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Prevalence of hypertension, its correlates and levels of awareness in Rural Wardha, Central India

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ABSTRACT

Objective: To study the prevalence, correlates of hypertension and level of awareness regarding hypertension in rural area of Wardha District of Central India.
Design: It is a cross sectional study. Two stage sampling method was used to reach the study subjects. In first stage, cluster-sampling method was used to identify 30-clusters to be studied. Then in the second stage, systematic random sampling method was used to select the households. All the people of 18 years and above from the selected households were included in the study.
Setting: The study was carried out in the area of two Rural Health Training Centers, namely Bhidi and Anji of Department of Community Medicine, Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha District.
Participants: All the members aged 18 years and above from selected households were included in the study. Those who were absent on two repeated visits, pregnant mothers and those who were not able to stand erect were excluded from the study.
Main outcome measures: Prevalence of hypertension correlates of hypertension, proportion of individuals aware of their hypertensive status and proportion of hypertensive taking regular treatment.
Results: The overall prevalence of hypertension was found to be 20.6%. The mean systolic blood pressure was 119.08 + 15.68 mm Hg and mean diastolic blood pressure was 76.85 + 17.82 mm Hg. Significant risk of hypertension was found with increased age, increase in BMI, waist-hip ratio and occupations involving sedentary work. The risk decreased significantly with increase in educational level. The level of awareness regarding hypertension was very poor. Only 13.6% of the hypertensive was aware of the condition while only 8.7% of the hypertensive was taking the treatment regularly.
Conclusion: As the prevalence of hypertension is high (20.6%), an appropriate intervention program shall be launched considering the modifiable risk factors in the area are BMI and Waist-hip ratio.
KEY WORDS: Hypertension, Blood Pressure, BMI, WHR

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INTRODUCTION

The developing economies are undergoing epidemiological transition (1), resulting in a slow epidemic of all the life-style diseases. Hypertension is one of the leading risk factors attributed to life-style diseases. Globally, it is the third leading risk factor for poor health resulting in 13% of total deaths. In developing countries which have high mortality, hypertension ranks eighth among risk factors for poor health (2). On the other hand, in developing countries with low mortality and in developed countries, it ranks second (2). Projections show that altered life styles and concomitants of socio-economic developments, will lead to increased prevalence of hypertension (3). South-East Asians are even at more risk of these diseases, probably because they have higher body fat deposit at a lower BMI when compared to their western counterparts (4).

A meta-analysis of data from India shows increasing prevalence of hypertension amongst the rural population. The prevalence of hypertension increased from 0.52% in 1960 to 7.08% in 1995(5). In India, it contributes to 2-3.9% disability adjusted life years (DALY) lost.
Very few studies on hypertension have been carried out in rural India. The criteria used to define hypertension also differ in these studies. In 2003, the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure came out with its seventh report (JNC VII). Here, a new category – pre-hypertension (systolic blood pressure between 120 – 139 mm Hg and diastolic blood pressure between 80 – 84 mm Hg) has been introduced. From India, till now, no study has reported the prevalence of pre-hypertension.

Hence, the present study was undertaken to determine the prevalence and correlates of hypertension and level of awareness regarding hypertension in the rural area of Wardha district in Central India so that intervention programs could be launched appropriately. This study also sought to explore the prevalence of pre-hypertension in the area.

METHODOLOGY

Study design & setting

Department of Community Medicine, Mahatma Gandhi Institute of Medical Sciences, Sewagram has two Rural Health Training Centers (RHTC); namely Bhidi and Anji. The assigned population of 19341 and 41493 comprising 21 and 23 villages respectively which is used for training and teaching of medical students, interns and different categories of health professionals. These centers in collaboration with District Health System and the private practitioners in the area are responsible for providing preventive, promotive and curative health services in these areas.

This cross-sectional study was carried out in the areas of two Rural Health Training Centers of Department of Community Medicine, Mahatma Gandhi Institute of Medical Sciences, Sewagram; namely Bhidi and Anji through house-to-house visits. All those of 18 years and above were included in the study. A team of trained doctors and social workers carried out the study. The team was trained to ensure accuracy, completeness of questionnaire and measurement of blood pressure and anthropometric measures.

Sampling design

Two stage sampling method was used to reach the respondents household. In first stage, cluster sampling method was used to identify 30-clusters in each RHTC area separately (6).

In the second stage, systematic random sampling method was used to identify16 households per cluster in RHTC, Bhidi area and 32 households per cluster in RHTC, Anji area. As the population of RHTC, Anji area is almost double the population of RHTC, Bhidi area; we doubled the respondents from each cluster of RHTC, Anji area to get better representation from all the clusters. All households in the cluster were listed and number of households was divided by the required number of households (16 in Bhidi and 32 in Anji) to get the sampling interval. First household was selected randomly by using lottery method and then subsequent households were identified by adding sampling interval to the random number.

All family members of 18 years and above from the households thus selected were included in the study. The teams carried out the study in morning and evening time only so that maximum family member is available for the study. Two visits were made to ensure maximum participation in the study. The objective of the study and the method was explained to the formal and informal leaders of the clusters under study and the eligible people were requested to stay at home on the scheduled date and time. Those who were absent were asked again to be present at the second visit. Pregnant women and those who were unable to stand erect were excluded from the study.

Study questionnaire

Trained interviewer administered pre-designed and pre-tested questionnaire to elicit the information from the study participants on socio-demographic characteristics like age, sex, education, occupation; medical history like hypertensive status and personal characteristics like smoking and alcohol use. The questionnaire was pre-tested in the same area. The interviewers administered the questionnaire after obtaining oral informed consent.

Measurement of blood pressure and anthropometry

Blood pressure was measured by using mercury sphygmomanometer and the auscultatory method. The individual was made comfortable and seated at least for five minutes in the chair before measurement. The pressures at which sound appeared and disappeared were taken as systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. The measurements were made with individual in sitting position. Two readings were taken half an hour apart and average of two is reported here (7). Blood pressure was classified as normal (SBP <120 and DBP <80 mmHg), pre-hypertensive (SBP = 120-139 or DBP = 80-89 mmHg), stage I hypertension (SBP = 140-1159 or DBP = 90-99 mmHg), and stage II hypertension (SBP > 160 or DBP > 100 mmHg) as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VII) criteria (8).

Body weight was measured (to the nearest 0.5 kg) with the subject standing motionless on the weighing scale with feet 15 cm apart, and weight equally distributed on each leg. Height was measured (to the nearest 0.5 cm) with the subject standing in an erect position against a vertical scale of portable stadiometer and with the head positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit. Body Mass Index (BMI) was calculated as weight in

kilograms / (height in meter)2. Based on their BMI, individuals were classified into four groups: thin (BMI <18.5), normal (BMI = 18.5-24.9), overweight (BMI = 25.0-29.9) and obese (BMI > 30.0) as per WHO (9).

Waist circumference was measured at the level halfway between the iliac crest and the costal margin in the mid-axillary line after exhaling with the subject in standing position. Hip circumference was measured at the level of greater trochanters with the subject in standing position and both feet together. Two consecutive recordings were made for each site to the nearest 0.5-cm using a non-stretchable fiber measuring tape on a horizontal plane without compression of skin. The mean of two sets of values was used. The cut-off used for waist-hip ratio for males is 0.9 and for females it is 0.8 to define obesity (10).

Occupation was classified as hard work, moderate work and sedentary based on physical labor involved considering the local situation. Education was classified as illiterate, education up to middle school and education more than middle school. Smokers were defined as a person who was currently smoking at least once in a day and alcohol user was defined as currently consuming alcohol at least thrice in a week.

Data entry & Analysis

Data thus generated, was entered and analyzed using SPSS 10.0. Prevalence of hypertension is presented as percentage. Odds ratio was calculated for different risk factors. Systolic and diastolic blood pressure is shown as mean value with the corresponding standard deviation. One-way ANOVA is used to compare means of SBP and DBP among different subgroups of risk factors. Multiple logistic regressions was performed with hypertension status as dependent variable with dichotomous outcome and with age, sex, education level, occupation, smoking, alcohol use, BMI and waist-hip ratio as the independent variables. $p < 0.5$ was used as the definition of statistical significance.

OBSERVATIONS

Study sample characteristics

There were 2700 subjects aged 18 years and more. Majority (49.4%) of them was between the age group of 25-44 years followed by 20.1% in 18-24 and 45-59 years age group. There were more women (60.8%) than males. 55.6% of the study subjects had education more than middle school and 21.0% were illiterate. 45.9% subjects were involved in sedentary work and 41.9% in hard work. 51.5% of the subjects were thin whereas 5.2% were overweight by using BMI. As per waist-hip ratio, 27.0% were overweight. 4.3% subjects were smokers and 1.6% was alcohol users (Table 1).

Prevalence of hypertension

The overall prevalence of hypertension was found to be 20.6%. The prevalence among males was 21.8% and among female was 19.8%. The difference was not statistically significant. (Table 1)

Risk factors for hypertension

In univariate analysis, the risk of hypertension increased significantly with increased age, increase in BMI and waist-hip ratio. The risk increased significantly in occupations involving sedentary work as

compared to hard work. The risk decreased significantly as level of education increased. The risk of hypertension did not differ significantly among smokers and alcohol users (Table 1). In multivariate analysis, the determinants of hypertension were age, occupation, BMI and waist-hip ratio (Table 4). The area under curve for this model was 0.68.

Table 1: Risk factors for hypertension: Univariate logistic regression

Variable	Examined(%)	Hypertensive(%)	Odds ratio	95% CI	p-value
Overall	**2700(100)**	**556 (20.6%)**	**-**	**-**	**-**
Age (years)					
18-24	543(20.1)	67(12.3)	1	Reference	-
25-44	1334(49.4)	219(16.4)	1.40	1.04-1.87	0.026
45-59	542(20.1)	161(29.7)	3.00	2.19-4.11	0.000
≥ 60	281(10.4)	109(38.7)	4.50	3.17-6.39	0.000
Sex					
Female	1641(60.8)	325(19.8)	1	Reference	-
Male	1059(39.2)	231(21.8)	1.13	0.93-1.36	0.208
Education					
Illiterate	568(21.0)	150(26.4)	1	Reference	-
Up to Middle	632(23.4)	129(20.4)	0.72	0.55-0.94	0.014
> Middle	1500(55.6)	277(18.5)	0.63	0.50-0.79	0.000
Occupation					
Hard work	1132(41.9)	208(18.3)	1	Reference	-
Moderate	330(12.2)	90(27.3)	1.67	1.25-2.22	0.000
Sedentary	1238(45.9)	258(20.8)	1.17	0.95-1.43	0.132
BMI (kg/m^2)					
< 18.5	1391(51.5)	20114.4)	1	Reference	-
18.5-24.9	1170(43.3)	292(24.9)	1.97	1.61-2.40	0.000
≥ 25.0	139(5.2)	63(45.4)	4.91	3.40-7.07	0.000
Waist-hip ratio					
< cut-off	1972(73.0)	342(17.3)	1	Reference	-
≥ cut-off	728(27.0)	214(29.4)	1.98	1.63-2.42	0.000
Smoking					
No	2584(95.7)	525(20.3)	1	Reference	-
Yes	116(4.3)	31(26.7)	1.43	0.97-2.18	0.097
Alcohol use					
No	2658(98.4)	544(20.5)	1	Reference	-
Yes	42(1.6)	12(28.6)	1.55	0.79-3.06	0.201

Table 2: Mean blood pressure levels in different subgroups

Variable	Systolic BP (mean ± SD)	p-value	Diastolic BP (mean ± SD)	p-value
Overall	**119.08 + 15.68**	**-**	**76.85 + 17.82**	**-**
Age (years)				
18- 24	114.94 + 10.91		74.47 + 9.85	
25- 44	116.93 + 12.68		76.38 + 22.26	
45- 59	123.44 + 18.91		79.04 + 12.98	
≥ 60	128.86 + 2.24	0.000	7944 + 12.70	0.000
Sex				
Female	118.35 + 15.58		76.29 + 21.07	
Male	120.20 + 15.70	0.003	77.70 + 11.00	0.045
Education				
Illiterate	121.53 + 17.97		78.18 + 32.52	
Up to Middle	118.94 + 16.37		76.55 + 11.10	
> Middle	118.21 + 14.30	0.000	76.46 + 10.91	0.131
Occupation				
Hard work	117.98 + 14.82		76.57 + 24.04	
Moderate	122.47 + 18.15		79.85 + 12.82	
Sedentary	119.18 + 15.61	0.000	76.29 + 10.87	0.004
BMI (kg/m^2)				
< 18.5	116.22 + 13.41		74.91 + 21.97	
18.5-24.9	120.95 + 16.78		78.29 + 11.36	
≥ 25.0	131.88 + 18.30	0.000	84.11 + 12.20	0.000
Waist-hip ratio				
< cut-off	117.17 + 13.55		76.14 + 19.35	
≥ cut-off	124.25 + 19.44	0.000	78.78 + 12.61	0.001
Smoking				
No	118.98 + 15.59		76.80 + 18.03	
Yes	121.28 + 17.41	0.121	77.83 + 12.24	0.545
Alcohol use				
No	119.06 + 15.65		76.82 + 17.90	
Yes	119.95 + 17.37	0.716	78.86 + 11.53	0.461

Table 3: Grades of hypertension

Variable	Number Examined	Pre-hypertensive (%)	Hypertensive Grade I (%)	Hypertensive Grade II (%)
Female	1641	741 (45.1)	240 (14.6)	85 (5.2)
Male	1059	525 (49.6)	147 (13.9)	84 (7.9)
Total	2700	1266 (46.9)	387 (14.3)	169 (6.3)

Table 4: Correlates of hypertension: Multiple logistic regressions by Forward conditional method

Variable	beta-coefficient	Odds ratio	95% CI	p-value
Age (years)				
18-24	Reference	1	-	-
24-44	0.222	1.249	0.918-1.693	0.155
45-59	0.879	2.409	1.721-3.361	0.000
≥ 60	1.419	4.132	2.872-5.926	0.000
Occupation				
Hard work	Reference	1	-	-
Moderate work	0.383	1.467	1.086-1.982	0.013
Sedentary	0.114	1.121	0.899-1.399	0.312
BMI				
< 18.5	Reference	1	-	-
18.5-24.9	0.383	1.760	1.423-2.175	0.000
≥ 25.0	0.114	3.506	2.350-5.227	0.000
Waist hip ratio				
< cut-off	Reference	1	-	-
≥ cut-off	0.245	1.277	1.023-1.593	0.030

Blood pressure levels

The mean systolic blood pressure (SBP) was 119.08 + 15.68 and mean diastolic blood pressure (DBP) was 76.85 + 17.82. The mean SBP and mean DBP increased significantly with increased age, increased BMI, waist hip ratio and occupations with lesser physical work. The mean SBP and mean DBP were higher among males than females but the difference was not statistically significant (Table 2).

Grades of hypertension

46.9% of the study subjects were with pre-hypertension, 14.3% were in grade I hypertension and 6.3% were with grade II hypertension. This accounts to 67.5% of the study subject having blood pressure higher than normal (Table 3).

Level of awareness

Table 5 shows that only 13.6% of the hypertensive was aware of their elevated blood pressure status. Only 8.7% were taking regular treatment. Majority of these individuals were taking allopathic medicines. Meager 0.7% hypertensive individuals were practicing meditation.

Table 5: Levels of awareness

Awareness regarding Hypertension	Frequency (n=556)	Percentage
Hypertensive status	75	13.5
Takes regular treatment	48	8.6
Does meditation	4	0.7

DISCUSSION

Prevalence of hypertension

Very few studies on hypertension have been carried out in rural India. The studies using JNC VI/VII diagnostic criteria are even scarce. The prevalence of hypertension, in the present study was found to be 20.4%. The different studies carried out in rural area of India are given below along with their diagnostic criteria. According to the recent studies, the prevalence of hypertension (>140/90 mm Hg) has been reported in the range of approximately 3 - 22%, while the prevalence of severe hypertension (>160/95 mm Hg) has been reported in the range of approximately 1.5 – 7%.

The differences may be due to difference in age groups studied, different study settings and due to time trend. And even the diagnostic criteria have changed over the years, which make the results incomparable.

In the present study, prevalence of hypertension did not differ in two sexes significantly though males had significantly higher mean SBP and DBP than females. Jajoo et al (12) reported higher prevalence in women (40.60 per thousand verses 28.92 per thousand), Malhotra et al (13) (5.8% verses 3.0%), Goel et al (14) (8.82% verses 5.57%) reported the same. But Gupta et al (15) and Agarwal et al (16) reported higher prevalence in males than females. Whelton (17) reported relative male preponderance below the age of 50 years.

Studies on prevalence of hypertension in rural areas of India(11)								
Study of	**State**	**Study Design**	**Year**	**Age group**	**Hypertension criteria**	**Prevalence(sample size)**		
						Males	**Females**	**Overall**
Malhotra et al	Haryana	Cross-sectional	96-97	16-70	>140/90	-	-	4.5 (2559)
Gilberts et al	Kerala	Cross-sectional	94	>20	>160/95	-	-	1.5 (3760)
Kutty et al	Kerala	Cluster sample	93	>25	>140/90	-	-	8.8 (1130)
Chadha et al	Haryana	Cross-sectional	89	25-64	>160/90	2.9 (1214)	2.8 (2161)	-
Jajoo et al	Maharashtra	Cross-sectional	93	>20	>160/95	2.8 (2247)	4.0 (1798)	-
Kumar & Chaudhary	Rajasthan	Cross-sectional	91	>21	>160/95	4.0 (3742)	3.6 (3098)	-
Hussain	Rajasthan	Cross-sectional	88	>20	>140/90	6.1(2887)	7.3 (2255)	-
Baldwa et al	Rajasthan	Cross-sectional	84	21-60	>160/95	6.9 (447)	8.8 (465)	-
Gupta et al	Haryana	Cross-sectional	77	20-69	>160/95	3.5 (1154)	3.5 (891)	-
Padmavati & Gupta	Rural Delhi	Selected group	59	>20	>140/90	10 (267)	9 (381)	-
Hypertension Study group	Kerala	Cross-sectional	2001	=/>60	>140/90	-	-	55.0

Correlates of hypertension & Blood pressure levels

In the present study, the risk of hypertension increased significantly with increase in age, increase in BMI and waist-hip ratio. Malhotra et al (18), Singh et al (19), Gupta et al (15), Gilberts et al (20) also reported that there is increase in prevalence of hypertension with the advancement of age. Prospective observational cohort studies also showed similar picture (17). Jajoo et al (12), Malhotra et al (18), Singh et al (19), Goel et al (14) And Joshi et al (21) also reported increase in risk of hypertension as BMI increased. Same is the finding when nutritional status was decided by using waist-hip ratio. In the present study, only 5.2% of the population was overweight (BMI > 25.0), 27.0% of the population had waist-hip ratio equal to or more than cut-off (0.9 for males and 0.8 for females). This implies the importance of waist-hip ratio in thin built individuals as central obesity indicated by increased waist-hip ratio has been positively correlated with high blood pressure in several populations(7). We found that the risk of hypertension increased in occupations involving sedentary work as compared to those involving hard work. Agarwal et al (22) also reported that there is direct impact of occupation on hypertension. Though sedentary individuals have increased risk of developing hypertension when compared to their more active and fit peers, the inverse relationship between blood pressure and aerobic physical activity in leisure time persists after adjustment for age, sex, BMI and workplace activity (23). We also found that the risk of hypertension decreased with increased level of education. Though most of the studies documented that hypertension is more prevalent in people with high educational level, such finding is expected in communities where the epidemiological transition is in advanced stage. The risk of hypertension did not differ significantly in smokers and alcohol users though daily drinkers were observed to have SBP and DBP levels higher than once-a-week drinkers, independent of total weekly quantity (24). Hazarika et al (25) reported alcohol use as significant risk factor.

On multivariate analysis, significant correlates of hypertension, in our area were, age, occupation, BMI and waist-hip ratio. The mean blood pressure levels followed the same trends. All these factors need to be considered while designing intervention program in the area.

Grades of hypertension

In the present study, 46.9% of study subjects were pre-hypertensive, 14.3% were with grade I-hypertension and 6.3% were with grade II hypertension as per JNC - VII criteria. The findings can not be compared as there is no other study using JNC - VII criteria in rural India. Hazarika et al (25) reported 17.4% having high normal blood pressure, 29.3% having stage I, 16.4% having stage II, and 14.9% having stage III hypertension as per JNC - VI criteria among tea garden workers. In the present study, 67.5% individuals had blood pressure higher than normal. This has great implications in terms of morbidity and mortality as per the "risk pyramid" concept for blood pressure and coronary heart disease (26). The knowledge regarding distribution of blood pressure is valuable in highlighting the need to lower the blood pressure across the population rather than targeting those at highest risk. Although the relative risk is highest in those identified as having severely elevated blood pressure, there are considerably fewer people in this category than in the group identified as having mildly elevated blood pressure where the relative risk is less. Therefore, the greatest absolute number of complications attributable to high blood pressure occurs at lower levels of elevated blood pressure(7). Reduction in mean blood pressure of community greatly reduces the morbidity as well as mortality associated with hypertension.

Awareness and treatment of hypertension

In the present study, only 13.6% of the hypertensive was aware of their elevated blood pressure status and only 8.7% were taking regular treatment. Majority of these individuals was taking allopathic medicines. Meager 0.7% hypertensive individuals were practicing meditation. Hazarika et al (25) reported that only 13.2% were previously diagnosed and only 4.3% were on treatment. Ahlawat et al (27) reported that 57.7% were aware of the condition but only 59.6% of those who were aware were taking treatment. Hypertension study group (28) reported that only 45% of the hypertensive was aware of their condition and 97% of them were taking the treatment. NHANES III survey reported that 35% of the participants with SBP of or greater than 140 mmHg or a DBP of, or greater than 90 mmHg reported lack of awareness of their raised blood pressure status; only 49% of those with high blood pressure were receiving drug therapy (16). This indicates that the condition is worse than that of rule of halves, which says that only 50% are aware and 50% of those aware are on treatment.

CONCLUSION

As the prevalence of hypertension is high (20.6%) in the area, and more than two-third (67.5%) population has blood pressure higher than normal, an appropriate intervention program shall be launched aimed at reducing the mean population blood pressure (presently 119.08 + 15.68 SBP and 76.85+17.82 DBP) and increasing awareness of population. The intervention needs to keep in mind that the important correlates of hypertension in the area are age, occupation, BMI and waist-hip ratio. BMI and waist-hip ratio are modifiable risk factors. Though occupation is not easy to change, due importance of aerobic physical activity during leisure time shall be recognized, more importantly in population with sedentary occupations.

Moreover, 46.9% of population was having pre-hypertension. Although this is not a disease status, it is essential to identify individuals at high risk of developing hypertension. Making physician aware of the need to advise lifestyle modifications to those falling in this category will go a long way in preventing development of hypertension in people.

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