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Original Research Article

Prevalence of Hypertension and Its Correlates among Adult Tribal Population (≥20 Years) of Maharashtra State, India

Meshram I. I.[1*], Laxmaiah A.[2], Mallikharjun Rao K.[1], Arlappa N.[1], Balkrishna N.[1], Ch. Gal Reddy[3], Ravindranath M.[4], Sharad Kumar[4], Brahmam G.N.V.[5]

[1]Scientist 'D', [2]Scientist 'F', [3]Scientist 'B', [4]Technical Officers, [5]Ex-Scientist 'F'
Division of Community Studies, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.

[*]Correspondence Email: indrapal.m@rediffmail.com

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ABSTRACT

Background: Hypertension is an important public health problem in developed and developing countries including India. Increasing prevalence of hypertension among rural/tribal population is a concern for India. Therefore the study was undertaken to estimate the prevalence of hypertension and its correlates among the adult tribal population, Maharashtra State.
Materials & Methods: A community based cross-sectional study was carried out, during April 2007 to March 2009, in tribal areas of Maharashtra, covering a total of 4,348 adults of ≥ 20 years of age. Bivariate and multivariate regression analysis was done to study association between hypertension and various socio-demographic, behavioral factors and overweight/obesity.
Results: The overall prevalence of hypertension was 23% and was significantly higher among men (28%, CI=26-29.9) as compared to women (19%, CI=17.4-20.6). Regression analysis showed that the risk of hypertension was 1.5 times among those engaged in service/business (CI=1.02-2.40) and among housewives (CI=1.17-2.21). Overweight/obesity and central obesity had 2 times higher risk of hypertension (BMI ≥23, CI=1.38-2.60), (OR for Central obesity 1.68, CI=1.19-2.38). Alcohol consumption and tobacco snuffing was significantly ($p<0.01$) associated with risk of hypertension.
Conclusions: Prevalence of hypertension is a major public health problem among tribal population and appropriate intervention strategies are needed for prevention and control of hypertension such as increasing awareness, promoting physical activity by reducing overweight/obesity and change in risk behaviour.

Key words: Hypertension, Prevalence, Risk Factors, Obesity, Tribal adult.

INTRODUCTION

Non-communicable diseases, especially cardiovascular diseases (CVD) are on rise even in developing countries including India due to epidemiological, nutritional, demographic, socio-economic and lifestyle transition. [1] Apart from these factors, gene-environmental interactions and

early life influences of fetal under-nutrition are the likely causes for increased burden of CVD in India. [2] According to the WORLD Health Organization (WHO), cardiovascular diseases are now the leading cause of death, accounting for 29% of all deaths. [1] In Indians, CVD has been occurring prematurely, i.e. at least a decade or two, earlier than their counterparts in the developed countries.

Hypertension is an important risk factor for CVD and is a major public health problem in developing countries around the world and is one of the most important modifiable risk factor. As reported by World Health Organization, [1] hypertension (HTN) is the third 'killer' disease, accounting for one in every eight deaths worldwide. It has been expected that the number of hypertensive may rise from 118 million in 2000 to 214 million in 2025. [3]

Hypertension is well recognized as a public health problem among urban and as well as among rural adults in India [4] and is directly responsible for 16% for ischemic heart disease, 21% for peripheral vascular disease, 24% for acute myocardial infarction and 29% for stroke in India. [5] Premature mortality from CVD could be prevented, to a considerable extent, by the effective control of hypertension.

Study on prevalence of hypertension among tribal population of Maharashtra is not available. However, studies carried out in other areas reported that the prevalence of hypertension among tribal was 0.5% among Oraon tribal in 1994, [6] while another study reported 24% & 13% prevalence of hypertension among men & women in tribal population of Orissa in 2009 [7] indicating that the hypertension is increasing among tribal population. The present study was carried out by National Nutrition Monitoring Bureau (NNMB) to assess food & nutrient intake and prevalence of hypertension among adult tribal population residing in integrated tribal development agency (ITDA) areas of India. Data pertaining to hypertension and its correlates among tribal adult in Maharashtra is presented in this communication. The ITDA project areas are *Tensil* or *Block* where the scheduled tribe (ST) population is 50 percent or more.

About NNMB

The NNMB was established under the aegis of the Indian Council of Medical Research (ICMR) in the year 1972. The Bureau is currently in operation in the States of Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal, representing more than two-thirds of the geographical area of India. Since 1975, the Bureau has been generating a dynamic database on the diet and nutritional status of rural and tribal communities.

MATERIALS & METHODS

Study protocol was approved by NNMB Steering Committee as well as NIN scientific advisory committee. Ethical clearance was obtained from Institutional Ethical Review Committee, NIN, ICMR, Hyderabad. Written informed consent was also obtained from all the subjects involved in the study.

Sampling design and study population: It was a community based cross-sectional study, carried out in ITDA areas of Maharashtra, during April 2007 to March 2009. A total of 120 villages were covered, of which 90 were selected from that were surveyed in 1985-87 [8] and first repeat survey 1998-99 [9] and the rest of 30 villages were selected randomly from the list of new villages obtained from ITDA. The detailed methodology is described elsewhere. [8,9] From each selected village, 40 households (HHs) were chosen by adopting 'probability proportional to population size' (PPS) of different tribes. For this purpose, in each village, households were grouped according

to the type of tribe and required number of HHs was covered contiguously from each tribal group by selecting a random start.

Sample size: Considering 10% prevalence of hypertension in rural areas [10] as there are no systematic studies available on prevalence of hypertension in tribal population, with 95% confidence interval (CI), 20% relative precision and design effect of 2, sample required was 1728≈1800 for each gender.

Inclusion & exclusion criteria: All the individuals' ≥20 years of age and willing to participate in the study were surveyed, while those less than 20 years of age, not willing to participate and pregnant women were excluded from the study.

Collection of data: Data was collected on pre-tested and validated proforma by the team of trained Medical Officer, social worker and nutritionist. Supervision and quality control was carried out by scientists of National Institute of Nutrition (NIN). For this purpose, households covered during previous day were visited by an expert and anthropometric measurements such as height, weight, waist and chest circumference were re-measured on those subjects covered by the team and three measurement of blood pressure was also recorded to check inter individual variations.

Data on socio-economic and demographic particulars was collected from the selected adults. Anthropometric measurements like weight (nearest of 0.1kg, with SECA weighing scale), and height with anthropometer rod (nearest of 0.1cm) was measured using standard procedure. [11] Waist and hip circumference was measured on all the adults covered for anthropometry with standard equipment and procedure using fiber reinforced non-elastic tape. [12] Waist circumference was measured at a point midway between lower rib margin and iliac crest. BP was measured using Diamond Regular mercury sphygmomanometer BP Apparatus (IS: 3390/CL/L-0196043) on all the available individuals present at the time of survey and next day revisits to cover maximum adults. Three measurements of BP at 5 minute interval in recumbent position were taken and average of three readings was used. Although sitting position was preferred for BP measurements, however the facilities (table, chair etc) are not available in tribal areas, therefore BP was measured in reclining position. Individuals diagnosed with hypertension were given referral slips to consult Medical Officer, Primary Health Center (PHC) for confirmation of diagnosis and treatment if required.

A 24 hour recall method of diet survey was carried out in every fourth HHs. Consumption of salt (g) per day per person was also assesses through 24 hr diet survey. [13] Based on WHO recommendation of salt consumption, individuals were categorized into two groups (≤5g/day and >5g/day).

Information on diabetes mellitus (DM) was collected based on history and medical records available such as prescription medication. Out of 737 individuals, who were aware of the condition, only 6 (0.8%) were suffering from DM and most of them were on treatment.

Definition and diagnostic criteria of various parameters

Individual with systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mm Hg and/or currently on treatment for hypertension were categorized as hypertensive. Hypertension was also classified as per Joint National Committee (JNC 7) criteria, which excludes subjects already on anti-hypertensive treatment. [14] About 4350 individuals were covered for measurement of blood pressure.

Body mass index (BMI) was calculated as weight (kg)/[ht.(mt)^2]. Individuals with BMI of <18.5 were

classified as 'chronic energy deficiency' (CED), between 18.5-22.99 as 'normal' and ≥ 23-27.49 as 'overweight' and ≥ 27.5 as 'obese'. [15]

Individuals with waist circumference of ≥90 cm for men and ≥ 80 cm for women were considered cut off points for defining an abdominal obesity as per Asian cut off. [16] Individuals with waist to hip ratio (WHR) of ≥0.90 for men and ≥0.80 for women were considered as cut off points for truncal obesity. [16]

Smokers, alcohol consumers or tobacco chewers were defined as those who ever smoked, consume alcohol or chew tobacco during their lifetime (present as well as in the past). *'Pucca'* house means walls made up of cement and bricks or stones and reinforced cement concrete roof (RCC), while '*semi pucca* house' is one that has brick or stone wall and tiled or asbestos roof, while *'kutcha*' house had mud or thatched walls and thatched or tiled/asbestos roof.

Statistical Methods: Data analysis was carried out using SPSS (Window Version 15.0). Descriptive statistics were carried out for all variables. Means (SD) of anthropometric measurements were compared between hypertensive and normotensive subjects by unpaired two tailed t-test. Prevalence of hypertension was calculated by age groups and gender as well as % intake of RDA for nutrients. Bivariate and multiple logistic regression analysis were carried out between hypertension and socio-economic and demographic variables, risk behaviours such as use of tobacco, smoking etc and overweight/obesity, which were observed significant in bivariate analyses, to know important risk factors for hypertension. Significance was tested at 95%, p value of <0.05 was taken as significance.

RESULTS

A total of 4,348 tribal adults of ≥ 20 years of age (men 48%, mean age 40.7±11.9) were covered. There was a significant mean difference in age, BMI, WC, HC and WHR between normotensive and hypertensive men and women (Table 1).

Table 1: Mean (SD) for age and anthropometric measurements by normotensive and hypertensive subjects.

Variables	Normotensive		Hypertensive		
	Mean	Std. Deviation	Mean	Std. Deviation	P value
		Men			
Age	39.8	12.0	46.5	13.5	<0.001
BMI	18.6	2.3	19.7	3.0	<0.001
WC	70.1	7.1	74.3	9.2	<0.001
HC	79.8	5.2	82.2	6.3	<0.001
WHR	0.87	0.05	0.90	0.06	<0.001
		Women			
Age	38.1	10.3	47.4	11.2	<0.001
BMI	18.0	2.5	19.3	3.5	<0.001
WC	66.2	7.7	71.4	10.2	<0.001
HC	81.2	6.1	83.2	7.3	<0.001
WHR	0.81	0.07	0.85	0.08	<0.001

BMI-body mass index, WC-waist circumference, HC-hip circumference, WHR-waist hip ratio

Age-group and gender wise prevalence of hypertension is presented in Fig 1. The overall prevalence of hypertension was 23% (men 27.7%; women 19.3%). The prevalence of hypertension increases with increase of age from 12% among 20-34 years of age to 48% among ≥ 60 years of age.

Bivariate analyses showed that the risk of hypertension was significantly (p<0.001) associated with age, gender, type of family, literacy status, per capita income

and physical activity. Salt consumption was not observed to be significantly associated with hypertension (Table 2).

Table 2: Bivariate analysis for hypertension with socio-demographic variables among the study population .

Socio-demographic variables		n	OR (CI)
Age groups (yrs)	20-34	1453	1.0
	35-59	2461	2.71 (2.25-3.25)
	≥60	434	7.15 (5.58-9.16)
Gender	Men	2089	1.60 (1.39-1.84)
	Women	2259	1.0
Type of house	Kutcha	233	1.0
	Semi Pucca	4090	1.59 (1.11-2.27)
	Pucca	25	2.88 (1.18-7.01)
Type of family	Nuclear	2509	1.0
	Extended Nuclear	679	1.31 (1.07-1.59)
	Joint	1160	1.34 (1.14-1.57)
Education	Illiterate	2436	1.0
	1st -8th class	1320	1.11 (0.95-1.30)
	9th class and above	592	0.84 (0.67-1.05)
Occupation	Labour/ Agriculture	3888	1.0
	Housewife and others	317	2.10 (1.65-2.67)
	Service +Business	142	2.14 (1.51-3.03)
Per Capita Income	1st tertile	1448	1.0
	2nd tertile	1462	1.09 (0.91-1.28)
	3rd tertile	1436	1.30 (1.09-1.55)
Landholdings	Landless	1732	1.0
	<2.5 acres	1269	0.92 (0.77-1.10
	>2.5 acres	1347	1.25 (1.06-1.48)
Type of activity	Sedentary	271	1.78 (1.37-2.32)
	Mod/Heavy	4077	1.0
Salt intake (g/day)	<5	470	1.0
	≥5	1014	1.17 (0.86-1.58)

OR: odds ratio, CI: confidence interval

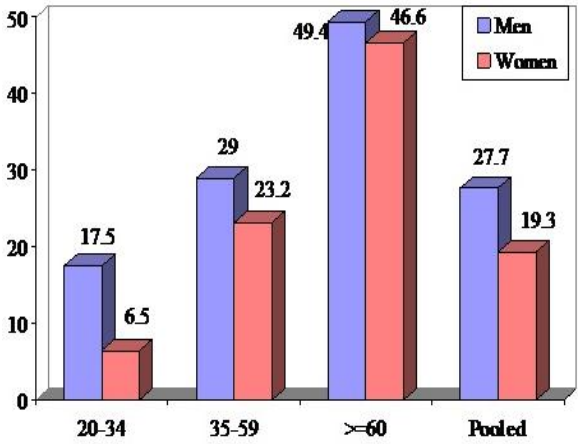
The risk of hypertension was also associated with use of tobacco in any form, alcohol consumption, frequency & duration of smoking, tobacco chewing and snuffing (Table 3).

Table 3: Bivariate analysis for hypertension with behavioral factors & obesity among adults.

Behavioral factors		n	OR (CI)
Tobacco use*	Yes	317	1.83 (1.43-2.33)
	No	4031	1.0
Alcohol consumption#	Yes	888	2.05 (1.74-2.41)
	No	3460	1.0
Smoking frequency	Nil	4031	1.0
	≤10	245	1.61 (1.21-2.12)
	>10	72	2.75 (1.72-4.41)
Smoking duration (yr)	No	4031	1.0
	≤10	102	1.24 (0.79-1.94)
	>10	215	2.17 (1.63-2.88)
Tobacco chewing frequency	Nil	4031	1.0
	≤10	1900	0.99 (0.86-1.14)
	>10	48	2.16 (1.20-3.88)
Tobacco chewing duration (yr)	Nil	2400	1.0
	≤10	956	0.75 (0.62-0.91)
	>10	992	1.29 (1.09-1.53)
BMI	CED	2414	0.60 (0.51-0.69)
	Overweight	309	2.63 (2.05-3.37)
	Normal	1625	1.0
WC	Normal	4055	1.0
	Obese	257	3.71 (2.87-4.79)
WHR	Normal	2283	1.0
	Obese	2029	1.90 (1.64-2.19)

*In any form, #daily/biweekly/fortnightly, CED-chronic energy deficiency
BMI-body mass index, WC-waist circumference, WHR-waist hip ratio, OR: odds ratio, CI: confidence interval

Figure 1. Prevalence (%) of hypertension according to age groups and gender.



Risk of hypertension with among overweight/obesity subjects is presented in Table 3. It was observed that the risk of hypertension was significantly ($p<0.001$) higher among overweight/obese (BMI ≥23, OR= 2.63, CI =2.05-3.37) as compared to subjects with normal BMI. Abdominal obesity had 3.7 (CI= 2.87-4.79) times and truncal obesity had 1.9 (CI= 1.64-2.19) times higher risk of hypertension (Table 3).

Nutrient intake Vs hypertension

Prevalence of hypertension was observed to be significantly ($p<0.01$) higher among subjects consuming <70% of RDA for energy, proteins and folic acid (Table 4).

Table 4: Prevalence of hypertension among adults according to % RDA intake.

% RDA intakes	n	Prev. of HTN (%)
Energy		
≥100	520	14
70-100	711	16.3
<70	253	22.5
	χ^2, p value	8.94, 0.01
Total fats		
≥100	781	15.6
70-100	433	16.2
<70	270	20.0
	χ^2, p value	2.85, 0.24
Proteins		
≥100	476	13.7
70-100	625	16.2
<70	383	20.9
	χ^2, p value	8.16, 0.01
Folic acid		
≥100	206	19.9
70-100	332	11.1
<70	946	17.8
	χ^2, p value	9.68, 0.01
Iron		
≥100	383	15.7
70-100	339	14.2
<70	762	18.1
	χ^2, p value	2.95, 0.22

HTN-hypertension, RDA-Recommended dietary Allowances

Multivariate logistic regression analysis was carried out by including age groups, gender, type of house, type of family, occupation, per capita income, land holdings, risk behaviour such as use of tobacco, alcohol consumption and obesity as independent and hypertension as dependant variable. The risk of hypertension was 2.3 (CI=1.89-2.79) and 5.5 (CI=4.46-7.68) times higher among 35-59 years and ≥ 60 years of age respectively as compared to 20-34 years age group.

Risk of hypertension was 1.4 times (1.21-1.72) higher among men as compared to women. Subjects engaged in service/business had 1.8 times and women who were housewives/others had 1.3 times higher risk of hypertension as compared to

those engaged in labour work. Alcohol consumption was significantly ($p<0.01$) associated with 1.7 higher risk of hypertension (1.46-2.10). Subjects with overweight/obesity (BMI ≥23) had 1.9 times (1.36-2.57) and abdominal obesity had 1.7 (CI=1.22-2.40) times higher risk of hypertension. Risk of hypertension 1.4 times (CI=1.16-1.63) times higher among subjects with truncal obesity (Table 5).

Table 5: Multiple logistic regression analysis between hypertension among study population with socio-demographic factors, personal habits and obesity.

Particulars		OR (CI)
Age groups (yrs)	20-34	1.0
	35-59	2.30 (1.89-2.79)
	≥60	5.85 (4.46-7.68)
Gender	Men	1.44 (1.21-1.72)
	Women	1.0
Occupation	Labour/ Agriculture	1.0
	Housewife and others	1.32 (1.00-1.74)
	Service +Business	1.80 (1.22-2.66)
Type of activity	Sedentary	1.44 (1.08-1.93)
	Mod/Heavy	1.0
Alcohol consumption#	Yes	1.75 (1.46-2.10)
	No	1.0
BMI	CED	0.70 (0.59-0.82)
	Overweight	1.88 (1.36-2.57)
	Normal	1.0
WC	Normal	1.0
	Obese	1.71 (1.22-2.40)
WHR	Normal	1.0
	Obese	1.38 (1.16-1.63)

daily/biweekly/fortnightly, BMI-body mass index, WC-waist circumference, WHR-waist hip ratio, CED-chronic energy deficiency, OR: odds ratio, CI: confidence interval ,
Variables included: Age groups, gender, type of house, type of family, occupation, activity, tobacco use, alcohol consumption, BMI, WC, WHR

DISCUSSION

This is first kind of its study carried out exclusively among tribal population of Maharashtra. Tribals differ from other population in that they live in forest areas, often isolated; depend mostly on forest produce and hunting, with some agriculture, with minimal or no access to health care services. The present study revealed that hypertension is a significant public health problem in tribal population of Maharashtra.

In the present study, the prevalence of hypertension was 23% and was higher among men as compared to women, which is similar with other study. [17] The prevalence of hypertension increases as increased in age and was higher among elderly which is similar with other study. [18] The pcurrent prevalence was similar to that observed in rural areas of Maharashtra and central India. [19,20]

However, recent study carried out among aboriginal Nicobarese tribe in Andaman-Nicobar islands reported very high prevalence (50.5% each) of hypertension. [21]

The present study reported a large proportion of population in the pre-hypertensive group (45% men & 39% women). Kusuma et al observed 50% and 57% prevalence of pre-hypertension among tribal men and women of Orissa. [7] In recognizing 'pre-hypertension' as a clinical condition, JNC 7 pointed out that BP related mortality was linear and that higher BP levels was associated with increasing morbidity and mortality. [14,22]

Multiple regression analysis showed that age groups, gender, type of activity, overweight/ obesity, abdominal obesity, waist: hip ratio and alcohol consumption were significantly ($p<0.01$) associated with risk of hypertension. Risk of hypertension

increases with increase in age and was higher among elderly as observed by other authors. [18,21] Increasing age is an important risk factor which is non modifiable, but hypertension can be prevented through regular physical exercise, lower intake of saturated fat and low salt intake. Sedentary lifestyle is an important risk factor for hypertension as observed by other authors. [23,24] So lifestyle modification is important for prevention for hypertension. No association was observed between hypertension and education in the present study, although some authors reported inverse association between hypertension and education. [24,25] Socio-economic status (SES) is one of the indicators of high blood pressure, as was previously assumed that hypertension was more prevalent in higher socioeconomic group. In the present study, no such association was observed between hypertension and SES. This may be due to that majority of tribal population belongs to low socioeconomic status. However, some authors reported lower prevalence of hypertension among higher socio-economic groups,[26] while others observed higher prevalence among higher socio-economic group.[27] The prevalence of hypertension was significantly higher among overweight/obese compared to normal subjects which is similar with findings of other studies [28,29] High prevalence of hypertension among those who consume alcohol was similar with the findings of other authors [28]

CONCLUSION

Overweight/obesity is an important risk factor for hypertension, so weight control through regular physical exercise should be recommended for prevention of hypertension.

In conclusion, prevalence of hypertension is higher in tribal population of Maharashtra. The prevalence of hypertension was associated with age, gender, type of activity, obesity and alcohol consumption. Regular screening of population should be done for early diagnosis and treatment of hypertension among tribal population. Knowledge and awareness about hypertension may be imparted through appropriate information, Education and communication (IEC) activities to reduce burden of chronic diseases in the population.

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