Antrocom Online Journal of Anthropology vol. 17. n. 2 (2021) 261-269 – ISSN 1973 – 2880

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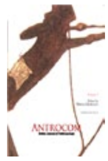

Skinfolds, Behavioural and Socio-economic Risk Factors in Hypertension among the Hill and Valley Tangkhuls of Manipur

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KEYWORDS

Hypertension, prevalence, risk factors, Tangkhuls.

ABSTRACT

Hypertension is a medical term used when blood pressure is higher than the normal level. It is a major cause of mortality in underdeveloped, developing, and developed countries causing a significant public health problem. This study investigates hypertension-associated risk factors among the Tangkhuls in Manipur. The cross-sectional study was conducted among randomly selected 590 Tangkhul males (350 of hill and 240 of valley). The ages of the participants ranged from 20-80 years. A pre-tested schedule was used, which consisted of height, weight, 6 (six) skinfold measurements, blood pressure, behavioural and socio-economic parameters. Anthropometric and blood pressure were measured following standardized procedures. BMI (Body Mass Index) in kg/m2 was computed, and fat mass was derived from six skinfold measurements. Statistical methods viz., t-test, Chi-square test, and multivariate logistic regression were applied. Results indicated that the valley population had higher mean values (P<0.05) in weight, skinfold measurements, indices, and blood pressure and a higher prevalence of hypertension (P<0.05) compared with the hill. Among the skinfolds, abdominal skinfolds showed the highest mean values. Multivariate logistic regression analysis indicated that hypertension was independently associated in both hill and valley Tangkhuls with age ≥50 (OR =4.34 and 2.12), smoking (OR =4.05 and 6.01), and risk FMI (OR =7.50 and 17.88), respectively. Age ≥50 years, smoking, physical inactivity, and risk FMI were independent risk factors associated with hypertension.

Introduction

Hypertension is the lateral pressure exerted by blood on the vessel walls while flowing through it (Chatterjee, 1992). High blood pressure, also called hypertension, is characterized as a systolic blood pressure of 140 mm/Hg or higher and a diastolic blood pressure of 90 mm/ Hg or higher (WHO, 2015). According to Spence (2017) every year, hypertension-related complications accounts for 9.4 million deaths worldwide. High blood pressure is one of the risk factors for cardiovascular disease in developed countries, with an estimated 7.1 million deaths, mainly among middle-aged and elderly people (WHO, 2002). Other studies from India have reported that the incidence of hypertension is higher in the urban than in the rural areas (Kumar *et al*., 2013). The rising prevalence of hypertension, as frequently reported, could be due to an unhealthy diet, harmful use of alcohol, lack of physical activity, excess weight, and exposure to persistent stress (WHO, 2009). Research has indicated that fat cells, particularly abdominal fat cells, are biologically active, and visceral fat cells correlate with the fat inside the abdomen. Fat is an endocrine gland producing hormones and other substances that can profoundly affect health. It pumps out cytokines that can be a risk for cardiovascular diseases. This chemical is deleterious to sensitivity to insulin and blood pressure (Harvard, 2019). Studies suggest that urban residents have larger physical dimensions than rural residents, and that urban and rural differences exist among adults in several nations (Sahoo *et al*., 2011). The present study examines the

Please cite this article as: Zimik U. and Sorojini Devi H. , Skinfolds, Behavioural and Socio-economic Risk Factors in Hypertension among the Hill and Valley Tangkhuls of Manipur. *Antrocom J. of Anthropology 17-2 (2021) pp. 261-269.*

hypertension associated risk factors among the hill and valley Tangkhul males of Manipur.

Problem statement

Hypertension has become a global burden. The prevalence of hypertension varies across regions and in different rural-urban settings. The number of adult hypertension increases in the low and middle-income countries, not only in the high-income groups, due to modernization and technological development, which impacted the lifestyle of human beings worldwide. People living in varying ecological settings with different lifestyles possess different amounts of body fats, thereby causing hypertension. Therefore, it is necessary to explore the various underlying risk factors that cause hypertension and its prevalence among the populations living in different habitats. The present study will explore the various risk factors associated with hypertension, and this will help in minimising the problem.

Material and Methods

The Tangkhuls are one of the recognized scheduled tribes of Manipur. They mostly inhabit the Ukhrul, which is recognized as the hill area of Manipur. Many of them migrated and settled in the urban valley districts of Imphal east and west. A cross-sectional data of 590 Tangkhul adult males (350 of Ukhrul and 240 of Imphal east and west) was randomly collected from 9 villages in Ukhrul district and 5 villages in Imphal east and west district, Manipur. The age of the subjects ranges from 20-80 years. The sample size was estimated using the formula ($N=Z^2PQ/d^2$) by Lemeshow and Lwanga (1991). Where Z is the constant, standard normal deviation at 95% confidence intervals (CI). The assumed prevalence (P) of hypertension for the sample size estimation was considered 28.2% in the hill population and 33% in the valley population of the state (National Family Health Survey, 2019-20). Q=1-P and d, the error of the estimate were considered as ±5. The minimum total sample size (N) required for this study was 546 participants. A pre-tested schedule was used, including anthropometric measurements, blood pressure, and behavioural and socio-economic parameters. The institutional ethics committee has reviewed and accepted the methods. Height, body weight, triceps, sub-scapular, supra-illiac, abdominal, thigh, and calf skinfolds were measured following standard techniques of Singh and Basin (2004). Body Mass Index (BMI) = weight (in kg)/ height (in metre^2) was computed of each subject and categorized according to WHO (2003). The Z score formula of Drinkwater and Ross (1980) was used to determine fat mass using six skinfold measurements. FMI was derived using VanItallie *et al*. (1990) and categorized applying ROC (Receiver operating characteristics curve analysis) and classified.

Blood pressure was measured using a standard mercury sphygmomanometer and a stethoscope (Beevers *et al*., 2001), and a mean value of three different readings was considered. Systolic blood pressure (SBP) was recorded as the first korotkoff sound, and diastolic blood pressure (DBP) was recorded when korotkoff sound disappeared (Sherwood 2008). The WHO guidelines for hypertension management were used to classify systolic and diastolic blood pressures (WHO, 1999). The Joint National Committee VII (JNC VII) criteria for hypertension diagnosis, which included readings of systolic blood pressure (SBP) less than 140 mm/Hg or diastolic blood pressure (DBP) less than 90 mm/Hg was followed (Chobanian, 2003). Physical activity pattern was classified as physically active with moderate and vigorous-intensity- activity achieving at least 600 MET minutes and physically inactive who did not meet the criteria mentioned above (WHO 2005; Bull *et al*., 2009). While assessing the anxiety disorder, the GAD-7 (Generalized Anxiety Disorder) questionnaire was adopted. The questionnaire includes seven (7) self-rated questions, and in the response categories, scores were assigned as '0' not at all, '1' several days, '2' more than half the days, and '3' nearly every day. By using the scoring (0-21), the anxiety level was classified as minimal (0-4), mild (5-9), moderate (10-14), and severe anxiety (15-21) (Spitzer *et al*., 1999). In the present study, individuals who smoke any tobacco product regularly were considered smokers. While according to National Institute on Alcohol Abused and Alcoholism (NIAAA) alcoholic is defined as those individuals who consumed alcohol daily, i.e., for men, more than four (4) drinks on any day or more than fourteen (14) drinks per week (NIAAA, 2010). Thus based on these criteria, smokers and alcoholic individuals were considered in the study. Household income was also collected and converted into per-capita monthly income. Hence classified as a high-income group (HIG), middle-income group (MIG), and low-income group (LIG) (Khongsdier, 2002).

Data Analysis

Statistical constants such as mean, standard deviation (SD) were computed. t-test, Chi-square, and multivariate logistic regression were applied and analyzed using SPSS version 20. In the multivariate logistic regression analysis, odds ratios (OR) at 95% confidence intervals (CI) were estimated by considering hypertension as a dependent variable, while the independent variables were adjusted with each other for the possible confounding factors.

Results

Table 1 indicates that the hill individuals are slightly taller as compared to the valley population. However, the latter group is found having larger means in all skinfold thicknesses, body weight and BMI than the hill counterparts. The valley participants also display higher mean fat mass (8.67±0.14 kg), SBP (132.37±0.97 mm/Hg), and DBP (86.71±0.73 mm/Hg) as compared to the hill counterparts. Statistically, significant differences have been observed in all variables in between the two comparing groups except in DBP (P < 0.05).

Table 1 - Descriptive statistics and t values of anthropometric, derived variables and blood pressure

Sl. No	Variables	Hill (n=350)		Valley (n=240)		t value
		Mean± SEx̄	SD	Mean± SEx̄	SD	
1.	Height	163.92±0.28	5.17	163.01±0.32	4.97	2.14*
2.	Body weight	57.39±0.43	8.05	58.86±0.59	9.17	2.01*
3.	Triceps skinfold	9.19±0.14	2.69	10.36±0.18	2.85	5.01**
4.	Sub-scapular skinfold	12.43±0.16	3.15	13.75±0.24	3.82	4.42**
5.	Supra iliac skinfold	13.94±0.24	4.55	15.06±0.30	4.68	2.90**
6.	Abdominal skinfold	16.38±0.26	4.99	18.29±0.35	5.53	4.28**
7.	Thigh skinfold	13.75±0.20	3.77	14.62±0.23	3.61	2.82**
8.	Calf skinfold	12.02±0.18	3.52	13.02±0.22	3.50	3.39**
9.	Body mass index	22.06 ± 0.37	2.90	23.90±0.49	3.14	2.95*
10.	Fat mass	7.98±0.10	1.93	8.67±0.14	2.09	4.01***
11.	Systolic blood pressure	129.22±0.69	13.06	132.37±0.97	15.02	2.63**
12.	Diastolic blood pressure	85.23±0.48	8.99	86.71±0.73	11.34	1.69

Note: Height in cm, body weight and fat mass in kg, Systolic and diastolic blood pressure in mm/Hg, skinfold in mm.[1]

Table 2 displays the distribution of individuals having hypertension in different independent categorical variables of age, behavioural, and income. The prevalence of hypertension was significantly higher in the valley population (36.7%) as compared to the hill (25.7%) and the difference was significant (χ^2 = 8.10, P< 0.01). Age ≥50 was significantly associated with higher hypertension than aged <50 years, moreover, in the intra age group comparisons, the difference was found significant in hypertension in between the hill and valley (P < 0.05). Alcoholic individuals had significantly higher hypertension as compared to non-alcoholic in both hill (χ^2 = 12.92, P< 0.001) and valley (χ^2 = 10.43, P< 0.01) Significant difference was observed in hypertension between the non-alcohol users of hill and valley (χ^2 = 6.91, P< 0.01). Hypertension was significantly higher among the inactive group than the active individuals in the hill (χ^2 = 16.72, P< 0.001), and valley (χ^2 = 15.22, P< 0.001). Smoking was significantly associated with hypertension as compared to non-smoking in the hill (χ^2 = 36.29, P< 0.001), and also in the valley (χ^2 = 24.95, P< 0.001). Significantly higher hypertension was further observed in both smoking and non-smoking group of the valley as compared to the hill regions (P < 0.05). Anxiety was significantly associated with hypertension in both hill (χ^2 = 16.14, P< 0.001), and valley (χ^2 = 16.87, P< 0.001) as compared to without anxiety. Individuals having higher BMI had higher hypertension in the hill (χ^2 = 53.66, P< 0.001), as well as in the valley (χ^2 = 29.36, P< 0.001) as compared to normal, and intra categorical comparison indicated that among the normal BMI group hypertension was higher in the valley than the hill (P< 0.05). Risk FMI individuals had higher hypertension than the normal FMI individuals in both hill (χ^2 = 78.54, P< 0.001), and valley (χ^2 = 55.22, P< 0.01). Significant variation was observed in the comparison of normal FMI individuals of hill and valley in hypertension (P < 0.05). Statistically, no significant differences were found among the individuals of alcoholic, active and inactive, anxiety, income groups, BMI categories, and risk FMI of hill and valley. Therefore, individuals with ≥50 years, alcoholic, inactive, smoking, anxiety, higher BMI, and risk FMI group had hypertension as compared to their respective categorical counterparts in the hill as well as in the valley (Table 2).

Table 2 - Prevalence of hypertension in different independent categorical variables

Sl. No.	Categorical variables		Hill		Valley		χ^2–value
			F	Prevalence %	F	Prevalence %	
1.	Sex	Male	350	90 (25.7)	240	88 (36.7)	8.10*
2.	Age	Age<50	189	24 (12.6)	128	32 (25)	7.94*
		Age≥50	161	66 (40.9)	112	56 (50.0)	2.16*
		χ^2	36.43***		16.07***		
3.	Consumption of alcohol	Alcoholic	25	14 (56.0)	20	14 (70.0)	0.92
		Non-alcoholic	325	76 (23.3)	220	74 (33.6)	6.91**
		χ^2	12.92***		10.43**		
4.	Physical activity	Active	193	33 (17.0)	102	23 (22.5)	1.28
		Inactive	157	57 (36.3)	138	65 (47.1)	3.52
		χ^2	16.72***		15.22***		
5.	Use of smoke	Smoking	88	44 (50.0)	49	33 (67.3)	3.84*
		Non-smoking	262	46 (17.5)	191	55 (28.7)	8.05**
		χ^2	36.29***		24.95***		
6.	Anxiety	With anxiety	49	24 (48.9)	44	28 (63.6)	2.20
		Without anxiety	301	66 (21.9)	196	60 (30.6)	4.73*
		χ^2	16.14***		16.87***		
7.	Income	Low income	176	39 (22.16)	110	35 (31.82)	3.29
		Middle income	95	27 (28.42)	61	23 (37.70)	1.47
		High income	79	24 (30.37)	69	30 (43.48)	2.72
		χ^2	2.42		2.52		
8.	BMI group	Underweight	75	4 (5.33)	39	5 (12.82)	1.97
		Normal	178	37 (26.24)	124	40 (32,26)	5.06*
		Overweight	88	42 (47.73)	63	31 (49.21)	0.03
		Obese	9	7 (77.78)	14	12 (85.71)	0.24
		χ^2	53.66***		29.36***		

9.	FMI	Normal	270	39(14.4)	176	40(22.7)	5.01*
		At risk	80	51(63.7)	64	48(75.0)	2.09
		$\chi2$	78.54***		55.22***		

*Note: *p<0.05, **p<0.01, ***p<0.001.*[2]

The odds ratio of multivariate logistic regression analysis for risk factors of hypertension (Table 3) indicated that age ≥50 years had a higher risk of having hypertension than <50 years individuals in both hill (OR=4.34); (CI=2.21-8.52, *P*<0.01) and valley (OR=2.12); (CI=0.99-4.51, *P*<0.05). Inactive individuals had a significantly higher risk of hypertension than the active group in the case of the valley (OR=2.84); (CI=1.33-6.06, *P*<0.01). Further, smoking also had a higher risk of hypertensive as compared to non-smoking in both hills (OR=4.05); (CI=2.02-8.01, P<0.001) and valley populations (OR=6.01); (CI=2.51-14.37), *P*<0.001). Risk FMI revealed a significant risk of causing hypertension as compared to normal FMI individuals in both settings (OR=7.50); (CI=2.91-19.36, *P*<0.001) and (OR=17.88); (CI=5.19-61.59, *P*<0.001). However, consumption of alcohol, anxiety, income, and BMI of the two populations indicated a lower risk of hypertension. Statistically, no significant differences could be observed between the alcoholic and non-alcoholic, anxiety and non-anxiety, and low-middle and high-income individuals of hill and valley districts.

Table 3 - The odds ratio of Multivariate logistic regression analysis for risk factors of hypertension

Sl. No.	Variables	Subgroups	Hill			Valley		
			EX (B)	CI (95%)	Sig.	EX (B)	CI (95%)	Sig.
1.	Age	≥50years	4.34	(2.21-8.52)	0.006	2.12	(0.99-4.51)	0.04
		<50 years	0b			0b		
2.	Consumption of alcohol	Alcoholic	1.68	(0.54-5.22)	0.37	2.53	(0.78-8.21)	0.12
		Non-alcoholic	0b			0b		
3.	Physical activity	Inactive	1.72	(0.87-3.40)	0.11	2.84	(1.33-6.06)	0.007
		Active	0b			0b		
4.	Use of smoke	Smokers	4.05	(2.02-8.01)	0.000	6.01	(2.51-14.37)	0.000
		Non-smoker	0b			0b		
5.	Anxiety	Having anxiety	1.29	(0.57-2.92)	0.54	1.87	(0.75-4.68)	0.18
		Without anxiety	0b			0b		
6.	Income	High income	0.82	(0.39-1.72)	0.60	1.85	(0.85-4.02)	0.12
		Low & middle	0b			0b		
7.	BMI	Normal	2.30	(0.28-19.13)	0.44	1.07	(0.14-8.24)	0.95
		Overweight	2.62	(0.38-18.14)	0.33	2.35	(0.24-23.01)	0.46
		Obese	9.47	(0.89-101.01)	0.06	4.92	(0.76-31.75)	0.09
		Underweight	0b			0b		
8.	FMI group	At risk	7.5	(2.91-19.36)	0.000	17.88	(5.19-61.59)	0.000
		Normal	0b			0b		

Note: Hypertension 'No' = reference group, Hypertension = dependent category, 0^b = baseline, and CI= Confidence Interval.[3]

Discussion

The present paper highlighted that the valley population had higher mean body weight, BMI, skinfold measurements, fat mass, SBP, DBP with significant differences in all variables except DBP.

Others reported higher systolic and diastolic blood pressure in urban areas (Gupta 2004; Midha *et al*., 2013). The present valley population sample was collected from the urban regions of Imphal east and west districts. Studies conducted among the urban and rural communities of India by Mitra *et al*. (2017) and Prabhakaran *et al*. (2017) also indicated that urban individuals have a higher blood pressure than the rural. Other studies of Palanivel et al. (2015) and Midha *et al*. (2009) also found higher hypertension in the urban of Utter Pradesh (32.8 %) and in the rural area (27.1%) of Tamil Nadu. A study of the urban-rural population in Crete (Mamalakis *et al*., 2000) found higher skinfolds among the urban inhabitants (Table1).

The present study revealed that hypertension was higher in the valley (36.6%) as compared to hill Tangkhuls (25.7%). Higher age ≥50 years of individuals had a significantly higher rate of hypertension as compared to <50 years in both populations. Such a similar finding was also reported by various researchers (Borah et al., 2012; Oliveros *et al*., 2020). Hypertension was also more associated with regular consumption of alcohol in the hill (56.0%) and also in the valley (70.0%) than in the non-alcoholic individuals. This conforms to other studies of Skliros *et al*. (2012) and Manimunda *et al*. (2011). Individuals who didn't engage in physical activity had more hypertension than the active group in both settings, and this finding is supported by other studies (Diaz *et al*., 2013; Pescatello *et al*., 2004).

It was also found that smokers of the hill (50.0%) and valley (67.30%) had a higher prevalence of hypertension as compared with non-smokers. In different studies conducted by Tuomilehto *et al*. (1982) and Najem *et al*. (2006), smoking is considered an important determinant of hypertension. Anxiety was another factor, and individuals having anxiety problems had higher rates of hypertension in both populations as compared to normal. Antonov *et al*. (2016), in their study on hypertension, reported that anxiety and hypertension were highly associated. Among the income groups, the high-income group showed more rates of hypertension than the middle and low-income groups in the hill (30.37%) and also in the valley (43.48%) in the present study. Busingye *et al*. (2014) reported a positive association of income and hypertension, in particular to south East Asia. A higher prevalence of hypertension was also found among the obese BMI individuals in both populations as compared to less BMI individuals. A similar observation was also confirmed by Simon *et al*. (2017) and Raghavendra *et al*. (2017). They found positive associations between BMI and blood pressure in the Indian populations. Further, hypertension was found higher among the risk FMI groups as compared to normal FMI in both settings. Ittermann *et al*. (2019) reported a positive association between fat mass and hypertension. Statistically, no significant differences could be observed between the alcoholic and non-alcoholic, anxiety and non-anxiety, low-middle and high income, and low and high BMI individuals of hill and valley districts (Table 2).

Multivariate logistic regression analysis indicated that age ≥50 years, smoking physical inactivity, and risk FMI were independent factors for causing hypertension in both settings, which was also reported by various researchers (Ibrahim and Damasceno, 2012; Singh *et al*., 1997). Physical inactivity was independently associated with hypertension only in the valley population.

Conclusion

The present study has led to the conclusion that the valley population showed a higher prevalence of hypertension with higher mean body weight, BMI, skinfold measurements, and fat mass than the hill population. Abdominal fat mostly contributed to the larger fat mass in both cases. Age ≥50 years, smoking, physical inactivity, and risk FMI were significant independent risk factors of hypertension. The present study has shown that hypertension is a multifactorial problem, and among the various factors, increasing age, smoking, physical inactivity, and risk FMI seemed to have more impact on it in both the populations; however, inactive physical behaviour was not a significant independent risk factor for hypertension in the hill areas.

Ethical Issues *- The authors have declared that there were no ethical issues in this present study. Participants were informed and explained about the purpose of the study and consent was obtained from each subject under the study.*

Ethical approval *- Authors hereby declare that methods have been reviewed, examined, and approved by the institutional ethics committee.*

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