant.

All statistical analyses have been done with the help of SPSS 7.5 for windows software. Mean and standard deviations of the variables were calculated and one way ANOVA has been done to know whether the means are significantly different between the age groups. To examine the relationship of age with blood pressures and other obesity measures, correlation coefficients were calculated. Stepwise multiple regression analysis was performed to identify the significant predictors of SBP and DBP, separately.

RESULTS

Table 1 shows the descriptive statistics i.e., means and standard deviations of the dependent and independent variables considered in the study viz. age, blood pressures, anthropometric traits including the ratios, PBF and FM, by gender and age groups. It is evident from the table that mean values of both SBP and DBP clearly increase with increasing age. For the females they show a slightly declined value at the last age group (≥ 60 years). The same declining trend is noticed for the males also, but in the age group of 50 to 59 years. In all the age groups, males show a higher mean value of SBP and DBP, than the females. With respect to anthropometric variables, males show higher mean values than females for height and weight. Height shows an uniform decreased mean value with increasing age for the males, while for the females the trend is more or less similar although lacks uniformity. All circumference measurements have a clear increasing trend with increasing age for females, while the males show a relatively lower value for the older people. Females show higher values for all the skinfold thickness measurements considered than males. Mean values of all the skinfolds are increasing with age and finally show a lower value for the older age group (≥ 60 years), except the calf, which shows a clear decreasing trend with increasing age for the females. Mean values for PBF, FM and other body fat indices like BMI, WHR and CI, are higher in females than males. Except the mean values for WHR for females and those of CI for both the sexes which show an increasing trend with age, other ratios, PBF and FM show an increasing trend with age till age 60 years, and then show a decreasing trend. Table 2 shows the result obtained from one way ANOVA. Both systolic and diastolic blood pressures show a significant difference for both the sexes (for male, F=14.450 and 4.051 for SBP and DBP respectively, while for female the corresponding F values are 10.427 and 8.069, respectively), among the age groups. For the males, difference in weight and for the females all the circumferences, among the age groups are statistically significant ($P<0.01$). Except biceps and calf, all the skinfolds show statistically significant ($P<0.01$) differences among the age groups for the males, while for the females, only suprailiac skinfold shows significant (F=3.054, $P<0.01$) difference. PBF, WHR and CI are significantly different for both the sexes ($P<0.01$), while BMI and FM are also significant among the males (F=3.412 and 6.670 for BMI and fat mass, respectively, $P<0.01$).

Overweight and obese persons among different age groups are described by sex in Table 3. It is evident from the table that following the cut-off BMI value recommended by WHO and IDI (2000), both males and females show a steady increasing trend of overweight with the increasing age. Females show marginally higher prevalence (70.00%) than males (68.00%). Correlation coefficients are calculated to examine the relationship of age with blood pressures (SBP and DBP) other anthropometric and clinical traits, and the result is shown in Table 4. Irrespective of sex, age shows highly significant correlation with blood pressures ($r = 0.58$ and 0.35 for SBP and DBP for males, for females, the corresponding r values are 0.56 and 0.46; $P<0.01$). Again, irrespective of sex, prevalence of essential hypertension, both systolic and diastolic, clearly increase with increasing age. Overall prevalence of systolic hypertension was found to be 35% and 27% for males and females, respectively. While, that of diastolic hypertension was found to be 41% and 31% for males and females respectively following WHO (1999) recommended value (table not shown here). Height shows a significant negative correlation with age for the males ($r = -0.20$; $P<0.05$). Age has highly significant ($P<0.01$) correlation with all the circumferences for

Table 1: Descriptive statistics of the age, blood pressure and anthropometric variables according to age groups and sex

	Age groups (years)									
	20 – 29		*30 – 39*		*40 – 49*		*50 – 59*		*≥ 60*	
Variables	*Male(n=18)* *Mean ± sd.*	*Female(n=25)* *Mean ± sd*	*Male(n=26)* *Mean ± sd*	*Female(n=28)* *Mean ± sd*	*Male(n=23)* *Mean ± sd*	*Female(n=19)* *Mean ± sd*	*Male(n=15)* *Mean ± sd*	*Female(n=15)* *Mean ± sd*	*Male(n=18)* *Mean ± sd*	*Female(n=13)* *Mean ± sd*
Age (yrs.)	24.72 ± 2.24	24.52 ± 2.57	34.23 ± 2.75	33.89 ± 2.75	43.87 ± 3.00	43.84 ± 3.15	56.07 ± 2.22	54.73 ± 2.4	65.67 ± 6.2	63.08 ± 5.06
SBP(mm/Hg)	120.1 ± 8.78	118.8 ± 9.08	128.9 ±14.6	124.7 ±15.15	136.0 ±15.00	133.8 ±16.57	131.9 ± 10.1	145.9 ±18.08	157.6 ±24.9	143.7 ± 22.21
DBP(mm/Hg)	79.8 ± 8.20	79.1 ± 6.49	87.7 ± 9.74	82.3 ± 8.84	90.7 ±10.62	88.4 ±10.22	87.9 ± 7.06	95.3 ±13.08	93.4 ±13.03	87.5 ± 10.46
Height (cm.)	167.6 ± 5.51	154.2 ± 5.73	166.2 ± 6.01	155.6 ± 4.78	166.1 ± 6.61	154.3 ± 5.65	165.0 ± 5.18	155.4 ± 6.03	163.5 ± 6.06	152.7 ± 4.64
Weight (Kg.)	61.9 ± 8.41	57.2 ± 8.51	69.0 ± 7.98	60.9 ± 9.34	70.8 ±13.19	60.6 ± 8.65	72.9 ± 12.07	63.2 ±10.66	64.7 ±12.96	60.0 ± 13.52
Circum. (cm.)										
Abdomen	75.5 ± 7.56	79.9 ± 9.29	84.5 ± 8.48	82.0 ± 9.25	87.9 ±10.9	82.0 ± 9.96	91.6 ± 10.68	91.8 ±10.64	84.4 ±10.22	93.0 ± 9.05
Waist	77.9 ± 7.03	90.01 ± 9.37	85.9 ± 6.54	94.2 ± 9.35	88.3 ± 9.23	94.8 ±11.05	90.0 ± 9.57	99.8 ±11.01	87.17 ± 9.9	103.0 ± 9.68
Hip	90.0 ± 5.17	96.9 ± 6.57	93.8 ± 5.97	98.5 ± 6.73	94.0 ± 6.69	99.9 ± 6.47	94.8 ± 4.56	102.8 ± 8.86	91.83 ± 7.6	102.9 ± 8.5
Skinfolds (mm)										
Biceps	4.2 ± 1.66	8.5 ± 5.28	5.3 ± 2.34	8.2 ± 4.07	5.9 ± 2.49	7.8 ± 3.41	5.8 ± 1.96	7.4 ± 3.14	4.6 ± 2.5	8.5 ± 4.5
Triceps	9.1 ± 4.11	17.0 ± 6.99	12.3 ± 3.82	20.1 ± 5.36	12.3 ± 4.45	18.8 ± 7.1	12.5 ± 3.87	17.6 ± 8.87	9.9 ± 4.0	15.9 ± 6.55
Subscapular	12.8 ± 5.76	24.0 ± 8.90	16.6 ± 5.15	28.1 ± 8.29	15.9 ± 5.29	28.3 ± 9.28	18.0 ± 4.66	28.5 ± 9.47	13.7 ± 5.56	24.8 ± 11.73
Abdominal	10.6 ± 5.19	21.7 ± 8.28	14.3 ± 5.97	23.0 ± 7.47	15.1 ± 6.21	26.1 ± 9.63	16.2 ± 5.72	22.6 ± 8.65	16.7 ± 7.03	22.5 ± 8.63
Suprailiac	9.3 ± 5.62	18.1 ± 7.94	17.6 ± 5.14	27.5 ± 7.35	17.6 ± 5.24	25.4 ±10.06	20.6 ± 7.87	26.2 ± 9.75	12.4 ± 6.88	18.2 ± 10.52
Calf	8.7 ± 3.98	19.1 ± 7.55	10.9 ± 4.05	19.1 ± 5.98	11.0 ± 4.46	18.5 ± 7.05	12.3 ± 6.42	17.9 ± 7.95	8.6 ± 4.74	13.5 ± 4.76
PBF	20.8 ± 4.47	31.2 ± 4.78	26.2 ± 3.76	34.1 ± 4.87	28.0 ± 5.78	35.4 ± 5.25	30.3 ± 3.76	36.3 ± 5.69	29.6 ± 5.02	37.4 ± 6.17
FM	13.2 ± 4.24	18.2 ± 5.49	18.3 ± 4.42	21.2 ± 6.11	20.3 ± 6.93	21.8 ± 5.92	22.3 ± 5.52	23.0 ± 7.17	19.4 ± 6.11	23.1 ± 8.7
Ramtios										
BMI	22.0 ± 2.44	24.0 ± 3.08	25.0 ± 2.97	25.3 ± 3.72	25.5 ± 3.50	25.5 ± 3.29	26.7 ± 3.72	26.1 ± 4.18	24.1 ± 3.95	25.6 ± 4.93
WHR	0.87 ± 0.00	0.92 ± 0.00	0.91 ± 0.00	0.96 ± 0.00	0.94 ± 0.00	0.96 ± 0.00	0.94 ± 0.00	0.97 ± 0.00	0.94 ± 0.00	1.0 ± 0.00
CI	1.2 ± 0.07	1.4 ± 0.09	1.2 ± 0.05	1.4 ± 0.07	1.2 ± 0.06	1.4 ± 0.11	1.2 ± 0.07	1.4 ± 0.07	1.3 ± 0.08	1.5 ± 0.05

Table 2: Results of the one way ANOVA pertaining to blood pressure, anthropometric variables and obesity measures.

Variables	*Male*		*Female*	
	F-Ratio	*Prob*	*F-Ratio*	*Prob*
SBP (mm Hg)	14.450	P<0.01	10.427	P<0.01
DBP (mm Hg)	4.051	P<0.01	8.069	P<0.01
Height (cm)	1.237		0.794	
Weight(kg)	2.988	P<0.01	0.967	
Circum. (cm)				
Abdominal	6.685	P<0.01	7.061	P<0.01
Waist	5.483	P<0.01	4.476	P<0.01
Hip	1.771		2.413	P<0.01
Skinfolds(mm)				
Biceps	1.883		0.221	
Triceps	2.911	P<0.01	1.153	
Sub-scapular	2.792	P<0.01	1.089	
Abdominal	6.468	P<0.01	1.806	
Supra-iliac	3.484	P<0.01	3.054	P<0.01
Calf	2.080		1.815	
PBF	11.621	P<0.01	4.073	P<0.01
FM	6.670	P<0.01	1.928	
Ratios				
BMI	3.412	P<0.01	0.749	
WHR	3.398	P<0.01	2.279	P<0.01
CI	3.862	P<0.01	7.533	P<0.01

Table 3: Prevalence of overweight and obesity by sex

Age groups	*Male*			*Female*		
	N	*BMI>23.0*	*%*	*N*	*BMI>23.0*	*%*
20 – 29	18	8	44.44	25	16	64.00
30 – 39	26	18	69.23	28	20	71.43
40 – 49	23	19	82.61	19	14	73.68
50 – 59	15	13	86.67	15	12	80.00
>=60	18	10	55.56	13	8	61.54
Total	100	68	68.00	100	70	70.00

females, while for the males only the hip circumference does not show any significant relation with age. Except BMI for females, PBF, FM and all other ratios are highly correlated with age for both the sexes. For the males, the correlation between SBP and DBP and BMI is highly significant (r=0.281 and 0.300 respectively; P<0.01). The correlation is also significant (r = 0.219; P<0.05) for females between BMI and DBP, and also between BMI and SBP (r=0.328; P<0.01). The result of stepwise multiple regression analysis is shown in Table 5, which reveals that age is a strong predictor for SBP in both the sexes, and also for DBP in case of females. PBF is the only significant predictor for DBP for male, where as weight, FM and PBF are the best predictors for DBP for the females. Obesity related blood pressure values are shown in Table 6. It is observed that for both the sexes mean values of

Table 4: Correlation Coefficient (r) between age and the quantitative variables studied.

Variables	*Male*		*Female*	
	F-Ratio	*Prob*	*F-Ratio*	*Prob*
SBP (mm Hg)	0.58**	P<0.01	0.56**	P<0.01
DBP (mm Hg)	0.35**	P<0.01	0.46**	P<0.01
Height (cm)	-0.20*	P<0.05	-0.06	
Weight (kg)	0.1		0.12	
Circum. (cm)				
Abdominal	0.29**	P<0.01	0.41**	P<0.01
Waist	0.33**	P<0.01	0.38**	P<0.01
Hip	0.08		0.27**	P<0.01
Skinfolds (mm)				
Biceps	0.03		-0.02	
Triceps	0.04		-0.06	
Sub-scapular	0.05		0.06	
Abdominal	0.29		0.04	
Supra-iliac	0.15		0.04	
Calf	0.02		-0.19*	P<0.05
PBF	0.54**	P<0.01	0.37**	P<0.01
FM	0.37**	P<0.01	0.25*	P<0.05
Ratios				
BMI	0.21*	P<0.05	0.16	
WHR	0.36**	P<0.01	0.30**	P<0.01
CI	0.44*	P<0.05	0.48*	P<0.05

* Correlation is significant at 0.05 level
** Correlation is significant at 0.01 level

Table 5: Results of multiple regression analysis using age and anthropometric variables as predictors, by sex

Sex	*Dependent variable*	*Sample size*	*Significant quantitative predictors*	R^2
Male	SBP	100	Age, FM, suprailiac and sub-scapular skinfold thicknesses	0.45
	DBP	100	Percent fat	0.18
Female	SBP	100	Age, FM, Weight, BMI	0.44
	DBP	100	Age, Weight, FM. PBF	0.32

SBP and DBP among the non-obese (BMI < 23.0) individuals are lower than those among the obese (BMI ≥ 23.0) individuals, except for DBP at the last age group in case of the females, where the mean values of the obese women are lower.

DISCUSSION

The present paper examined the age related changes in blood pressure and obesity among the Bhutias of Gangtok and its neighbourhood located in the East district of Sikkim. The study reveals that both SBP and DBP have a clear increasing trend with increasing age. This parti-

Table 6: Blood pressure according to BMI value by age group and sex

Age groups	BMI ≤ 23.0						BMI ≥ 23.0					
	Male			Female			Male			Female		
	N	SBP	DBP	N	SBP	DBP	N	SBP	DBP	N	SBP	DBP
20-29	10	116.4	78.5	9	119.4	77.6	8	124.7	83.7	16	118.4	80.0
30-39	8	122.3	82.9	8	120.1	79.3	18	131.6	89.8	20	126.6	83.6
40-49	4	130.8	83.8	5	127.6	86.0	19	137.2	92.2	14	136.0	89.3
50-59	2	129.0	85.0	3	139.7	95.0	13	132.3	88.3	12	147.4	95.4
≥ 60	8	148.6	89.8	5	142.6	89.4	10	164.8	96.4	8	144.4	86.3
Total	32	128.59	83.47	30	126.87	83.13	68	137.37	90.44	70	132.20	86.2

cular phenomenon of elevated blood pressure with increasing age could be an effect of modernisation, which is found elsewhere also (Dressler and Bindon, 1997). Further, considering the anthropometric traits and ratios that measure adiposity and obesity, central and peripheral, it is clear that age effect on obesity exists in study population. Similar results have also been found in another recent study among the Bengalees of Kolkata (Ghosh et al., 2001).

Except in DBP for the males, age effect on blood pressures is found to be significant. When the anthropometric variables and other obesity measures such as fat mass, sub scapular and supra iliac skinfolds are considered, they are found to be predictors of SBP in males and for the females the variables predicting the same are weight, FM and BMI. While PBF is the only predictor of DBP for males, weight, PBF and FM are best predictors for DBP in females. Irrespective of sex, the study also reveals that the effect of obesity, measured in terms of BMI value, on both SBP and DBP is discernible among the Bhutias, which is found among the Sherpas of Nepal (Smith, 1999), as well.

It is to be noted that the rates of blood pressure change with age vary in socioculturally distinguishable populations/sub populations owing to myriad factors. It has also been demonstrated that populations exposed to cultural transitions and populations in developing countries tend to have higher blood pressure than populations with traditional cultures (Aubert et al., 1998). The age related changes in body fat, blood pressures and the relationship between obesity and blood pressures are characteristic features of modernizing populations as documented in the earlier studies also. A study among the native English men carried out recently, which shows increase in BP with increasing age (Bose, 2002). Another study among the semi-urban population of Andhra pradesh, India, found that sedentary lifestyle and higher socioeconomic status are responsible for elevated BP level (Reddy et al., 2002).

Many developing countries including India are experiencing rapid socioeconomic changes leading to behaviour shift in the domain of lifestyles. Although it is generally believed that the major urban centers of India are places where people are exposed to modernizing forces, fact remains that in situ modernization is taking place in many moderate and small urban centers located in diverse ecological settings in the country.

Sikkimese Bhutias, as this study reveals, are found to experience increase in blood pressures and obesity as they age. Again, it is evident that obesity affects blood pressure in the study population. Certainly, there are many factors which contribute in age-related changes in blood pressure and obesity in the population in question. James and Baker (1995) suggest that genetic and behavioural variation influence blood pressure change with age. Further, Henry and Cassel (1969) suggested that in a traditional society accumulation of years bringforth fewer social changes and less disruption of beliefs and values that may lead to less stressful life situation and little or no rise of blood pressure with age. Our findings among the Bhutias of Gangtok and its neighbourhood are not indicative of Henry and Cassel's (1969) observations. As a matter of fact there are enough evidence that Bhutias of Gangtok are exposed to socioeconomic changes over more than two decades. As a consequence of such changes there have been behavioural and dietary changes pertaining to lifestyle domain. Our analyses (not shown here) indicate that urban Bhutias are leading a life that tends to minimize physical activity; encourages consumption of alcohol and salt in larger quantities; prefers exclusively non vegetarian diet enriched with saturated fat. Though genetic factors may have some contribution (which can not be captured in this study) it is plausible that these lifestyle factors influence elevation of blood pressure and having higher prevalence of hypertension as well as obesity in the study population, as age increases.

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KEYWORDS Blood pressure; obesity; anthropometry; Bhutias

ABSTRACT Blood pressure and obesity are two major risk factors for cardiovascular disease. Many population based studies have already been conducted in many countries on epidemiological profile of hypertension and obesity. Such studies among the Himalayan populations in general and the Eastern Himalayan ones in particular are extremely few in numbers. Age related changes in blood pressures and obesity have been observed in many modernizing and transitional communities. It has often been found that such changes lead to adverse cardiovascular health outcomes. In view of the above, the present paper is aimed to examine the age related changes in blood pressures and prevalence of obesity in one hand, and the influence of obesity on blood pressures, if any, on the other, among the Bhutias, a tribal community in Sikkim. Data on blood pressures and anthropometrics were collected from 200 randomly chosen Bhutia study participants of both sexes inhabiting Gangtok, the capital town of the Sikkim State, and its neighbourhood, following standard techniques. Further, information on dietary habits, activity pattern and other life style related behavioural traits were gathered from the study participants using appropriate questionnaires. The results of the study show that irrespective of sex, both Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) increase with increasing age; a reversal of this trend is noticed, however, after attaining 60 years of age. Age differences in SBP and DBP are statistically significant in both sexes. Obesity as measured in terms of body mass index (BMI) value as well as other relevant measures such as Fat Mass (FM), Percent body Fat (PBF), Conicity index (CI) show age related changes. It is also observed that obesity is influencing blood pressures, both systolic and diastolic, in the study population.

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