

Research Article

Prevalence of prehypertension and hypertension in rural area of Amravati District of Maharashtra, India

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ABSTRACT

Background: Hypertension is responsible for 57% of stroke deaths and 24% of coronary heart disease deaths in India. Cardiovascular disease will be the largest cause of death and disability in India by 2020. Hypertension is emerging as a major health problem. The prevalence of hypertension has increased in rural people. The objectives were to find the prevalence of prehypertension and hypertension in rural area of Amravati District and to study association between various factors and hypertension in a rural area.

Methods: A community based cross sectional study was carried out in rural community. 792 study subjects aged 10 years and above were selected using systematic random sampling. A structured pretested schedule was used to collect data regarding demographic characteristics and blood pressure pattern. Mean, Standard Deviation, Chi-square test and ANOVA were used to analyze data.

Results: The prevalence of prehypertension and hypertension was found to be 55.8% and 13.4% respectively. The mean systolic as well as diastolic blood pressure patterns were found to be higher with the increase in age. Older age and increased body mass index were significantly higher among hypertensive compared to normotensive. Factors like tobacco use and alcohol were significantly associated with hypertension.

Conclusions: The prevalence of prehypertension and hypertension was found to be high in rural Amravati.

Keywords: Prevalence, Pre hypertension, Hypertension, Rural study, Screening

INTRODUCTION

Hypertension is a silent and invisible killer that rarely causes symptoms but is an important public health challenge because of its high prevalence and concomitant risk of coronary artery diseases, heart failure, cerebrovascular diseases and chronic renal failure.¹⁻⁴ In India, hypertension is directly responsible for 57% of all stroke deaths, 24% of all coronary heart disease deaths and 10% of all deaths.⁵ The number of hypertensive individuals will double from 118 million in 2000 to 213 million in India by 2025.⁶ The prevalence of hypertension has increased in urban communities as well as in rural people.⁷ This rising epidemic reflects the profound changes in society and in behavioral Patterns of

communities over recent decades. Among NCDs, Hypertension, with all its variegates, affects the entire spectrum of the population, including men, women, and even the children.⁸

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) defines hypertension as blood pressure >140/90 mmHg. Persons with blood pressure above optimal levels, but not clinical hypertension (systolic blood pressure of 120-139 mm Hg or diastolic blood pressure of 80-89 mm Hg), are defined as having "prehypertension".⁹ Persons with pre-hypertension have a greater risk of developing hypertension than do those with lower blood pressure levels.¹⁰ In addition, pre-

hypertension is associated with increased risk of major cardiovascular events, independent of other cardiovascular risk factors. There are only a few studies from India on the prevalence for prehypertension especially from rural areas. Epidemiological studies to assess the prevalence of prehypertension and hypertension are urgently needed to determine the baseline against which future trends in risk factor levels can be assessed and preventive strategies planned to promote health among the populations. The literature on prevalence of prehypertension and hypertension in Amravati was scarce, thereby the present study was undertaken to provide the data on the prevalence of prehypertension and hypertension amongst individuals aged 10 years and above residing in rural areas of Amravati District. Such study would address the paucity of data regarding hypertension in a rural area and to timely institute preventive measures to decrease the harmful effects of hypertension.

Objectives

1. To find the prevalence of prehypertension and hypertension in rural area of Amravati District.
2. To study association between various factors and hypertension in a rural area.

METHODS

Study design and the participants

This six months cross-sectional epidemiological study was carried out amongst individuals aged 10 years and above residing in the field practice area of Rural Health & training Centre, Ner Pinglai of District Amravati which is a field practice area under the Department of Community Medicine of our medical college. Stratified random sampling and Probability Proportionate to Size technique was used to select the study subjects. All villages in the study area were primary sample units (PSU) i.e. strata. All adults aged 10 years and above from the PSUs selected formed sampling units. We included adolescent age (10 to 19 Years) group, as this age group is not routinely studied and screened for hypertension so we tried to get the insight into this age group as well.

Data collection

This study was conducted between 1st December 2014 to 30th May 2015. A total of 792 individuals gave consent and participated in the study. A structured pretested schedule was used to collect data regarding socio-demographic characteristics (age, gender, occupation and education) and blood pressure pattern. 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. 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) as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VII) criteria.¹¹ Anthropometric measurements height and were recorded as per standard guidelines laid down by World Health Organization (WHO).¹² Using height and weight, Body Mass Index (BMI) was calculated and subjects were classified into categories of normal and overweight based on their BMI value.¹³

Inclusion criteria

All individuals aged 10 years and above, who resided in the villages situated near the Rural Health Training Centre.

Exclusion criteria

1. Patients who were non cooperative or refused to provide the necessary information were excluded from the study.
2. Those individuals who were already diagnosed hypertensives and were taking anti hypertensive therapy were excluded.

Sample size calculation

Considering the prevalence rate of hypertension approximately 25 per cent from a prior study and population of study area approximately 29950 at 95% confidence level with design effect 1 sample size calculated 792 by using Open epi software.

The following formula was used Sample size $n = [DEFF * Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p*(1-p)]$ Sample size came out to be 792. A total of 792 individuals gave consent and participated in the study. Ethical approval for the study was obtained from the institutional ethical committee.

Data entry and statistical analysis were performed using the Statistical Package of Social Sciences (SPSS) windows version 16.0 software. Mean, Standard Deviation, Chi-square test, Student's t test and ANOVA were used to analyze data.

RESULTS

Sixty five percent of respondents were aged 60 years and above age groups, 59% were males and 41 % were female. As per JNC VII criteria, 30.8% respondents were normotensives, 55.8% respondents were found to be pre-hypertensive while 9.3% and 4% respondents were in stage I and II of hypertension respectively, p value <0.001 (Table 1 & 2).

Table 1: Distribution of respondents according to age & sex.

| Age group (Years) | Male n=468 N (%) | Female n=324 N (%) | Total n=792 N (%) |
|-------------------|---------------------|-----------------------|----------------------|
| 10-19 | 28 (6.0) | 30 (9.3) | 58 (7.3) |
| 20-29 | 30 (6.4) | 24 (7.4) | 54 (6.8) |
| 30-39 | 25 (5.3) | 42 (13.0) | 67 (8.5) |
| 40-49 | 40 (8.5) | 23 (7.1) | 63 (8.0) |
| 50-59 | 22 (4.7) | 15 (4.6) | 37 (4.7) |
| 60 + | 323 (69.0) | 190 (58.6) | 513 (64.8) |

Table 2: Gender wise distribution of respondents according to blood pressures as per JNC-VII criteria.

| Gender | Normal | Prehypertension | Stage I Hypertension | Stage II Hypertension |
|--------------|------------|-----------------|----------------------|-----------------------|
| | N (%) | N (%) | N (%) | N (%) |
| Male n=468 | 118 (25.2) | 283 (60.5) | 42 (9.0) | 25 (5.3) |
| Female n=324 | 126 (38.9) | 159 (49.1) | 32 (9.9) | 7 (2.2) |
| Total n=792 | 244 (30.9) | 442 (55.8) | 74 (9.3) | 32 (4.0) |

Chi Square =21.04 df 3 P < 0.001

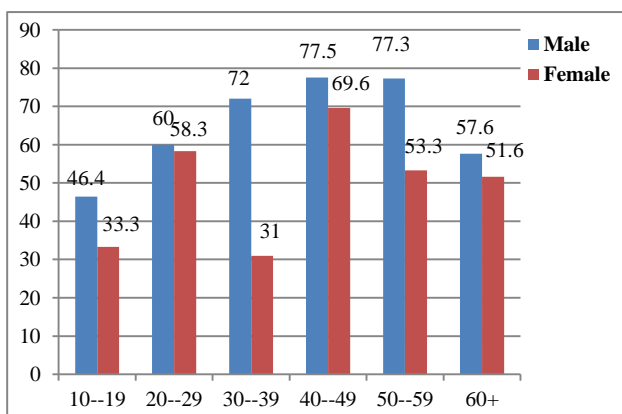


Figure 1: Gender wise distribution of prehypertension.

Figure 1 shows prevalence of pre-hypertension. It was 55.8%, higher in males (60.5%) than females (49.1%). This difference was highly significant (p< 0.001). The prevalence of pre-hypertension increased with age from

59.1% at the age of 20 – 29 years to 74.6% at 40 – 49 years and then dipped to 55.4% at the age of 60 years and above. Similar trend was seen in females. (Figure 1 & 2) The Overall 13.4% respondents were found hypertensive. The mean blood pressures were 124 ± 14.2 / 81.05 ± 9.94 mm Hg respectively. The proportion of hypertension showed an increasing trend with the increase in age. The Mean SBP and DBP also showed an increasing trend with age this difference was found statistically highly significant (p<0.001) (Table 3). The proportion of hypertension (14.3%) was found to be slightly higher among males as compared to that in females (12%). The Mean SBP and DBP observed in men was 125.5 ± 14.4/82.3 ± 9.76 mm Hg and in women 121.8 ± 13.54 /79.11 ± 9.90 mmHg respectively, the difference was found statistically highly significant (p<0.001) (Table 4).

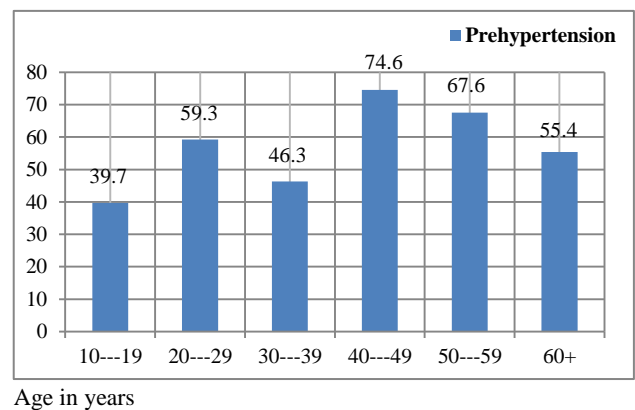


Figure 2: Age specific distribution of blood pressure levels.

Table 3: Age wise distribution of individuals identified with hypertension.

| Age group (years) | No | Hypertensive N (%) | Mean SBP mmHg | Mean DBP mmHg |
|-------------------|-----|--------------------|---------------|---------------|
| | | | Mean ±SD | Mean ±SD |
| 10-19 | 58 | 1(1.7) | 113±9.68 | 73.4±7.95 |
| 20-29 | 54 | 2(3.7) | 118.8±10.3 | 78.63±7.93 |
| 30-39 | 67 | 3(4.5) | 117.5±11.9 | 77.13±7.97 |
| 40-49 | 63 | 4(6.3) | 125.1±10.8 | 79.3±7.44 |
| 50-59 | 37 | 2(5.4) | 122.9±11.5 | 78.3±9.14 |
| 60 + | 513 | 94 (18.3) | 126±14.8 | 83.08±10.2 |
| Total | 792 | 106 (13.4) | 124±14.2 | 81.05±9.94 |
| F Value | | | 16.0 | 16.1 |
| P value | | | 0.001 | 0.001 |

The study subjects were categorized into various grade based on BMI according to WHO International Standard¹¹ prevalence of overweight was 28.5%. Thirty nine percent hypertensive was found to be overweight. Hypertension was not solely restricted to the overweight individuals and was also seen in study subjects who had a normal BMI but there was statistically significant

difference between hypertension and BMI. ($p < 0.05$) (Table 5).

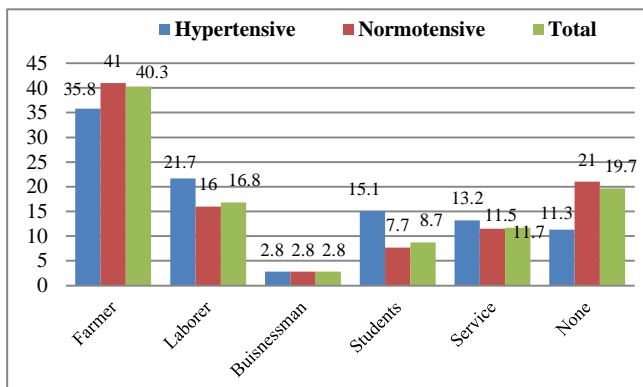
Table 4: Distribution of hypertensive according to mean systolic & diastolic blood pressure.

| Gender | Subject | Hyper tensive | Mean SBP mmHg | Mean DBP mmHg |
|--------|---------|---------------|---------------|---------------|
| | N (%) | N (%) | N (%) | N (%) |
| Male | 468 | 67 (14.3) | 125.5± 14.4 | 82.3± 9.76 |
| Female | 324 | 39 (12) | 121.8± 13.54 | 79.11± 9.90 |
| Total | 792 | 106 (13.4) | 124±14.2 | 81.1±9.9 |
| t | | | 3.6 | 4.6 |
| p | | | 0.001 | 0.001 |

Table 5: Distribution of study subjects according to BMI. (kg/m^2).

| BMI (kg/m^2) | Normot-ensive n=686 | Hypert-ensive n=106 | Total n=792 |
|-----------------------------------|---------------------|---------------------|-------------|
| | N (%) | N (%) | N (%) |
| < 18.5 kg/m^2 | 31 (4.5) | 2 (1.9) | 33 (4.2) |
| 18.5-24.99 kg/m^2 | 470 (68.5) | 63 (59.4) | 533 (67.3) |
| >25 kg/m^2 | 185 (27.0) | 41 (38.7) | 226 (28.5) |

Chi square =7.2 df =2 $p < 0.05$



$X^2 = 12.65$ df 5 $p < 0.05$

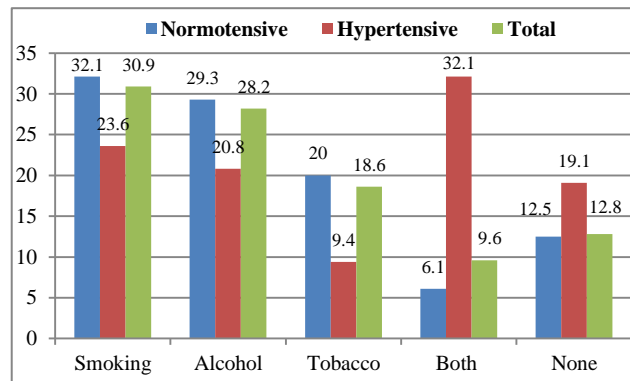
Figure 3: Distribution of hypertensive according to occupation.

40.3% of the study subjects were farmer by occupation followed by 28.4% of the subjects were having no occupation, which meant either they were unemployed or retired persons or housewives or students and were not contributing economically to the family, followed by cultivation (18.2%), laborers (16.8%), business (2.8%) & service (government or private) (11.7%). 35.8% of the Farmers are having Hypertension followed by laborer, housewife and others the difference was found to be statistically significant. It may be because of no

satisfactory crops since last three years farmers are in economic crisis (Figure 3).

Figure 4 shows that 245 (30.9%) subjects having habits of smoking and 54 (18.18%) were consuming alcohol 223 (28.2%) and 147 (18.6%) were chewing tobacco. 76 (9.6%) were having both habits. Risk factor like Smoking cigarette, tobacco use and alcohol were significantly associated with hypertension ($p < 0.001$).

Figure 4: Association of habit with hypertension.



Chi square =74 df 4 $p < 0.001$

DISCUSSION

Using the JNC VII Criteria among the age group 10 years and above in our study we found a prevalence of hypertension was 13.3%. The proportion of hypertension (14.3%) was found among male and 12% among female. The prevalence of hypertension in India was reported as ranging from 10 to 30.9%.¹⁴ Similar prevalence of hypertension (13.3%) has reported in the other study by Kumar et al (13.17%), vinay et al (12.75%), Midha et al (14.50%).¹⁵⁻¹⁷ However some studies showed lower prevalence than present study. Rao et al (4.89%), Madhukumar et al (8.06%), Thrift et al (11.40%), Ghosh et al (11.43%).¹⁸⁻²¹ However higher prevalence than present study was observed by Parekh et al (20.40%), Basu and Biswas (21.90%), Yuvaraj et al (18.30%), Bhardwaj et al (15.40%), study by Pooja & Mittal (33.20%) and Meshram et al (23%)²²⁻²⁷ (Figure 5).

In the present study the prevalence of hypertension was more among male than females (14.3% & 12%). Similar finding reported by Yuvaraj et al greater proportion of hypertension was observed among males (19.10%) as compared to females (17.50%) among rural population of Davanagere.²⁴ Bhardwaj, et al reported 41.60% in male & 34.60% in female) and Meshram, et al reported (27.70% & 19.30%).^{25,27} So it is clear that in some regions of India hypertension is more prevalent among males than females. Blood pressure rises with age in both sexes and rise in those with higher initial blood pressure. Age probably represents an accumulation of environmental influences and the effects of genetically programmed senescence in body systems. Early in life there is a little evidence of difference in blood pressure between the

sexes. However at adolescence men display a higher average level. This difference was most evident in young and middle aged adults late in life the difference narrows and the pattern may even reverse.

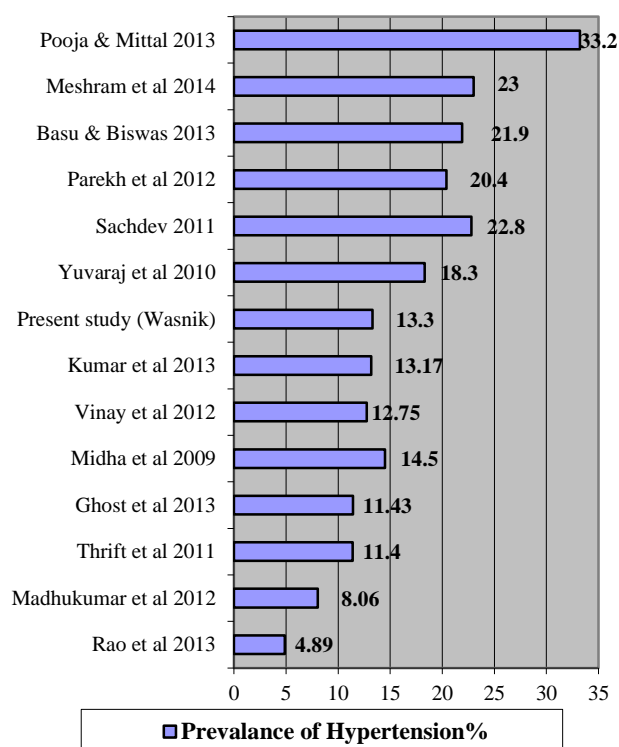


Figure 5: Showing comparative prevalence of hypertension in rural area with other studies.

On the other hand among rural adults, the highest prevalence (50.50%) of hypertension was reported in the population of Nicobar Island²⁸ and the lowest (4.50%) in the population of Haryana.²⁹ These differences in the prevalence of hypertension in these studies might be due to the variation in socio-economic status, lifestyle, genetic make-up and biological diversity.

It can be concluded from the present study that the prevalence of hypertension in both sexes and in rural populations is increasing at an alarming rate. If this increasing trend in the prevalence of hypertension would go with the same pace then after few years more than fifty percent population of India would be under the trap of cardiovascular diseases. The effective control and hypertension in India will require a centralized campaign with policy strategies applied at multiple levels. Thus, there is an urgent need to develop suitable strategies for prevention of hypertension in India.

The high prevalence of prehypertension (55.8%) confirms this increasing trend. It was higher in males (60.5%) than females (49.1%). The prevalence of prehypertension increased with age from 59.1% at the age of 20 – 29 years to 74.6% at 40-49 years and then dipped to 55.4% at the age of 60 years and above. Similar

finding reported by Bhardwaj Sumit D et al, his study showed that around half of the population was in pre HTN group (44.7%). The prevalence of pre HTN was more in younger population.³⁰ Low prevalence of prehypertension (18.8 per cent) has reported in the study by Kokiwar PR in a rural community of central India.³¹ Persons with pre-hypertension have a greater risk of developing hypertension than do those with lower blood pressure levels. In addition, pre-hypertension is associated with increased risk of major cardiovascular events, independent of other cardiovascular risk factors. Hypertension itself implies a disorder initiated by tension or stress. Since stress is nowhere defined, the hypothesis is untestable. However it is an accepted fact that psychosocial factors operate through mental processes, consciously or unconsciously, to produce hypertension. Virtually all studies on blood pressure and catecholamine levels in young people revealed significantly higher noradrenaline level in hypertensive than normotensive.

The Mean SBP and DBP observed in men was $125.5 \pm 14.4/82.3 \pm 9.76$ mm Hg and in women $121.8 \pm 13.54 / 79.11 \pm 9.90$ mmHg respectively. The proportion of hypertension as well as mean systolic and diastolic blood pressures was found to increase steadily with the increase in age. These findings are coherent with those reported in the study conducted among urban and rural adults of Lucknow.¹⁷ Such changes of blood pressure with age might be due to changes in vascular system. Cross-sectional surveys, as well as prospective observational cohort studies, have consistently demonstrated a positive relation between age and blood pressure in most populations with diverse geographical, cultural and socioeconomic characteristics.³² In our study we found that increased body mass index was significantly associated with hypertension. Similar findings were reported by Yadav S et al.³³ Also tobacco and alcohol was significantly associated with hypertension in the study population. Similar finding was reported by Malhotra P et al.³⁴ Farmers were having higher risk of hypertension than others occupation's probably reasons may be no satisfactory crops since last two to three years they are in economic crisis.

CONCLUSIONS

Prevalence of Prehypertension and Hypertension was found to be highly prevalent in rural area of Amravati District. If this increasing trend in the prevalence of hypertension would go with the same pace then after few years more than fifty percent population of India would be under the trap of cardiovascular diseases.

Limitation

A major limitation of the study was that the blood pressure pattern estimates were based on measurement of blood pressure on a single day and were not repeated again for practical reasons.

Recommendation

This study projects the need of early detection of hypertension which can be facilitated by periodic screening of high risk groups regularly at hospital as well as community level. Counseling of the pre-hypertensives and hypertensive on lifestyle modification as well as regular treatment of antihypertensive medicine and its role in controlling hypertension.

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REFERENCES

- Rao DP, Sigamani MA. Prevalence, risk factors and awareness of hypertension in India: a systematic review. *Journal of Human Hypertension*. 2013;27,281-7.
- Garg KA, Kanandaliyanage RA. Hypertension in the South-East Asia region: an overview. *Regional Health Forum*. 2013;17:7-14.
- Campbell MS, Chockalingam NA. Time to effectively address hypertension in India. *Indian Journal of Medical Research*. 2013;131:627-31.
- El-Din AZS, Erfan M. Prevalence of prehypertension and hypertension in a sample of Egyptian adults and its relation to obesity. *Australian Journal of Basic and applied Sciences*. 2013;6(13):481-9.
- Patel V, Chatterji S, Chisholm D, Ebrahim S, Gopalakrishna G, Mathers C. Chronic diseases and injuries in India. *Lancet*. 2011;377:413-28.
- Reddy SS, Prabhu GR. Prevalence and risk factors of hypertension in adults in an urban slum, Tirupati, Andhra Pradesh. *Indian Journal of Community Medicine*. 2005;30:84-6.
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL. The Seventh Report of the Joint National Rodgers A, Lawes C, MacMahon S. Reducing the global burden of blood pressure related cardiovascular disease. *J Hypertens*. 2000;18:S3-6.
- Verma M, Rajput M, Swaroop S. Prevalence of Hypertension and Its Association with Different Anthropometric Variables Among Adults In Rural Areas Of North India; *International Journal of Research and Development in Pharmacy and Life Sciences*. 2015;4,(5):1775-83.
- Gupta Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 Report. *JAMA*. 2003;289:2560-72.
- Greenlund KJ, Croft JB, Mensah GA. Prevalence of heart disease and stroke risk factors in persons with prehypertension in the United States. *Arch Intern Med*. 2004;164:2113-8.
- JNC VII Express: Prevention, detection, evaluation and treatment of high blood pressure. In: <http://www.nhlbi.nih.gov/guidelines/hypertension/express.pdf>. 2003. Accessed on 15th November 2009.
- World Health Organization: Physical status: The use and interpretation of anthropometry: WHO Tech Rep Series. 1995;854:424-38.
- The International Classification of underweight, overweight and obesity according to BMI Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004.
- Padmavati S. A meta-analysis-National Heart Institute, New Delhi. *Ind Heart J*. 2002;54:99-102.
- Kumar K, Kothari RP, Kothari K, Garg S, Khandelwal MK, Gupta R. Prevalence of hypertension in an urban and rural area of Jaipur district. *International Journal of healthcare and Biomedical Research*. 2013;1:120-6.
- Vinay KA, Swati M, Rajesh L, Vinod V, Amol G, Choudhari SG. Prevalence of hypertension in the rural community of Central Maharashtra, India. *International Journal of Medicine and Public Health*. 2013;2(2):39-45.
- Midha T, Idris MZ, Saran RK, Srivastav AK, Singh SK. Prevalence and determinants of hypertension in the urban and rural population of North India district. *East African Journal of Public Health*. 2009;6(3):268-73.
- Rao PC, Venkatramana P, Annaiah P, Reddy PC. Prevalence and predictors of hypertension in an ethnic population of South India. *Anthropologist*. 2013;15:193-7.
- Madhukumar S, Gaikwad V, Sudeepa D. An epidemiological study of hypertension and its risk factors in rural population of Bangalore rural district. *Al Ameen Journal of Medical Sciences*. 2012;3:264-70.
- Thrift AG, Evans RG, Kalyanram K, Kartik K, Fitzgerald SM, Srikant V. Gender-specific effects of caste and salt on hypertension in poverty: A population based study. *Journal of Hypertension*. 2011;29(3):443-50.
- Ghosh A, Sarkar D, Mukherji B, Pal R. Prevalence and risk correlates of hypertension among adult rural population of Bihar. *Asian Journal of Biomedical and Pharmaceutical Sciences*. 2013;6:71-5.
- Parekh A, Parekh M, Vadasmiya D, Kumar A. Study of prehypertension and hypertension in rural

- area of Vadodara district. *International Journal of Medical Science and Public Health.* 2012;2(1):117-20.
23. Basu G, Biswas S. Epidemiology of Hypertension and its risk factors in a village of West Bengal. *Indian Journal of research and reports in Medical Sciences.* 2013;3.
 24. Yuvaraj BY, Nagendra GMR, Umakantha AG. Prevalence, awareness, treatment and control of hypertension in rural area of Davanagere. *Indian Journal of Community Medicine.* 2010;35(1):138-41.
 25. Bhardwaj SD, Umesh S, Mamta S, Jyoti KR, Prakash BR. Prevalence, awareness, treatment and control of hypertension among people above 15 years in rural area of Nagpur, Maharashtra- A cross-sectional study. *National Journal of Community Medicine.* 2012;3(2):213-7.
 26. Pooja & Mittal Y. Prevalence of hypertension among rural population of Doiwala Block, Dehradun, Uttarakhand, India. *Recent Research in Science and Technology.* 2013;5(1):21-4.
 27. Meshram II, Laxmaiah A, Mallikharjun RK, Arlappa N, Balkrishna N, Reddy CG. Prevalence of hypertension and its correlates among Adult Tribal Population (≥ 20 years) of Maharashtra state, India. *International Journal of Health Sciences and Research.* 2014;4(1):130-9.
 28. Manimunda SP, Sugunan AP, Benegal V, Balakrishna N, Rao MV, Pesala KS. Association of hypertension with risk factors and hypertension related behaviour among the aboriginal Nicobarese tribe living in car Nicobar Island, India. *Indian Journal of Medical Research.* 2011;133:287-93.
 29. Malhotra P, Kumari S, Kumar R, Sharma BK. Prevalence of hypertension in an unindustrialized rural population of North India. *Journal of Human Hypertension.* 1999;13:467-72.
 30. Bhardwaj SD, Sinha U, Shewte MK, Khadse JR, Bhatkule P. Prevalence, Awareness, Treatment And Control Of Hypertension Among The People Above 15 Years in Rural Area Nagpur Maharashtra - A Cross Sectional Study. *National Journal of Community Medicine.* 2012;3,(2):213-21.
 31. Kokiwar PR, Gupta SS, Durge PM. Prevalence of Hypertension in a Rural Community of Central India. *Int J Biol Med Res.* 2011;2(4):950-3.
 32. Hypertension control. Technical Report Series: World Health Organization; 1996. Report No.: 862.
 33. Yadav S, Boddula R, Genitta G, Bhatia V, Bansal B, Kongara S. Prevalence and risk factors of prehypertension and hypertension in an affluent north Indian population. *Indian J Med Res.* 2008;128:712-20.
 34. Malhotra P, Kumari S, Kumar R, Jain S, Sharma BK. Prevalence and determinants of hypertension in an un-industrialised rural population of North India. *J Hum Hypertens.* 1999;13(7):467-72.

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