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Prevalence of Hypertension among Central Indian Population –A Cross Sectional Study

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Abstract

Background: Hypertension [HTN] is responsible for 57% of stroke deaths and 24% of coronary heart disease [CHD] deaths in India.

Hypertension will be the major cause of death and disability by the end of 2020. The prevalence of hypertension is increasing in both rural and urban communities. The objectives of the study were to assess the prevalence of hypertension and its associate risk factors in a rural population.

Methods: A cross sectional study was conducted by the Department of medicine, Government Medical college of Raigarh, Chhattisgarh from May 2014 to August 2014. The socio demographic variables and risk factors were obtained by interviewing the subjects in the study and collected in a predesigned questionnaire sheet. The sample size was calculated by prevalence of HTN in previous studies and 600 subjects (18-65yr) were included. The blood pressure was assessed and classified using recent JNC 7 and WHO criteria to grade hypertension.

Results: Waist Circumference, Blood pressure, Body Mass Index of the participants was calculated. P value < 0.05 was considered significant. In the sample population based on systolic BP, 61.3% were non-hypertensive, 29.7% were pre-hypertensive and 9% were hypertensive. Based on diastolic BP, 43.3% were non-hypertensive, 32.7% were prehypertensive and 24% were hypertensive. Subjects with hypertension and pre-hypertension have higher BMI and waist circumference.

Conclusion: A high prevalence rate of pre-hypertension and hypertension was depicted in urban areas of Chhattisgarh region.4.8% of the female participants had systolic high blood pressure compared to the 11.9% of the male participants. On the other hand, 21.8% of the female participants had diastolic high blood pressure compared to the over 25% of the male participants.

Keywords: BMI, Hypertension, Pre-hypertension, Risk factor, Waist circumference.

Introduction

Hypertension is one of the most important causes of the total disease burden in the world1. As per the statistics of Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India, the overall prevalence of hypertension in India by 2020 will be 159.46/1000 population. According to World Health Report 2002, cardiovascular diseases (CVDs) will be the largest cause of death and disability by 2020 in India.[1,2,4] In 2020 AD, 2.6 million Indians are predicted to die due to coronary heart disease which constitutes 54.1 % of all CVD deaths. Nearly half of these deaths are likely to occur in young and middle aged individuals (30-69 years). Currently Indians experience CVD deaths at least a decade

earlier than their counterparts in countries with established market economies (EME). The Global Burden of Disease (GBD) study estimates that 52% of CVD deaths occur below the age of 70 years in India as compared to 23% in EME, resulting in a profound adverse impact on its economy. The contributing factors for the growing burden of CVDs are increasing prevalence of cardiovascular risk factors especially hypertension, dyslipidemia, diabetes, overweight or obesity, physical inactivity and tobacco use. It is an area where major health gains can be made through the implementation of primary care interventions and basic public health measures targeting diet, lifestyles and the environment.[3]

In order to formulate national policies for the prevention and control of CVDs, we require nationally representative data collected through standardized techniques. Although studies have been conducted to assess CVD and its risk factor burden in many regions of India, the data was not compiled together. Understanding this problem, we tried to establish a database of all the studies and projects in past and present, relating to CVD epidemiology and prevention in India. This compilation would serve as an exhaustive database on relevant information about CVD in India and as a guide for future policy and research. It will be made accessible to all major stakeholders. In this report we have included prevalence data on cardiac disease.[5,6]

In addition, Mean values of anthropometric measurements and biochemical parameters listed in various studies are also summarized.

Methods

This hospital-based study was carried out by the Department of medicine, Government Medical college, Raigarh, Chhattisgarh from May 2014 to August 2014.

Aim of the study was to find out the prevalence and the socio demographic risk factors affecting hypertension among the population between 18 to 65 years of the urban and rural population from 2014 to August 2014 for the period of four months.

Study design: A questionnaire containing all the socio demographic data (age, sex, family history, socio economic status, weight, height etc.) and factors affecting hypertension [Tobacco intake, alcohol consumption, salt intake, diabetes mellitus etc.] were included in the study. The data was collected by interviewing the participants. The clinical measurements which were obtained include weight, height and blood pressure. All these were calculated by using standard instruments and following standard guidelines.

Socio economic status was defined as per Modified Prasad's Classification.

Definitions utilized for various variables[10-14]

- **Smoker:** A person who has smoked at least 100 cigarettes in his lifetime and has continued to smoke every day or some days in the last 30 days.
- **Tobacco chewing:** Defined as a person who has consumed smokeless tobacco once a day or nearly every day in any form for the last 12 month.
- **Alcohol:** Present consumer was defined as a person who has consumed alcohol every day or some days in the last 30 days. Past consumer was defined as a person who used to consume alcohol but stopped taking alcohol 12 months ago.
- **Salt intake:** Estimated per capita salt intake was calculated by 24-hour dietary recall method for three consecutive days and an average was calculated.
- **Waist- Hip ratio:** Waist circumference (WC) was measured to the nearest 0.1 cm at the narrowest point between the lower end of the rib cage and the iliac crest. Hip circumference (HC) was measured to the nearest 0.1 cm at the greatest horizontal circumference below the iliac crest, at the level of greater trochanter.

[waist–hip ratio (WHR)>0.85 for females and >0.90 for males].

- **Measurement of blood pressure:** Two measurements of blood pressure on each study participant with a mercury column sphygmomanometer were made 30 minutes apart in sitting position. Blood pressure measurements were made on the subject's left arm using a cuff of appropriate size at the level of the heart. The cuff pressure was inflated 30 mm Hg above the level at which radial pulse disappeared, then deflated slowly at the rate of about 2mm per sec and the readings were recorded to the nearest 2 mm Hg. In case where the two readings differed by over 10 mm of Hg, a third reading was obtained, and the three measurements were averaged. The pressures at which sound appeared and disappeared were taken as systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. To obtain accurate readings of Blood pressure, WHO guidelines were used. To avoid inter observer variation, BP was recorded by the authors themselves.

Inclusion criteria: Hypertension was diagnosed when systolic BP (SBP) was 140mmHg and/or mean diastolic BP (DBP) 90mmHg. Isolated systolic hypertension was defined as a systolic BP 140mmHg and a diastolic BP < 90mmHg. The recorded blood pressure was graded as normal (SBP <120 and DBP <80 mmHg), prehypertension (SBP = 120-139 and/or DBP = 80-89 mmHg), stage I hypertension (SBP = 140-159 and/or DBP = 90-99 mmHg), and stage II hypertension (SBP > 160 and/or DBP >100 mmHg).15

Sample size: Sample size was calculated estimating the prevalence of hypertension in the region by previous study from the department, which was around 20%.[16]

The following formula was used:

Sample size = 4PQ/L2.

Where, P is Prevalence = 20%,

Q = 100 – P = 80% and L is absolute error= 4%.

The sample size came out to be 400; however, a total of 600 participants gave consent for the study.

Exclusion criteria: patients on anti-hypertensive medication, who refused to participate and who didn't provide reliable information were excluded from the study. Participants were additionally excluded if they were missing selfreports of hypertension or diabetes diagnosis

Ethical consideration: The study was approved by the Institutional ethical committee. Written informed consent was obtained and referral services were provided to necessary cases if required.

Statistical analysis: The data was entered in Microsoft excel and analysed using SPSS version 21.0. Chi square's test of significance was performed to find out the results. A two tailed P value <0.05 was considered significant.

Results

The primary outcome in this study was hypertension prevalence, which was defined, according to WHO criteria as SBP of 140 mmHg or greater, diastolic blood pressure (DBP) of 90 mmHg or greater, and/or currently taking antihypertensive medications. Pre-hypertension was defined as an SBP of 120–139 mmHg and/or a DBP of 80 to 89 mmHg among persons not on treatment for hypertension. Individuals with a normal blood pressure reading who self-reported a previous diagnosis of high blood pressure by a doctor or other health worker but were not on treatment were not considered hypertensive. Additional analyses also explored variation in secondary outcomes of hypertension awareness, treatment and control by socio-demographic characteristics. Awareness of hypertension was defined according to self-report of previous diagnosis of high blood pressure (hypertension) by a doctor or other health worker, among participants identified as having hypertension. Treatment of

hypertension was defined as self-reported use of prescribed medication to control blood pressure among those who self-reported to have hypertension. Control of hypertension was defined as pharmacologic treatment of hypertension associated with an average SBP <140 mm Hg and an average DBP <90 mm Hg among those who self-reported to have hypertension.

Independent variables were coded categorically and included the sex of the respondent (male or female), age-group (18–30, 31–40, 41–50, 51–60, 60–65 years), highest level of education attended (no education or preschool only, primary schooling, or secondary school or higher), place of residence (urban or rural), and quintiles of wealth. Occupational status was defined as not currently working or currently working, with the latter category further classified using the International Standard Classification of Occupations (ISCO-08). Major ISCO08 groups were collapsed to create three categories:

Government Employee, Nongovernment Employee, Self Employed, Non Paid, Home Maker, Unemployed able to work and Student. The other category included those in elementary occupations, armed forces occupations and those who indicated that they were currently working but did not specify their employment type.

Current smoking status was classified into three categories (does not currently smoke, smokes cigarettes, or smokes pipes, cigars, etc.). BMI was classified based on WHO categories of underweight (less than 18.5 kg/m2), normal weight (18.5–24.9 kg/m2), overweight (25.0–29.9 kg/m2) and obese (30 kg/m2)[14.] Diabetes was defined as having a fasting plasma glucose value7.0 mmol/L (126 mg/dl) or being on medication for raised blood glucose[14].

Data analysis: Descriptive statistics and frequency distributions were used to describe participant characteristics. Prevalence data were weighted to account for the sampling design and non-response. Age-standardized prevalence estimates of hypertension were also calculated using the WHO world standard population[3] by taking weighted means of age-sex-specific estimates, with use of age weights from the standard population. In separate analyses by sex, odds radios (ORs) and 95% confidence intervals (CIs) for predictors of hypertension were estimated using logistic regression analyses. In accordance with recommended research practice, however, regressions were under weighted and statistical significance accepted when $p<0.05$.

Sample characteristics Subject characteristics by sex are summarized in Table 1. The mean age of participants was 46.8 years. Compared to men, fewer women in the sample lived in urban areas (50.0% vs. 44.3%; $p<0.01$), were currently working (61.7% vs. 37.2%; $p<0.001$), lived in households in the middle to highest quintiles of wealth (65.9% vs. 59.5%; $p<0.001$) or smoked (26.7% vs. 10.3%; $p<0.001$). More women were, however, overweight (24.2% vs. 18.0%; $p<0.001$) and obese (24.6% vs. 10.1%; $p<0.001$).

The prevalence of hypertension was similar among women and men (crude: 44.6%; men: 44.3%; women: 44.9%). Mean SBP and mean DBP for the total population were 128.8 mmHg and 83.1 mmHG, respectively. Mean SBP was 3.5 mmHg lower for women than men ($p<0.001$). There were no significant differences in mean DBP between men and women (82.7 mmHG vs. 83.4 mmHg). Notably, while just over a quarter of the population was normotensive (27.0%), nearly 30% (men: 29.1%; women: 27.9%) were classified as pre-hypertensive. The prevalence of hypertension increased consistently with age for both sexes until 55–59 years (Fig 1). Adjusted to the WHO world population, the prevalence of hypertension for all ages was 46.0% (95% CI 43.9–48.1). The age-standardized prevalence of hypertension

was 46.1% (95%CI 42.9–49.3) for men and 46.0% (95%CI 43.3–48.7) for women.

Discussion

Table 1 shows the socio demographic profile of the subject. Table 2 shows the behavioral modifiable risk factors of the study group. Various modifiable risk factors analyzed were smoking of tobacco products, smokeless tobacco, alcohol consumption, fruits and vegetable consumption, history of diabetes, BMI and waist circumferences. Table 3 shows Behavioral and other Characteristics of Study Population. Table 4 gives correlation of age and anthropometry with vital statistics. There was a significant positive correlation of pulse rate with age in males ($p<0.05$). There was also a significant positive correlation of weight with diastolic BP in males ($p<0.05$). Table 5 depicted the regression analysis which shows the presence or absence of Hypertension as the dependent variable and age, BMI, vegetable intake frequency, use of alcohol, smoking, presence of diabetes as independent variables. Analysis revealed that in the population of BMI was significantly associated with hypertension (OR 1.311, 95% CI; 1.035–1.662).BMI was significantly correlated with systolic BP in adults ($p<0.05$). Diastolic BP was significantly positively correlated with age and BMI in adults ($p<0.05$). Age was positively significantly correlated with pulse rate in adults ($p<0.05$). Thus, in Raigarh district of Chhattisgarh, with higher BMI, the risk hypertension increases by 1.3 times. Multivariate Analysis for Risk Factor of Hypertension was descrbed in Table 6. Dubey VD[11] carried out one of the earliest study in India (1954), documented 4% prevalence of hypertension (criteria:>160/95) amongst industrial workers of Kanpur. In 1984, Wasir HS et al[25] reported 3% prevalence of hypertension (criteria :≥ 160/95) in Delhi. During 1984-87 Gopinath and Chadha et al[8,9] reported the prevalence of hypertension in Delhi (criteria: >=160/90) to be 11% among males and 12% among females in the urban areas and 4% and 3% respectively in rural areas. Another two studies carried out in rural areas of Haryana[21] (1994-95) demonstrated 4.5% prevalence of hypertension (JNC V criteria) while urban areas of Delhi had a higher prevalence of 45% during 1996-97[7].

In the ICMR study[18] in 1994 involving 5537 individuals (3050 urban residents and 2487 rural residents) demonstrated 25% and 29% prevalence of hypertension (Criteria: >=140/90 mm of Hg) among males and females respectively in urban Delhi and 13% and 10% in rural Haryana.

Further, Gupta R from Jaipur, through three serial epidemiological studies (Criteria:>=140/90 mm of Hg) carried out during 1994[14], 2001[13] and 2003[15] demonstrated rising prevalence of hypertension (30%, 36%, and 51% respectively among males and 34%, 38% and 51% among females).

From south India, Kutty VR[19] carried out hypertension prevalence study (criteria: >=160/95 mm of Hg) in rural Kerala during 1991 in the 20 plus age group and the prevalence was found to be 18%. Later studies in Kerala (Criteria: JNC VI) reported 37% prevalence of hypertension among 30-64 age group[20] in 1998 and 55% among 40-60 age group[27] during 2000. A higher prevalence of 69% and 55% was recorded among elderly populations aged sixty and above in the urban and rural areas respectively during 2000.[17]

Few studies on prevalence on hypertension are available from eastern Indian population. In 2002, Hazarika et al[16] reported 61% prevalence (criteria: =JNC VI) among man and women aged thirty and above in Assam.

The Sentinel Surveillance Project[26], documented 28% overall prevalence of hypertension (criteria: =JNC VI) from 10 regions of the country in the age group 20-69. Another study[12] carried out in 1998 among Industrial population in the Bharat Electronics Limited (BEL), India using the same criteria illustrated a prevalence of 30% among men.

Few studies were carried out comparing different socio economic groups. The initial study from urban Chennai, Mohan et al[23] reported 8.4% prevalence of hypertension among men and women aged 20 years and above and belonging to the low socio economic group (based on household income, occupation and dietary pattern). Similarly, in the middle socio economic group had a higher prevalence (15%) during 1996-97.

A study conducted in the urban areas of Chennai during 2000[24] (age group>=40) reported a higher prevalence of hypertension (54%) among low income group (monthly income < Rs 30000/annum and 40% prevalence among high-income group (monthly income ≥ Rs 60000/annum). Misra et al[22] reported 12% prevalence of hypertension in the slums of Delhi.

In cessation, the study showed that more than 40 % population in our urban area has high BMI. There are alarming rates of high BMI and obesity among women and youth, signifying where targeted actions should be taken. Owing to the effective alliance of hypertension with lower BMI cut-off value (less than 23 kg/m2), this study uses Asian-specific cutoff for the defining levels of overweight and obesity among the population. This call an immediate attention and action at the state and also at national level to control the problem of Non communicable disease especially hypertension among Asian countries.

Conclusion

The present study demonstrated the prevalence of hypertension which was found significantly high among adults. Study showed a significant association of hypertension with age. In the present study, the unacceptably high rates of hypertension and BMI were detected among the population of the rural areas. This study outlines remarkable positive correlation between all the anthropometric factors (weight, BMI) and systolic and diastolic blood pressure except for waist circumference. Many researchers have already reported positive correlation of body mass index with hypertension (systolic and diastolic).

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TABLES

Table 1: Characteristics of respondents aged 18–65 years, by gender.

	Men (n = 352)	Women (n =248)	Total (n=600)	p-value
Mean age (95% CI), years	46.5 (46.0–47.1)	46.9 (46.5–47.4)	46.8 (46.4–47.2)	0.230
Age-group, years				
18–30	65 (10.7%)	61 (10.1%)	63 (10.5%)	
31–40	80 (13.4%)	108 (18.0%)	97 (16.1%)	
41–50	109 (18.1%)	104 (17.4%)	106 (17.6%)	0.116
51–60	132 (22.0%)	121 (20.2%)	126 (20.9%)	
60–65	154 (25.7%)	146 (24.3%)	150 (25.0%)	

Table 2: Socio demographic Characteristics of the Study Subjects.

Variables	Sub group	N	%	P Value
Gender	Male	176	58.7	<0.01
	Female 41.3	124		
Religion	Hindu	285	95	<0.01
	Muslim	82.7		
	Sikh	72.3		
Marital Status	Married	225	75.5	<0.01
	Unmarried	65	21.5	
	Divorced/Widow/Separated	82.7		
Education	Attended	288	96	<0.01
	Non Attended	12	4	
Occupation	Government Employee	28	9.3	<0.01
	Nongovernment Employee	68	22.7	
	Self Employed	100	33.3	
	Non Paid	10.3		
	Home Maker	40	13.3	
	Unemployed able to work	17	5.6	
	Student	40		

Table 3: Anthropometric characteristics of study population

	Men (n=352)	Women (n=248)	P- value
Age (years)	33.8±8.9	34.9±9.0	0.837
Height (cm)	166.2±6.1	153.2±5.7	0.001
Weight (kg)	65.4±9.2	56.1±8.1	0.001
BMI (kg/m2)	23.6±2.6	23.8±2.8	0.528
Waist circumference	86.7±9.3	81.8±11.4	0.001

Table 4: Behavioral and other Characteristics of Study Population

Variable	N	%	χ^2	(p value)
Smoke Tobacco Frequency	164	26.7	76.514	(<0.01)
Alcohol Use in past 12 months	154	25.7	64.041	(<0.01)
Brisk walk/cycling for 30 minutes	446	74.3	1.673	(0.195)
History of Diabetes	82	13.6	0.482	(0.487)
Consumption of Fruits everyday	132	22	7.364	(0.288)
Consumption of Vegetables/week	440	73.3	1.751	(0.941)

Table 5: Correlation of age and anthropometry with vital statistics when classified according to gender.

	Males (n=352)			Females (n=248)		
	Systolic BP	**Diastolic BP**	**Pulse Rate**	**Systolic BP**	**Diastolic BP**	**Pulse Rate**
Age	0.125	0.090	0.263	0.064	0.055	0.121
Weight	0.135	0.172	0.052	0.053	0.021	0.064
BMI	0.192	0.207	0.081	0.115	0.041	0.049
Waist circumference	0.069	0.092	0.011	0.117	0.015	0.054

Table 6: Multivariate Analysis for Risk Factor of Hypertension.

Variables in the Equation	Exp(B)	Lower	Upper
Gender	1.73	0 .528	5.663
Age	1.00	1 .931	1.075
Diabetes	1.17	1 .299	4.586
Smoking	0.548	0.046	6.555
alcohol_12_months	2.145	0.180	25.603
BMI	1.311	1.035	1.662