

A Study on Association of Non Communicable Diseases Risk Factors and Prehypertension in Garhwal Region of North India

Deep Shikha^{1*}, Jayanti Semwal^{3*}, A.K.Srivastava^{3*}, Shaili Vyas^{2*}, Ruchi Juyal^{3*}, Hemchandra Sati^{4**}

¹Assistant Professor, ²Associate Professor, ³Professor, ⁴Statistical Assistant,
*Department of Community Medicine, HIMS, SRHU, Jolly Grant, Dehradun-248140
**AIIMS, New Delhi

Corresponding Author: Deep Shikha

ABSTRACT

Introduction: The term ‘prehypertension’ (pre - HT) was coined in 1939 in the context of early studies that linked high blood pressure recorded for life insurance purposes to subsequent morbidity and mortality. Pre-HT is not a disease category; however, pre hypertensive subjects are known to be at high risk for developing hypertension, and even slightly elevated BP increases cardiovascular risk.

Materials & methods: Community based descriptive cross sectional study. The estimated total sample size was 632. “Kish” method was applied in each selected household for the selection of study subjects who were in the age group of 21-60 years. WHO STEPS methodology, (NCD Risk Factor Surveillance) was used to gather necessary information at household and individual level. SPSS 22.0 version was used for data analysis. Percentage, Chi square, & Risk (Odds Ratio) was estimated at significant level $p < 0.05$.

Results: Prevalence of normotension (NT) was 47.5%, while that of prehypertension (pre-HT) was 33.4% and hypertension (HT) was 19.1%. The prevalence of pre – HT and HT both continued to increase progressively with the increasing age & BMI. Overweight and obesity were the most significant determinants of pre –HT even at the level of more than 23 Kg/m². Stress and a family history of hypertension in both parents were other pre determinants of pre – HT.

Conclusion: In conclusion, our the study provides important information on the high burden of cardiovascular risk factors such as prehypertension, overweight and stress, in an apparently healthy adults.

Key words: Prehypertension, WHO STEPS, Kish method.

INTRODUCTION

The term ‘prehypertension’ (pre - HT) was coined in 1939 in the context of early studies that linked high blood pressure recorded for life insurance purposes to subsequent morbidity and mortality. [1] There was increased risk of not only developing hypertension among individuals but also early death from cardiovascular related diseases because of prehypertension

i.e. having blood pressure reading of $>120/80$ mmHg, but $<140/90$ mmHg. This observation has been confirmed by a number of studies. [1-3] It was demonstrated by meta-analysis of approximately 1 million individuals from 61 long-term epidemiological studies that for each 20 mmHg increase in systolic blood pressure or 10 mmHg increase in diastolic blood pressure over 115/75 mmHg, there was a

two-fold increase in mortality associated with coronary artery disease and stroke. [4] Based on this context, in 2003, the Seventh Report of the Joint National Committee (JNC-VII) on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure coined a new category of prehypertension (pre-HT) in their list. [5] The National Health and Nutrition Examination Survey (NHANES) 1999-2000 reported the overall prevalence of prehypertension as 31% all over the world, while in disease-free adult (NHANES participants) it was found to be 36.3%. [6,7]

Several studies have reported high prevalence of prehypertension ranging from 31% to 60% with more prevalence among males than females. [8-12]

There are some studies to show that prevalence of pre hypertension and cardiovascular disease is rapidly increasing in India. A survey conducted in nine States of India, by the National Nutrition Monitoring Bureau, reported the pooled estimate of prehypertension in rural men to be about 45 per cent. [13] A few studies from different regions of India have also indicated the prevalence of pre hypertension in the range of 40-60%. [14-15] Pre-HT is not a disease category; however, these subjects are known to be at higher risk for developing Hypertension, and even slightly elevated blood pressure increases cardiovascular risk. [16]

Many studies have shown that prevalence of pre hypertension and cardiovascular disease is rapidly increasing in India. The risk of cardiovascular disease in the individuals with prehypertension was also observed to increase with concomitant burden of other risk factors such as hypertension, obesity, diabetes, and dyslipidaemia. Even at the current stage, the magnitude of the problem is large enough to demand urgent attention and action. Thus an initiative is taken to estimate the prevalence of pre -hypertensive and its association with other risk factors such as overweight and diabetes. This cross-sectional study will also help in recommending designing strategies

for the control and prevention of cardiovascular diseases.

METHODOLOGY

Study Design

A Community based descriptive cross sectional study was planned. Based on prevalence of non communicable diseases as 41% (WHO survey on prevalence of NCDs done in 2004) [17] and using formula: $n = 4pq/d^2$ the sample size estimated was 575. Assuming that there will be a non response rate of 10%, the total sample size came out to be 632.

Sampling procedure

Multistage systematic random sampling was used for the selection of study area. From urban area, out of three, one nagarpalika (Rishikesh) was chosen & from rural area, out of six blocks, Doiwala block was purposively chosen for the study as they formed the rural & urban field practice area of the department of community medicine from district Dehradun. Doiwala block comprises of five Nyaypanchayat, out of which one Nyaypanchayat (Markham Grant) was selected randomly. Two villages which comprised 10% of the total villages in Markham Grant & two wards from Rishikesh nagarpalika (10%) were randomly selected to achieve the required sample population.

Study population and selection of study subjects: A line listing of houses in study areas was done with the help of local leader & health worker. Every k^{th} house in the area formed the study house which was selected by systematic random sampling & sampling interval. After explaining the purpose of the study and getting informed written consent "Kish" method was applied in each selected household for the selection of study subjects who were in the age group of 21-60 years. Pregnant and lactating women were however excluded from the study.

The survey questionnaire - one at household level and another at individual level based on WHO STEPS [18] methodology for NCD Risk Factor Surveillance was used to gather

the necessary information at household and individual level.

Anthropometry: Standing height was taken with the help of a portable stadiometer. The head was so positioned that the participant looks directly forwards with the Frankfurt plane and it was recorded to the nearest centimetre. Bathroom scale was used to measure weight of the participant wearing minimal clothing to the nearest 0.1 kg. BMI (weight in Kg/Height in metre²) was classified as per the recommendation of WHO, International Association for the study of obesity and the international obesity task force.^[19] BMI was categorized as <23.0 Kg/m², 23-24.9 Kg/m², 25-26.9 Kg/m², 27-29.9 Kg/m² and ≥ 30 Kg/m². The blood pressure was recorded using the

calibrated Welch Allyn aneroid BP instrument, placed on right arm of the subject after a seated 15 min rest. The subject was classified as normotensive (NT) (SBP/DBP ≤120/80 mm Hg), Pre HT (SBP 120 -139 mm Hg and diastolic 80-89 mm Hg), hypertension (HT) (SBP/DBP ≥ 140/90 mm Hg or taking medication for HT)⁵.

Statistical analyses

Data thus collected was compiled, tabulated and analysed using SPSS 22.0 version. Percentages were calculated for all the variables while Chi square was applied for categorical variables. Risk (Odds Ratio) was estimated to show strength of association. Significant level was set at p<0.05.

RESULTS

Table 1. Prevalence of prehypertension and hypertension according to different age group

Age Group	Males	Females	Total	Prehypertension (pre -HT)		Hypertension (HT)	
				No.	%	No.	%
21-30	67	117	184	58	31.5	12	7.0
31-40	61	86	147	48	32.7	16	10.9
41-50	49	66	115	42	36.4	25	21.7
51-60	77	109	186	63	34.0	68	36.6
Total	254	378	632	211	33.4	121	19.1

Table 1 shows the distribution and prevalence of pre hypertension and hypertension among the study subjects in different age groups. There were a total of 632 study subjects in the present study of which 254 were males and 378 were females. In the total subjects, prevalence of normotension (NT) was 47.5%, that of prehypertension (pre-HT) was 33.4% and that of hypertension (HT) was 19.1%. The prevalence of pre hypertension increased upto age of 50 years and then declined whereas prevalence of hypertension increased progressively with age.

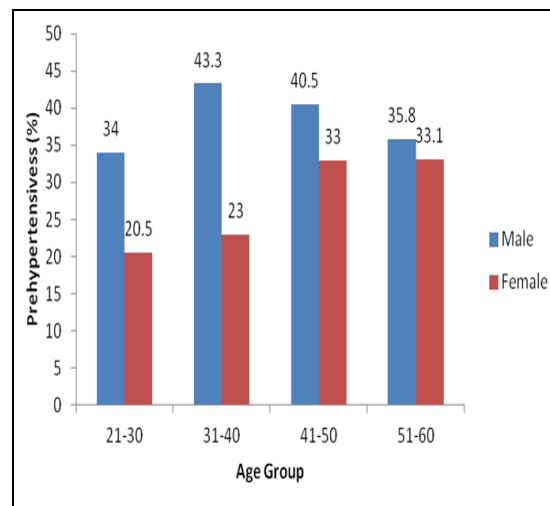


Figure 1. Prevalence of pre hypertensives (%) according to different age groups and sex

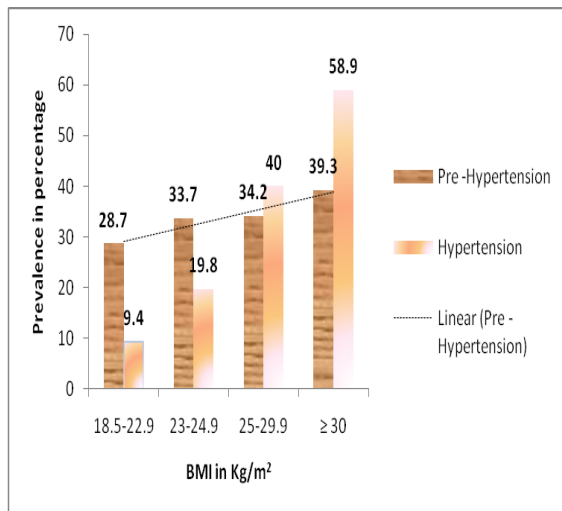


Figure 2. Prevalence of Pre – HT and HT according to BMI (Kg/m²)

Figure 1 depicts the prevalence of pre hypertension in different age groups according to sex. In males, while the prevalence of pre –HT increases upto the age of 40 and then decreases, in females however, the prevalence of pre –HT continued to increase as the age increases.

Figure 2 depicts the prevalence of pre –HT and HT according to BMI (Kg/m²). The prevalence of pre – HT and HT both continues to increase progressively with the increased BMI.

Table 2. Odds ratio of Pre – HT Vs NT among the study subjects

Variables	OR	Confidence Interval	p - value
Age (>40years)	1.26	0.76-2.07	0.35
BMI (Kg/m ²)			
< 22.9	1		
23-24.9	2.37	1.23-4.54	< 0.001
25-29.9	4.99	2.90-8.59	<0.0001
≥ 30	6.21	1.95-6.50	<0.0001
Current smokers	1.76	1.07-2.89	0.02
Stress	4.55	3.20-6.48	<0.0001
Alcohol drinkers	1.42	1.20-1.67	< 0.001
Family History			
None	1		
Father/Mother	1.46	0.84-2.16	0.50
Both	2.01	1.05-3.47	p < 0.001

Determinants of prehypertension in terms of relative risk (odds ratio) are shown in table 2. Overweight and obesity were the most significant determinants of pre –HT even at the level of more than 23 Kg/m². Stress and a family history of hypertension in both parents were other pre determinants of pre – HT.

DISCUSSION

The prevalence of pre hypertension in the present study was 33.4% as per JNC-VII classification. Hsia et al in their study found a little more prevalence of pre hypertensives i.e. 40.3% among Asian women. [20] Epidemiological data from National Health and Nutrition examination survey, USA estimated the prevalence of prehypertension to be 31% which was in accord with our study. [6] In a study among young Israeli adult population the prevalence of prehypertension has been estimated to be 50.6% in males and 35.9% in females. [21] In another study by Winegarden, Relative Risk (RR) for an individual becoming a hypertensive from prehypertensive status was being calculated. He divided prehypertension group into two subcategories namely, normal (120–129 systolic and/or 80–85 diastolic) and high normal (130–139 systolic and/or 86–89 diastolic). He estimated RR for the "normal" subcategory as 2.0 (95% CI, 1.6, 2.6) and for "high normal" as 2.9 (95% CI, 2.3, 3.7). [22] In the present study, the main determinants of pre –HT were increasing BMI, stress and family history of HT. Even being slightly overweight was positively associated with pre – HT.

A longitudinal Strong Heart study reported that pre hypertensive subjects had a 3.2 times higher risk of developing hypertension and 1.7 times higher risk for developing CVD than NT subjects. [23] Most of the pre-hypertensives have at least one additional risk factor such as overweight which is known to increase the cardiovascular risk. Earlier studies have also indicated that prehypertension generally coexists with other risk factors. BMI threshold level was associated with increased risk of pre –HT in the present study, but the BMI level was lower than that of western population. Other studies from India have also indicated that increasing age, BMI, waist hip ratio and impaired glucose tolerance/diabetes were independent risk factors for hypertension and prehypertension. [24] The prevalence of pre –

HT in subjects whose BMI was ≥ 25.0 Kg/m² was lower in the present study than that in NHANES (34.2% vs 63.9%).^[6] NHANES II data from the United States showed that 90 per cent of individuals with prehypertension had at least one or other cardiovascular risk factor.^[25] Israeli et al found that the BMI is the strongest modifiable predictor of prehypertension.^[26]

Smoking and alcohol were however negative determinant in the present study which could be due to under-reporting of these behaviours. Moderate alcohol drinkers were associated with increased risk of pre-HT in the present study. International School of Salt and Blood Pressure (INTERSALT) also found that high alcohol intake (three or four drinks per day (300 ml)) led to high blood pressure.^[27] The correlation between moderate alcohol use and elevated blood pressure however needs further evaluation.

It is well documented fact that a family history of hypertension in one or both parents is a major risk factor for HT. Having both hypertensive parents was a stronger determinant of developing HT. Hahn et al reported that parental history was related to higher BP in females, while Goldstein et al reported that elevated BP measured by ambulatory monitoring was related to family history of HT in both parents in males, but there was no association in females.^[28,29] Our finding indicates that family history of HT in both parents is a major determinant of pre – HT (OR 4.55 , 95% CI 3.20,6.48;).

Anger and Stress were another risk factors associated with development of pre HT in the present study. Player et al assessed the association of anger and long term psychosocial stress with progression from prehypertension to hypertension and resulting coronary artery disease and death.^[30]

There were certain limitations of the study. First, the cross-sectional design of the study does not allow any inference to be drawn with respect to the causal relationship among variables. Secondly, the study

sample was a select age group of adults and the findings may not be generalized to the whole population. Thirdly, though it is speculated that job related stress may be one of the causes of high prevalence of prehypertension, the factors causing stress needs to be evaluated in detail. In addition, the sample size of the present study was calculated keeping in mind all factors related to NCDs, which is probably not suitable for a highly prevalent problem of prehypertension. The conclusions of the study, therefore, need to be interpreted with caution.

In conclusion, our the study provides important information on the high burden of cardiovascular risk factors such as prehypertension, overweight and stress, in an apparently healthy adults. There was sex related differences in the prevalence of pre HT in our study. Lifestyle modifications such as increased physical activity along with reducing the intake of saturated fats and salt in diet and quitting smoking and alcohol intake can achieve a downward shift in the overall blood pressure.

ACKNOWLEDGEMENT

Authors are very much thankful to the HIMS, SRH University for providing support services and infrastructures for the study.

Conflict of interest: None

REFERENCES

1. Vasan RS, Larson MG, Leip EP, Evans JC, O'Donnell CJ, Kannel WB, et al. Impact of high normal blood pressure on the risk of cardiovascular disease. *N Engl J Med.* 2001; 345:1291–7.
2. Pimenta E, Oparil S. Prehypertension: epidemiology, consequences and treatment. *Nat Rev Nephrol.*2010; 6:21–30.
3. Robinson SC, Brucer M. Range of normal blood pressure: a statistical and clinical study of 11,383 persons. *Arch Intern Med.* 1939; 64:409–44.
4. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R: Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of

- individual data for one million adults in 61 prospective studies. *Lancet* 2002; 360:1903-1913.
5. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; 289:2560-2572.
 6. Y. Wang and Q. J. Wang, "The prevalence of prehypertension and hypertension among US Adults According to the New Joint National Committee Guidelines: new challenges of the old problem". *Archives of Internal Medicine* 2004; 164(19): 2126–2134.
 7. A. K. Gupta, M. McGlone, F. L. Greenway, and W. D. Johnson, "Prehypertension in disease-free adults: a marker for an adverse cardiometabolic risk profile". *Hypertension Research* 2010; 33 (9): 905–910.
 8. C. Chrysoshoou, C. Pitsavos, D. B. Panagiotakos, J. Skoumas, and C. Stefanadis. "Association between prehypertension status and inflammatory markers related to atherosclerotic disease: the ATTICA Study". *American Journal of Hypertension* 2004; 17(7): 568–573.
 9. K. M. Choi, H. S. Park, J. H. Han et al. "Prevalence of prehypertension and hypertension in a Korean population: Korean National Health and Nutrition Survey 2001". *Journal of Hypertension* 2006; 24(8):1515–1521.
 10. Y. Ishikawa, J. Ishikawa, S. Ishikawa et al. "Prevalence and determinants of prehypertension in a Japanese general population: the Jichi Medical School cohort study," *Hypertension Research* 2008; 31(7):1323–1330.
 11. J. W. Sit, L. Sijian, E. M. Wong et al. "Prevalence and risk factors associated with prehypertension: identification of foci for primary prevention of hypertension," *Journal of Cardiovascular Nursing* 2010;25(6): 461–469.
 12. J. Yang, F. Lu, C. Zhang et al. "Prevalence of prehypertension and hypertension in a Chinese rural area from 1991 to 2007," *Hypertension Research* 2010; 33(4): 331–337.
 13. Diet and nutritional status of population and prevalence of hypertension among adults in rural areas. NNMB Technical Report 24: Hyderabad: National Nutrition Monitoring Bureau (NNMB) 2006; 35–7.
 14. Yadav S, Boddula R, Genitta G, Bhatia V, Bansal B, Kongara S, et al. Prevalence & risk factors of prehypertension & hypertension in an affluent north Indian population. *Indian J Med Res.* 2008; 128:712–20.
 15. Deepa R, Shanthirani CS, Pradeepa R, Mohan V. Is the 'rule of halves' in hypertension still valid? - Evidence from the Chennai Urban Population study. *J Assoc Physicians India.* 2003; 51:153–7.
 16. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jr, et al. National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 Report. *JAMA* 2003; 289: 2560–72
 17. Arokiaswamy P. Patterns of Chronic Diseases: Cross-sectional Evidence from SAGE Countries. IIPS, India, 2010.
 18. STEP wise approach to surveillance (STEPS). WHO 2006. [Accessed on July 22, 2010]. Available from: <http://www.who.int/chp/steps/en/>
 19. Choo V: WHO reassess appropriate body mass index for Asian populations. *Lancet* 2002; 360:235.
 20. Hsia J, Margolis KL, Eaton CB, Wenger NK, Allison M, Wu LL, LaCroix AZ, Black HR: Prehypertension and Cardiovascular Disease Risk in the Women's Health Initiative. *Circulation* 2007, 115:855-860.
 21. Grotto I, Grossman E, Huerta M, Sharabi Y: Prevalence of prehypertension and associated cardiovascular risk profiles among

- young Israeli adults. *Hypertension* 2006, 48:254-259.
22. Winegarden CR. From “prehypertension” to hypertension? Additional evidence. *Ann Epidemiol.* 2005; 15:720 –725.
 23. Wang W, Lee ET, Fabsitz RR et al: A longitudinal study of hypertension risk factors and their relation to cardiovascular disease. The Strong heart study. *Hypertension* 2006; 47:403-9.
 24. Prabhakaran D, Shah P, Chaturvedi V, Ramakrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of northern India. *Natl Med J India.* 2005; 18:59–65
 25. Mainous AG, Everett CJ, Liszka H, King DE, Egan BM: Prehypertension and mortality in a nationally representative cohort. *Am J Cardiol* 2004; 94: 1496-1500.
 26. Israeli E, Schochat T, Korzets Z, Tekes-Manova D, Bernheim J, Golan E: Prehypertension and obesity in adolescents: a population study. *Am J Hypertens* 2006, 19:708-712.
 27. Stamler J. The INTERSALT Study: background, methods, findings, and implications. *Am J Clin Nutr.*1997;65 (Suppl 2): 626S–42S.
 28. Hahn WK, Brooks JA, Hite R. Blood pressure norms for healthy young adults: relation to sex, age and reported parental hypertension. *Rev Nurs Health* 1989; 12:53-56.
 29. Goldstein IB, Shapiro D, Guthria D. Ambulatory blood pressure and family history of hypertension in healthy men and women. *Am J Hypertens* 2006; 19: 486-91.
 30. Player MS, King DE, Mainous AG, Gessey ME. Psychosocial Factors and Progression From Prehypertension to Hypertension or Coronary Heart Disease. *Ann Fam Med* 2007; 5(5): 403-11.

How to cite this article: Shikha D, Semwal J, Srivastava AK et al. A study on association of non communicable diseases risk factors and prehypertension in Garhwal region of North India. *Int J Health Sci Res.* 2017; 7(7):31-37.
