HYPERTENSION AND ITS RISK FACTORS AMONG THE SHABAR TRIBE: A COMMUNITY-BASED CROSS-SECTIONAL STUDY IN ODISHA, INDIA

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ABSTRACT

In developing countries like India, the increasing trend of hypertension is one of the significant public health problems. In recent times, the Indian tribes are also experiencing a similar trend, which is rarely documented and less emphasized.

The objectives of the present study are to assess the prevalence of hypertension among the Shabar tribe and to understand the association with some selected biological, behavioural and socio-economic factors. The data were collected from 816 individuals (389 males and 427 females, aged 20 to 60 years) in the Khurda and Cuttack districts of Odisha. Conventional methodologies were used to collect the cross-sectional data of blood pressure and other parameters.

It was found that 9.2% of the respondents suffered from hypertension (SBP ≥ 140 and DBP ≥ 90 mmHg), and 12.3% had high normal blood pressure (SBP ≥ 130 and DBP ≥ 85 mmHg). The unadjusted odd ratios showed that the proportion of hypertension increased significantly as age increased. High normal blood pressure and hypertension were significantly higher in females and people who belonged to the high-income group and consumed more fat. The Shabar people who suffered from overweight and obesity, took extra salt during meals, smokers, smokeless tobacco chewers, and alcoholics were more vulnerable to hypertension and high blood pressure. Interestingly, the participants who perceived their fatty bodies and engaged in light activities were more likely to be hypertensive than their counterparts.

Shabar people residing in Odisha state have shown increasing frequencies of hypertension with advancing age. A significant co-occurrence of higher body

mass index (BMI), fewer physical activities, increased fat consumption, and changing habits relating behaviour to hypertension may be designated as potential risk factors.

INTRODUCTION

It has been established that hypertension is one of the critical risk factors for different forms of non-communicable diseases, mortality, and morbidity [1]. A recent national-level survey on blood pressure among Indian adults concluded that almost one in every three Indian adults was affected by hypertension [2]. Previously it was assumed that hypertension was mainly confined to urban people and the economically elite class. Still, recent investigations have shown a similar prevalence among the rural and even tribal populations throughout India [3].

It has been noted that an increasing trend has been found in the prevalence of hypertension in adult tribal populations across three decades (1981–2011) [4]. Besides, the epidemic of high blood pressure involves various sections of people, including the low socio-economic strata of the society [5]. Many risk factors, like overweight and obesity, modern dietary habits with high saturated fat, excessive salt intake, smoking, alcohol, smokeless tobacco chewing habits, sedentary lifestyle, etc. are associated with the high prevalence of hypertension across different populations [2, 3, 6–8]. A recent study also showed that people's body image might be a good predictor of hypertension [9].

Several studies have been conducted on the recent trends of hypertension among the Indian tribes [3]. Yet, the majority have considered whole tribes in a specific geographical region or part of the country [10–11]. A single tribal group distributed across different settlements has rarely been documented and less emphasized, although this is required for community-specific intervention amid the adverse health conditions keeping in mind the community-specific cultural perception and practice. Therefore, the objectives of the present study were to assess the prevalence of hypertension among the Shabar tribe and to understand its association with some selected biological, behavioural and socio-economic factors.

MATERIALS AND METHODS

The study area was situated in the Khurda and Cuttack districts of Odisha state in India because of the largest concentration of Shabar settlements there. For the present study, three urban hamlets of Bhubaneswar City, three rural villages of the Jatani block area, and three mono-ethnic forest villages located inside the Chandaka–Domapara Elephant Sanctuary, also known as the Asian Elephant Research Centre, were purposefully selected.

The present study's total sample comprised 816 unrelated individuals aged 20–60 years (389 males and 427 females) from three locations.

Statistical sampling was not done because of obvious operational difficulties in the field, specifically due to the unavailability and unwillingness of some participants. More than 75% of the total adult population aged 20–60 years was included in this study; the study was ethically approved by the Indian Statistical Institute, Kolkata. Written informed consent was obtained from all adult individuals before the actual commencement of the study.

Pre-tested household schedules were used to collect socio-economic data from all the nine studied settlements. Schedules were composed of information like age, sex, income, expenditure, household assets, etc. However, the adults' age was obtained through birth certificates or horoscopes (about 5% individuals) or relying on specific festivals or some meaningful local events, natural calamities, etc., and was cross-checked with elderly individuals to reduce the chance of error of reporting.

The standard techniques were used to obtain anthropometric measurements [12]. A portable weighing machine (Edryl India) and anthropometer (GPM, Swiss made) were used for the measurements of weight (kg) and height (cm). Height measurement was recorded to the nearest 0.1 cm, and weight was recorded to the nearest 0.5 kg. Technical errors of measurements were computed and found to be within acceptable limits [13]. No ill individuals and lactating and/or pregnant women were included in the sample. The first author collected all the anthropometric measurements single-handedly.

A Salter pan type balance was used to measure one-day dietary consumption of raw food items. Besides, the approximate amount of outside food items during that day was also recorded. For this study, we avoided taking food data during the day of special cuisine.

Information on the frequency of smoking, non-smoking tobacco, and alcohol was collected through structured individual schedules. Individual body physique perception and activities status were also collected through a structured interview.

A mercury sphygmomanometer (AccuSure, India) was used to measure blood pressure through conventional methodology; two measurements were taken after 15 minutes of initial rest, and average measures were considered for the present study [14].

For understanding the nutritional status, the height and weight were computed into the body mass index (BMI), which was classified as under-nutrition < 18.50 kg/m^2, normal 18.50–22.99, and overweight and obese ≥ 23.00 kg/m^2 [15]. The nutritive values were estimated from the food composition tables prepared by the Indian Council of Medical Research (ICMR) [16]. The basis for estimation of consumption unit was the calorie need of an individual. The consumption unit (cu) per household was estimated by the method suggested by Mandal et al. [17]. Only per capita consumption of fat was considered in the present study.

Considering systolic and diastolic blood pressure, the levels of hypertension were categorized as normal (SBP < 120 and DBP < 80 mmHg); high normal blood pressure (SBP 130–139 and/or DBP 85–89 mmHg); hypertension (grade I & II) (SBP ≥ 140 and DBP ≥ 90 mmHg) [18].

The median value (50th percentile) of per capita monthly income and per capita fat consumption per day was used to categorise the variables.

Levels of hypertension were cross-tabled with age groups and BMI categories to compare the association. The chi-square (χ^2) test for trend was used to study the magnitude of the association between hypertension and age-groups and BMI categories. A binary variable was computed for hypertension and a value labelled as '1' for hypertension and the high normal group using this binary variable. Both unadjusted and adjusted odds ratios were computed using bivariate and multivariate logistic regressions. The critical level of significance was two-tailed $p < 0.05$. The SPSS 16.0 version was used to analyse the data.

RESULTS

Table 1 shows the background characteristics of the study sample. It was observed that the majority of the individuals belonged to the age group of 20–40 years (63.4%). Both sexes' representation was nearly equal, but more individuals were from the urban settlements (43.3%) than the rural and forest counterparts. The per capita monthly family income (Indian rupees) was also equally distributed between the two groups (below vs above median values), and consumption of fat also followed similar trends.

Table 1. Characteristics of study participants

Characteristics	No.	%
Age groups (years)		
20–40	517	63.4
41–60	299	36.6
Sex		
Male	389	47.7
Female	427	52.3
Settlement		
Urban	353	43.3
Rural	287	35.2
Forest	176	21.6
Per capita monthly income group (Rs)		
Below median	415	50.9
Above median	401	49.1
Per capita per day fat consumption unit group (gm)		
Below median	433	53.1
Above median	383	46.9
Nutritional status		
Undernutrition (BMI < 18.50 kg/m^2)	421	51.6
Normal (18.50–22.99 kg/m^2)	349	42.8
Overweight/Obese (> 23.0 kg/m^2)	46	5.6
Amount of extra salt intake (teaspoon/person/day)		
One (approx. 6 g)	477	58.5
Two and more (12 g and above)	339	41.5
Smoking status		
Smoker	521	63.8
Non-smoker	295	36.2
Smokeless tobacco consumption status		
No	108	13.2
Yes	708	86.8
Alcohol consumption status		
No	530	65.0
Yes	286	35.0
Perception of body physique		
Fat	111	13.6
Moderate	301	36.9
Thin	404	49.5
Perception of daily activity pattern		
Heavy	204	25.0
Moderate	490	60.0
Light	122	15.0

Out of the total studied sample, 5.6% of the individuals were overweight and obese compared to 51.6% who were underweight. It was interesting to note that a sizable number of individuals consumed extra salt (41.5%) and belonged among smokers (63.8%), consumers of smokeless tobacco (86.8%), and alcoholics (35.0%). Regarding the perceived notion of the body physique and daily activity level, the majority of the respondents replied that they have a thin body (49.5%) are and engaged in moderate activity (60.0%). However, 13.6% of the individuals said they felt to be fatty as per their perception, whereas 15.0% believed to be engaged in light activity presently.

Table 2 depicts the percentage of distribution of hypertension in age groups and BMI categories (high normal blood pressure and hypertension). It was found that 9.2% of the respondents suffered from hypertension (SBP $\geq$ 140 and DBP $\geq$ 90 mmHg), and 12.3% suffered from high normal blood pressure (SBP $\geq$ 130 and DBP $\geq$ 85 mmHg). Age group-wise, the prevalence was higher in the older age group (41–60 years), and the difference was statistically significant (p = 0.000). On the other hand, hypertension and high normal blood pressure were higher among those individuals who suffered from overweight or obesity. The overall distribution between nutritional status and hypertension status was statistically significant (p = 0.003).

Table 2. Prevalence of hypertension by age groups and BMI categories

Variables	Percentage			Total
	Normal	High normal blood pressure	Hyper-tension	
Age groups (years)				
20–40	86.3	6.4	7.4	517
41–60	65.2	22.4	12.4	299
χ^2 = 55.586, df = 2, p = 0.000				
Nutritional status				
Undernutrition (BMI<18.50 kg/m²)	81.2	10.2	8.8	421
Normal (18.50–22.99 kg/m²)	78.2	12.6	9.2	359
Overweight/obese ($\geq$ 23.0 kg/m²)	56.5	28.3	15.2	46
χ^2 = 16.321, df = 4, p = 0.003				
Total	78.6	12.3	9.2	816

Logistic regression was used to study the association of various risk factors with hypertension. Hypertension is considered here as hypertension as well as high normal blood pressure group together. Table 3 describes unadjusted and adjusted odds ratios for various risk factors of hypertension. The unadjusted

odd ratio shows that the proportion of hypertension significantly increased as age increased. Hypertension was higher among the adult females, in the high monthly per capita family income group and those whose fat consumption was high. The study participants who were overweight and obese, took extra salt (more than 12 g and above) during meals; smokers, tobacco chewers, and alcoholics were more prone to hypertension and high blood pressure.

Interestingly, those individuals who perceived that they had fatty bodies and engaged in light activities were more vulnerable to hypertension. However, after adjusting of age group, sex, and settlement, the multivariate logistic regression model for all risk factors significant in bivariate logistic regressions, many risk factors were no longer statistically significant. Nevertheless, even after controlling for all other risk factors, BMI group, total salt consumption, smokeless tobacco consumption, and light physical activity level perception showed significant associations with hypertension (Table 3).

Table 3. Prevalence of hypertension[a] and odd ratios of risk factors

Characteristics	Hyper-tension[a] (%)	n	Unadjusted OR (95% CI)	Adjusted OR[#] (95% CI)
Age groups (years)				
20–40	13.7	71	1.00	–
41–60	34.8	104	3.350 (2.372–4.733)**	
Sex				
Male	15.7	61	1.00	–
Female	26.7	114	1.958 (1.384–2.7720**	
Settlement				
Urban	19.8	70	1.00	
Rural	24.4	70	1.304 (0.896–1.899)	–
Forest	19,9	35	1.004 (0.638–1.579)	
Per capita monthly income group (Rs)				
Below median	17.3	72	1.00	1.00
Above median	25.7	103	1.647 (1.173–2.310)**	1.261 (0.867–1.836)
Per capita per day fat consumption unit group (gm)				
Below median	18.0	78	1.00	1.00
Above median	25.3	97	1.544 (1.103–2.161)*	1.321 (0.913–1.910)

Characteristics	Hyper-tension[a] (%)	n	Unadjusted OR (95% CI)	Adjusted OR[#] (95% CI)
Nutritional status				
Undernutrition (BMI < 18.50 kg/m^2)	18.8	79	1.00	1.00
Normal (18.50 – 22.99 kg/m^2)	21.8	76	1.205 (0.847–1.715)	1.114 (0.761–1.631)
Overweight/Obese (≥ 23.0 kg/m^2)	43.5	20	3.330 (1.770–6.266)**	2.306 (1.144–4.694)*
Amount of extra salt intake (teaspoon/person/day)				
One (approx. 6 g)	17.8	85	1.00	1.00
Two and more (12 g and above)	26.5	90	1.667 (1.191–2.333)*	1.652 (1.162–2.347)**
Smoking status				
Non-smoker	19.0	99	1.00	1.00
Smoker	25.8	76	1.479 (1.052–2.079)*	1.149 (0.699–1.888)
Smokeless tobacco consumption status				
No	9.3	10	1.00	1.00
Yes	23.3	165	2.978 (1.518–5.840)*	2.662 (1.317–5.379)**
Alcohol consumption status				
No	18.9	100	1.00	1.00
Yes	26.2	75	1.528 (1.086–2.151)*	1.322 (0.804–2.171)
Perception of body physique				
Fat	30.6	34	1.817 (1.132–2.914)*	1.540 (0.925–2.564)
Moderate	20.6	62	1.067 (0.736–1.548)	0.962 (0.647–1.428)
Thin	19.6	79	1.00	1.00
Perceive notion of daily activity pattern				
Heavy	17.2	35	1.00	1.00
Moderate	20.8	102	1.269 (0.830–1.940)	1.400 (0.884–2.216)
Light	31.1	38	2.184 (1.288–3.705)**	1.987 (1.118–3.530)*

Significance level *p < 0.05; **p < 0.01
[#]Adjusted for age group. sex and settlement
[a] Considering individuals with high normal blood pressure and hypertension together

DISCUSSION

The present study was carried out in 816 adult Shabar tribal men and women aged 20–60 years from nine different settlements in Khurda and Cuttack districts of Odisha state in India. In general, there was a moderate prevalence of hypertension (combination of hypertension and high blood pressure groups) in the studied tribal men and women, i.e., more than 20%, and there were variations in the prevalence of hypertension across the settlements. The significant risk factors for hypertension in the present study were overnutrition, substance abuse, and a sedentary lifestyle (based on types of occupation). Similar findings were also reported in a comprehensive survey covering many Indian tribal populations [3]. Laxmaiah et al. [3] reported that 50–54.4% of the tribal people were hypertensive in Odisha state of India followed by Kerala state (36.7–45.0%). Earlier it was believed that hypertension and its adverse consequences in the form of various non-communicable diseases were mainly confined to non-tribal and urban people. Still, subsequent studies have broken those myths and have established that the prevalence of hypertension is high even in tribal populations, including the present study [7]. The overall prevalence of hypertension was 21.7% among the Jenu Kuruba tribal population in Mysore, which is slightly higher than in the present studied group [8].

The present study found that the prevalence of hypertensive trends was higher in the 40–60 years age group than in the group of 20–40 years; nonetheless, 13.8% of adults aged 20–40 years showed higher blood pressure trends. This may signify that high blood pressure is not confined only to the higher age group and that young adults are susceptible to a large extent. A similar finding by Reddy et al. from Karnataka also reported a 7.2% prevalence of hypertension among young adults aged 18–25 years [19]. The present study also highlights that females had comparatively higher prevalence of hypertension than males. A similar result was emphasized among the Jatapu tribal adults living in the Srikakulum district of Andhra Pradesh [5]. However, an opposite effect has been shown in all Indian blood pressure surveys, where 34.2% of males were hypertensive compared to 23.7% of females [2]. The higher prevalence of hypertension in females may be due to the higher percentage of rural females suffering from hypertension in the present study. The actual causes behind such findings would require further research of rural females through future studies. The adults in the present study showed a high prevalence of hypertension among those who, based on BMI categorization, suffered from overweight and obesity. Similar findings were noted among the adult Bengalese slum dwellers in Kolkata [20].

Conversely, a sizable number of adults in the undernutrition group also suffered from high blood pressure. Hypertension among a population with low BMI was also reported by Hu et al. [21] about the Chinese rural population. Tesfaye et al. [22] also reported similar findings from Ethiopia and Vietnam. Hypertension among low BMI cases could be due to increased oxidative stress [23] due to reduced bioavailability of nitric oxide resulting from chronic micro-nutrient deficiency.

It has been well formulated and historically known that salt intake has a deep-rooted connection with hypertension and high blood pressure [24]. We also observed that those who consume more extra salt during lunch and dinner are more likely to suffer from hypertension. Besides, after adjusting the age group, sex, and settlements, the final multivariate logistic models showed that smokeless tobacco chewing was one of the potential risk factors for increased high blood pressure and hypertension in the present study population. It was evident that the use smokeless tobacco had a considerable impact on poor blood pressure control due to its nicotine, sodium, and liquorice content [6]. In the logistic regression model, body image perception and perception regarding activities were positively related to hypertension and high blood pressure among the studied group where activity perception was detected as one of the best predictors of hypertension. Ford and Pickett also supported the present findings, and they have shown that hypertension and BMI were predictors of body image perception [9]. There are limitations in this study, as the study design itself is cross-sectional. Therefore, it was hard to conclude the study outcomes by using any causal relationship between hypertension and its risk factors, and the settlement-wise sample size was small. This study may have some sampling error due to the non-adoption of proper sampling strategies. Despite these limitations, the study had a well-represented population under investigation covering the total settlements-wise distribution of the Shabar tribe in Khurda and Cuttack districts of Odisha state in India. It may be an accurate representation of a micro-level anthropological study that highlighted the current trends of changing lifestyle and dietary behaviours suggested by Kshatriya [25].

CONCLUSION

The Shabar people residing in Odisha state have shown increasing frequencies of hypertension with advancing age and a significant co-occurrence of higher body mass index, fewer physical activities, and rapidly changing dietary and lifestyle behaviour.

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