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Research Article

# PREVALENCE OF HYPERTENSION AND ITS ASSOCIATION WITH VITAL STATICS OF ADULTS AMONG URBAN, SEMIURBAN, RURAL AREAS OF UTTARAKHAND

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**ABSTRACT**

**Objective:** India is in the affirmed phase of evolution and transition, demographic, economic, epidemiological, and nutrition transition. Moreover, all these transitions are leading non-communicable diseases such as obesity, hypertension, and insulin resistance. The study was aimed to estimate the prevalence of hypertension and its association with vital statics of adults among urban, semiurban, rural areas of Sub-Himalayan Region.

**Methods:** A cross sectional community based study was done, using WHO step questionnaire. A survey was conducted in urban, semi urban, Rural areas of Uttrakhand, to make a sample size of 300 adults (18-45yr), 100 from each zone. Blood pressure and body mass index (BMI) of the participants was calculated. $p<0.05$ was considered statistically significant.

**Results:** In the sample population based on systolic BP, 61.3% were non-hypertensives, 29.7% were pre-hypertensives, and 9% were hypertensives. Based on diastolic BP, 43.3% were non-hypertensives, 32.7% were pre-hypertensives, and 24% were hypertensives. Participants 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, semiurban, and rural areas of the sub-Himalayan 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. Dehradun has the highest rates of high blood pressure while Rudraprayag has the lowest. BMI was significantly correlated with systolic BP in Dehradun adults ($p<0.05$). Diastolic BP was significantly positively correlated with age and BMI in Dehradun adults ($p<0.05$). Age was positively significantly correlated with pulse rate in Dehradun and Uttarkashi adults ($p<0.05$). In Rudraprayag adults, weight was significantly positively correlated with both systolic and diastolic BP ($p<0.05$). No other correlations were seen in anthropometry and vital statistics of Rudraprayag or Uttarkashi adults ($p>0.05$).

**Key words:** Body mass index, Hypertension, WHO step questionnaire.

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## INTRODUCTION

India is suffering from the twin trouble of undernutrition and the swift steady boost in the outbreak of non-communicable disease (NCD). In 2002, NCDs were the cause for 60% deaths and 43% of diseases globally by the year 2020, it is roughly estimated to affect for about 73% deaths and 60% burden of disease burden [1,2]. NCDs are anticipated to cause death to almost double, that is, from approximately 4 million to 8 million from the year 1990 to 2020 in India [2,3]. The key factors of increasing burden of NCDs in India are urbanization, nutrition transition, globalization, and economic growth. Rapid urbanization leads to pitiable dietary practices and lifestyle with low physical activity. In India, approximately 28% of the total population was living in urban areas in 2001, with an estimation of about 50%, with 605–618 million by 2021–2025 [2-4]. The growth in the urban population is not uniform and demographic trend shows that the growth rate in the urban was stabilized at 3% over the past decade (1991–2001), whereas the growth rate of the slum gets double at 5–6% [5]. Urban poor faced two worst ends; first, modern lifestyle (which makes them at risk of degenerative diseases) and second, poverty (which cause low health-care purchasing capability).

Uttrakhand is a newly developed state of India which is at the nascent stage of development. It is geographically, ecologically feeble, economically unformed, and densely populated mountain ecosystem. With swift growing urbanization and development of infrastructure, connectivity to the villages is more and therefore area has undergone urbanization in a speedy way and with this, there is easy access to markets. Hence, major area of cultivated land and are being used for more infrastructure expansion, services activities, and economic activities in the hilly region [5,6] There is a reasonable regional transition from farming of traditional crop and animal husbandry system to locally yielded vegetables, fruits, and milk for sale in townified, urban locale. This affects the conventional land use model. The shift in the pattern of physical activity and dietary changes is the main reason of demographic and socioeconomic changes [6].

Uttarakhand is a diverse state with varied terrains and compact population density in the plain region. Demographic shift is pointing a transition in population dynamics homologs with socioeconomic growth (i.e., rising economies, education, employment, improvement in health status, and life expectancy and changes in lifestyle). This has been coincided by an epidemiological shift [7,8]. Despite the boost in life expectancy, there is a sturdy growth in chronic diseases of aging and life-styles related diseases such as hypertension, stroke, diabetes, and other cardiovascular diseases. The various studies have shown the emergence of the epidemiological shift has often been linked with epidemics of degenerative heart diseases (including hypertension, ischemic heart diseases, and cardiovascular disease), type 2 diabetes mellitus, and other chronic diseases [9].

Weather conditions result in various contradictory lifestyle practice and lead to practices such as smoking, tobacco consumption, alcohol

consumption, and consumption of fruits and vegetables not grown locally [10,11]. This gives rise to a high prevalence rate of NCDs [6,12].

The study was undertaken to find the prevalence and associated risk factors of hypertension and also association of changes in lifestyle practices such as smoking and alcohol consumption, with various other vital statistics among the study population. The study would aid in generating the data regarding obesity and hypertension in a rural area and hence would initiate timely precautionary measures to reduce the adverse health effects.

## METHODS

A survey was conducted in three zones of Uttarakhand state (Uttarkashi, Rudraprayag, Dehradun) representing the rural, semirural, and urban village population of the state to make a sample size of 300, 100 adults were selected from each of the 3 zones, respectively. One man and woman from eligible age groups of each household were selected and visited personally. Random selection was done if there is more than one eligible candidate present in a particular household.

### Data collection

The data collection was done using the WHO STEPS questionnaire approach. Interview technique was used by the investigator for the collection of data. Confidentiality of the information was ensured and written consent form was filled. Anthropometric measurements and variables such as weight (kilograms) using Karda digital weighing scale, height (centimeters) using stadiometer and (waist circumference [WC] in centimeters) were recorded using standard procedures were measured in a separate room. Body mass index (BMI) ($kg/m^2$) was calculated [13]. The latest classification of BMI for Asian populations was used to define overweight (23–24.99 $kg/m^2$) and obesity (>25 $kg/m^2$) [14]. WC in men and women was taken as high and used to define central obesity [15].

Blood pressure was measured using a mercury sphygmomanometer. Two readings of blood pressure were taken of the subject sitting in a relaxed sitting and average of both reading was taken. Hypertension was classified using JNC-8 criteria [16].

Analysis was carried out using SPSS version 17.0. Pearson's Chi-square test was used to evaluate differences between groups for categorized variables. Normally distributed data were 90% confidence intervals.

### Sample size

The sample size calculated was 269 with confidence interval of 90% and margin of error 5%. Formula used for the calculation is as under:

$$\text{Sample size} = \frac{z2 \times p\,(1-p)}{e2}$$

$$\frac{1 + (z2 \times p\,(1-p)}{e\ 2N}$$

where

N = Population size

e = Margin of error

Z = z score.

The calculated sample size was 269, but a total of 300 participants were included for the study. Written consent was obtained from each study participant.

### Data analysis

The analysis was done using SPSS 17 computer statistical software package. To find the relationship with categorical variables, frequency distribution and cross-tabulation were done. The Chi-square test was used and level of significance was 0.05 ($p<0.05$).

## RESULTS

For the study, 100 adults were selected from each of the 3 zones (Uttarkashi, Rudraprayag, and Dehradun). Table 1 shows the sociodemographic profile of the subject. Out of the 300 adults, 176 (58.7%) were male whereas 124 (41.3%) were female. The mean age of males from Dehradun, Rudraprayag, Uttarkashi were 31.5±8.1, 36.9±8.7, and 33.1±9.1 respectively. Whereas, the mean age of females from Dehradun, Rudraprayag, and Uttarkashi were 33.6±7.9, 36.8±8.4, and 34.2±10.1 respectively. The literacy level of the population was 96% whereas 4% population has never attended school. The mean year of schooling was least in Uttarkashi zone ($p<0.001$).

Table 2 shows the 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 WC.

Table 3 depicted the correlation of age and anthropometry with vital statistics when classified according to zone. BMI was significantly correlated with systolic BP in Dehradun adults ($p<0.05$). Diastolic BP was significantly positively correlated with age and BMI in Dehradun adults ($p<0.05$). Age was positively significantly correlated with pulse rate in Dehradun and Uttarkashi adults ($p<0.05$). In Rudraprayag adults, weight was significantly positively correlated with both systolic and diastolic BP ($p<0.05$).

Table 4 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, the and presence of diabetes as independent variables. Analysis revealed that in the population of Dehradun, BMI was significantly associated with

**Table 1: Sociodemographic characteristics of the study subjects**

| Variable | Zone | | |
|---|---|---|---|
| | Dehradun (%) | Rudraprayag | Uttarkashi |
| Sex | | | |
| Male | 66 | 59 | 51 |
| Female | 34 | 41 | 49 |
| Age | | | |
| Male | 31.5±8.1 | 36.9±8.7 | 33.1±9.1 |
| Female | 33.6±7.9 | 36.8±8.4 | 34.2±10.1 |
| Religion | | | |
| Hindu | 85 | 100 | 100 |
| Muslim | 8 | - | - |
| Sikh | 7 | - | - |
| Marital status | | | |
| Married | 62 | 92 | 71 |
| Unmarried | 36 | 6 | 23 |
| Divorced | 2 | 2 | 6 |
| Education level | | | |
| No formal education | - | - | _ |
| Less than primary | - | 1 | 2 |
| Primary complete | - | 18.6 | 15.2 |
| Secondary school | 5 | 18.6 | 12.1 |
| High school complete | 37 | 39.2 | 38.4 |
| Graduation | 41 | 8.2 | 24.2 |
| Post-graduation | 16 | 13.4 | 7.1 |
| Type of house | | | |
| Pakka | 100 | 92 | 79 |
| Semi Pakka | - | 3 | 15 |
| Kaccha | - | 3 | 7 |

**Table 2: Modifiable risk factor of the study subjects**

| Variable | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Dehradun n=66 (%) | Rudraprayag n=59 (%) | Uttarkashi n=51 (%) | Dehradun n=34 (%) | Rudraprayag n=41 (%) | Uttarkashi n=49 (%) |
| Smoke tobacco products | 40.9 | 35.7 | 66.7 | - | - | 0.8 |
| Smokeless tobacco | 13.6 | 27.1 | 15.7 | - | - | - |
| Alcohol consumption | 45.5 | 35.7 | 49 | - | - | 1.7 |
| 7 days consumption of vegetable | 57.6 | 96.6 | 68.6 | 76.5 | 90.2 | 57 |
| 7 days consumption of fruits | 6.1 | 59.6 | 6 | 8.8 | 46.3 | 6.4 |
| History of diabetes | 13.6 | 3.6 | 9.8 | 8.8 | - | 8.2 |
| BMI | 24.5±2.1 | 23.4±3.3 | 22.8±2.9 | 25.7±2.7 | 23.9±3.0 | 22.5±1.9 |
| WC (cm) | 88.5±9.0 | 86.0±10.4 | 85.4±8.2 | 89.8±13.9 | 78.8±10.9 | 78.8±6.0 |

Data presented as mean±SD and percentage. WC: Waist circumference

**Table 3: Correlation of age and anthropometry with vital statistics when classified according to zone**

| Variables | Dehradun (n=100) | | | Rudraprayag (n=100) | | | Uttarkashi (n=100) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Systolic BP | Diastolic BP | Pulse rate | Systolic BP | Diastolic BP | Pulse rate | Systolic BP | Diastolic BP | Pulse rate |
| Age | 0.196 | 0.211* | 0.259* | -0.093 | -0.166 | 0.042 | 0.148 | 0.143 | 0.205* |
| Weight | 0.079 | 0.095 | 0.049 | 0.357* | 0.343* | 0.181 | 0.001 | 0.080 | 0.022 |
| BMI | 0.266* | 0.206* | 0.109 | 0.141 | 0.151 | 0.091 | -0.008 | 0.091 | 0.058 |
| WC | 0.125 | 0.060 | 0.096 | 0.194 | 0.124 | 0.019 | -0.021 | 0.066 | 0.037 |

Data presented as Pearson correlation value. *p<0.05. WC: Waist circumference

**Table 4: Multivariate analysis for risk factor of hypertension**

| Variables in the equation | | | |
|---|---|---|---|
| Zone | Exp (B) | 95.0% CI for EXP (B) | |
| | | Lower | Upper |
| Dehradun | | | |
| Step 1[a] | | | |
| Gender (1) | 1.730 | 0.528 | 5.663 |
| Age | 1.001 | 0.931 | 1.075 |
| Diabetes (1) | 1.171 | 0.299 | 4.586 |
| Smoking (1) | 0.548 | 0.046 | 6.555 |
| Alcohol_12_ months (1) | 2.145 | 0.180 | 25.603 |
| BMI | 1.311 | 1.035 | 1.662 |
| veg_freq_code (1) | 2.930 | 0.284 | 30.271 |
| Constant | 0.001 | | |
| Rudrapryag | | | |
| Step 1[a] | | | |
| Gender (1) | 1.933 | 0.697 | 5.362 |
| Age | 0.963 | 0.914 | 1.015 |
| Diabetes (1) | 3.205E9 | 0.000 | |
| Smoking (1) | 0.487 | 0.092 | 2.572 |
| Alcohol_12_ months (1) | 0.802 | 0.150 | 4.294 |
| BMI | 1.022 | 0.886 | 1.177 |
| Veg_freq (1) | 0.497 | 0.040 | 6.238 |
| Constant | 2.360 | | |
| Uttarkashi | | | |
| Step 1[a] | | | |
| Gender (1) | 2.305 | 0.634 | 8.388 |
| Age | 1.014 | 0.960 | 1.072 |
| Diabetes (1) | 1.584 | 0.274 | 9.161 |
| Smoking (1) | 1.854 | 0.395 | 8.692 |
| Alcohol_12_ months (1) | 1.117 | 0.233 | 5.358 |
| BMI | 1.249 | 0.972 | 1.604 |
| Veg_freq_code (1) | 1.124 | 0.080 | 15.839 |
| Constant | 0.005 | | |

[a]Variables entered on step 1: Gender, age, diabetes, smoke, alcohol_12_months, BMI, veg_freq_code

hypertension in Dehradun (OR 1.311, 95% CI; 1.035–1.662) and Uttarkashi (OR 1.249, 95% CI; 0.972–1.604). BMI was significantly correlated with systolic BP in Dehradun adults (p<0.05). Diastolic BP was significantly positively correlated with age and BMI in Dehradun adults (p<0.05). Age was positively significantly correlated with pulse rate in Dehradun and Uttarkashi adults (p<0.05). In Rudraprayag adults, weight was significantly positively correlated with both systolic and diastolic BP (p<0.05). No other correlations were seen in anthropometry and vital statistics of Rudraprayag or Uttarkashi adults (p>0.05). Thus, in Dehradun and Uttarkashi, with higher BMI, the risk of hypertension increases by 1.3 times.

## DISCUSSION AND CONCLUSION

The study verified the prevalence of hypertension which was radically high among adults. A study by Vasan *et al*. shows a positive alliance of hypertension with age [17]. The present study shows the inaptly high rates of hypertension and BMI were detected among the population of the rural areas. This study outlines the noteworthy positive correlation between all the anthropometric factors (weight, BMI) and systolic and diastolic blood pressure except for WC. Many studies have reported positive correlation of BMI with hypertension (systolic and diastolic) [18-20].

No significant association was shown with tobacco and alcohol intake among modifiable risk factors. This is contradictory with other findings where tobacco use alcohol consumption has been found to be associated with hypertension [21-24].

The key point of this study was to presume the prevalence of hypertension and to hit upon associated risk factors in different rural zones of Uttrakhand. This study concluded to bring about the behavior changes and modification in life style so that the prevalence of Hypertension can be reduced in the population.

The study shows that more than 40% population in our rural area has high BMI. The distressing rates of high BMI and obesity among the population, especially women and youth, signifying where the action plan should be taken. Owing to the effective association of hypertension with lower BMI cutoff value (<23 kg/m$^2$), this study uses Asian-specific cutoff for the defining levels of overweight and obesity among the population. This calls an in need of awareness and act at the state and also at national level to control the problem of NCD, especially hypertension among Asian countries.

**Limitations**

Lack of specific data on stress levels is a major limitation of the study. Any causal association cannot be derived from the present cross-sectional study design. More research with appropriate study design is needed to find if any causal association exists between hypertension and the discussed variables.

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**AUTHOR CONTRIBUTION**

Vinita Thapliyal: Data collection, data analysis, data interpretation, and paper writing. Dr. Karun: Finalization of manuscript. Dr. Anil Joshi: Conceptualization of the Study.

**CONFLICT OF INTEREST**

There is no potential conflict of interest involved in this research.

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