

Blood Pressure Trends and Hypertension among Rural and Urban Jat Women of Haryana, India

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ABSTRACT

*Hypertension is an important public health problem and the major causes of cardiovascular morbidity and mortality among aged and elderly population in India. The present study is an attempt to assess age related trends of blood pressure and prevalence of hypertension in rural and urban women as well as correlation of blood pressure with obesity indicators (WC, BMI, and WHR). Data for present cross-sectional study were collected by purposive sampling method from six hundred Jat women (300 rural and 300 urban), aged 40 to 70 years. Karl Pearson's correlation coefficient (r) was employed to find the relationship between blood pressure and obesity indicators. The results revealed an age associated increase in mean values of systolic and diastolic blood pressure in rural and urban women. Urban women showed significantly higher overall mean value of systolic (mm of Hg) (133.93 vs. 130.79, $p < 0.001$), diastolic blood pressure (mm of Hg) (84.34 vs. 82.81, $p < 0.01$) and pulse rate (81.72 ± 6.27 vs. 80.94 ± 9.06 , $p > 0.05$) as compared to rural women. The overall prevalence of hypertension was found to be 9% in rural and 26.66% in urban women as per JNC VII criteria. Increased prominence of hypertension among urban Jat women may be attributed to their modern lifestyle having more stress, less manual work and faulty dietary habits. There was a very low awareness of hypertension in the rural subjects (37%) than their urban (72%) counterparts. Rural and urban women revealed a positive and significant association of systolic blood pressure with body mass index, whereas only urban women displayed positive correlation of waist circumference with systolic ($r = 0.183^{**}$) and diastolic ($r = 0.151^{**}$) blood pressure.*

Key words: hypertension, JNC VII criteria, obesity, prevalence, pulse rate

Introduction

Hypertension is traditionally defined as a persistent systolic blood pressure (BP) of at least 140 mm Hg and/or diastolic blood pressure at least 90 mm Hg, or blood pressure that is controlled to guideline-recommended levels using antihypertensive medication¹. The quickening pace of change and adoption of western life style by people in developing countries has led to a sharp rise in morbidity and mortality from cardiovascular diseases particularly those related to hypertension^{2,3}. The contributing factors for the growing burden of cardiovascular diseases are increasing prevalence of diabetes, hypertension, overweight/obesity, dyslipidemia, physical inactivity and tobacco use⁴. WHO-ISH⁵ reported that death and disability from cardiovascular diseases are increasing so rapidly in the developing countries that they will rank number one as cause of the global burden.

In India, the prevalence of hypertension has increased by 30 times among the urban population over a period of 55 year and about 10 times among the rural population over a period of 36 years⁶. World health report⁷ reported that cardiovascular diseases caused 2.3 million deaths in India in the year 1990; this is projected to double by the year 2020. With the increase in the proportion of elderly population in India, hypertension has posed as an important public health challenge. Studies describing and comparing the trends of blood pressure and prevalence of hypertension in Jat population, leading different life styles are still scarce. Hence, in the present study an attempt has been made to have a clear picture of this aspect as well as to gauge association of blood pressure with obesity indicators (WC, BMI, and WHR) among rural and urban Jat women of state Haryana (North India).

Materials and Methods

Area and people

Haryana is a state in northwest India. The name Haryana means »The Abode of God« from Sanskrit Hari (the Hindu God Vishnu) and ayana (home), although it may also refer to the lush green landscape of the state (from Sanskrit harit meaning green). The people of Haryana belong to the Indo Aryan type and in parts to the Indo-Dravidian type. Both the rural and urban subjects of present study belong to one endogamous group that is Jats of Haryana. These two sub-groups of Jat population have same broad genetic constitution, but were exposed to different environment settings. Jats in urban area were mainly engaged in trade, commerce, government, and private jobs. Most of the families residing in rural area were engaged in agriculture. Both the groups of Jat females of Haryana (North India) were believers of Hindu traditions and were mainly vegetarian.

Sample

It was a cross-sectional study carried out in the rural and the urban areas of Haryana, North India. The sample in the present investigation comprised of 600 healthy Jat women (rural=300 and urban=300), ranging in age from 40 to 70 years. Field work was conducted from the year 2006 to 2007. All the subjects were selected by purposive sampling method. Twenty one districts of Haryana state is divided into four divisions for administrative purpose i.e Ambala, Gurgaon, Hissar, Rohtak divisions. Seventy five rural and equal numbers of urban subjects were selected from each division. All the subjects were belonging to middle socio-economic status. Each subject was contacted individually at her residence and was explained about the nature of study. Detailed information regarding their education, occupation, type of dietary intake was obtained. Pregnant and lactating women or women suffering from any chronic disease or physical deformity were excluded from the study.

Rural and urban Jat subjects were sub-divided in six age groups, each of five years duration except the first age group, which is of six years duration i.e 40–45 years, 46–50 years, 51–55 years, 56–60 years, 61–65 years, 66–70 years. Age in years had been obtained from the date of birth, which majority of the urban women could recall. Whereas in most of the rural women and some elderly women nearly the correct age had to be ascertained by cross-questioning.

Measurements

Height (cm) and weight (kg) were measured by anthropometer and weighing machine respectively. Waist circumference (cm) was measured at the minimum circumference between the iliac crest and the rib cage. Hip circumference (cm) was measured at the maximum protuberance of the buttocks with Freeman's steel tape. Body mass index (BMI), was calculated as the ratio of weight in kilograms to the height in meters square. Waist-hip ratio (WHR) has been estimated by divid-

ing waist circumference by hip circumference. Systolic and diastolic blood pressure of each subject was taken using manual mercury Sphygmomanometer, after the subject had rested at least for 15–20 minutes. Three readings were recorded on each woman and the lowest value has been included in the study. Pulse rate was recorded from the beats of the radial artery.

Definition of hypertension (Based on JNC – VII criteria)

Any individual with raised blood pressure (BP) values of systolic blood pressure above 140 mm of Hg and diastolic blood pressure above 90 mm of Hg was classified as hypertensive. The different categories are as follows:

| Blood Pressure classification | Systolic blood pressure (mm of Hg) | and | Diastolic blood pressure (mm of Hg) |
|-------------------------------|------------------------------------|-----|-------------------------------------|
| Normal | <120 | and | <80 |
| Pre hypertensive | 20–139 | or | 80–89 |
| Stage I hypertensive | 40–159 | or | 90–99 |
| Stage II hypertensive | ≥160 | or | ≥100 |

Statistical analyses

All the statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 14.0. Differences between rural and urban were evaluated using student's t-test with significance level of $p < 0.05$ (*), $p < 0.01$ (**), $p < 0.001$ (***). Karl Pearson's correlation coefficient (r) was employed to find the relationship between two variables.

Results

Age associated trend of blood pressure

Age wise mean and standard deviation values of systolic, diastolic blood pressure and pulse rate in rural and urban Jat females are presented in Table 1. Mean values of systolic blood pressure showed an increase with advancing age in both the rural and urban groups of Jat women. Systolic blood pressure experienced a total gain of 9.16 mm of Hg in rural and 8.94 mm of Hg in urban women during the entire age range under consideration. Systolic blood pressure of urban women displayed higher mean values than their rural counterparts at all age groups, but statistically significant ($p < 0.01$) differences had been obtained only at 46–50 years and 51–55 years.

In rural women, diastolic blood pressure registered a mean value of 80.78 mm of Hg at age group 40–45, which increased by 4.32 mm of Hg to attain a mean value of 85.10 mm of Hg at age group 66–70. On the other hand, the mean value of urban women increased by 3.84 mm of Hg from the initial value of 82.14 mm of Hg to reach the maximum value of 85.98 mm of Hg at 61–65 years, where after a slight decline was witnessed (Table1). Diastolic blood pressure of urban women exhibited higher mean

TABLE 1
MEAN AND STANDARD DEVIATION VALUES OF SYSTOLIC, DIASTOLIC BLOOD PRESSURE (MM OF HG) AND PULSE RATE OF RURAL AND URBAN JAT WOMEN

| Age group (in years) | N | Systolic blood pressure Mean±S.D | t- value | Diastolic blood pressure Mean±S.D | t- value | Pulse rate Mean±S.D | t- value |
|----------------------|------|----------------------------------|----------|-----------------------------------|----------|---------------------|----------|
| 40–45 | R=50 | 126.06±7.39 | -1.75 | 80.78±6.46 | -0.96 | 77.38±6.61 | -1.11 |
| | U=50 | 129.38±11.14 | | 82.14±7.57 | | 78.70±5.18 | |
| 46–50 | R=50 | 126.82±11.56 | -2.16** | 80.90±6.69 | -2.17** | 78.30±4.55 | -3.06*** |
| | U=50 | 131.74±11.14 | | 83.92±7.16 | | 81.12±4.63 | |
| 51–55 | R=50 | 130.16±10.15 | -2.02** | 81.88±5.99 | -1.63 | 80.54±6.75 | -0.04 |
| | U=50 | 134.06±9.04 | | 84.00±6.96 | | 80.60±5.69 | |
| 56–60 | R=50 | 131.98±9.58 | -0.88 | 83.74±6.12 | -0.74 | 81.56±6.50 | -0.27 |
| | U=50 | 134.26±15.47 | | 84.60±5.46 | | 81.90±5.82 | |
| 61–65 | R=50 | 134.50±10.64 | -0.62 | 84.48±6.80 | -1.13 | 83.70±13.04 | -0.03 |
| | U=50 | 135.80±10.24 | | 85.98±5.99 | | 83.82±7.40 | |
| 66–70 | R=50 | 135.22±11.78 | -1.07 | 85.10±6.44 | -0.22 | 83.95±11.83 | -0.10 |
| | U=50 | 138.32±6.76 | | 85.44±8.29 | | 84.16±7.02 | |
| Total | R=50 | 130.79±10.79 | -3.23*** | 82.81±6.60 | -2.74** | 80.94±9.06 | -1.22 |
| | U=50 | 133.93±12.84 | | 84.34±7.02 | | 81.72±6.27 | |

TABLE 2
FREQUENCY DISTRIBUTION OF DIFFERENT CATEGORIES OF HYPERTENSION (AS PER JNC- VII CRITERIA) AMONG RURAL AND URBAN JAT WOMEN

| Age groups (in years) | Number of subjects | Normal < 80 < 120 | Hypertension | | |
|-----------------------|--------------------|-------------------|--|-----------------------|----------------------------------|
| | | | Prehypertensive systolic 80–89 120–139 | Stage I 90–99 140–159 | Stage II ≥ 100...DBP ≥ 160...SBP |
| 40–45 | R=50 | 48 (96%) | 2 (4%) | 0 | – |
| | U=50 | 36 (72%) | 4 (8%) | 10 (20%) | – |
| 46–50 | R=50 | 44 (88%) | 5 (10%) | 1 (2%) | – |
| | U=50 | 30 (60%) | 10 (20%) | 10 (20%) | – |
| 51–55 | R=50 | 40 (80%) | 7 (14%) | 3 (6%) | – |
| | U=50 | 30 (60%) | 8 (16%) | 11 (22%) | 1 (2%) |
| 56–60 | R=50 | 39 (78%) | 7 (14%) | 4 (8%) | – |
| | U=50 | 27 (54%) | 8 (18%) | 13 (26%) | 2 (4%) |
| 61–65 | R=50 | 33 (66%) | 10 (20%) | 7 (14%) | – |
| | U=50 | 20 (40%) | 14 (28%) | 14 (28%) | 2 (4%) |
| 66–70 | R=50 | 27 (54%) | 11 (22%) | 11 (22%) | 1 (2%) |
| | U=50 | 16 (32%) | 17 (34%) | 14 (28%) | 3 (6%) |
| 40–70 | R=300 | 231 (77%) | 42 (14%) | 26 (8.66%) | 1 (0.33%) |
| | U=300 | 159 (53%) | 61 (20.33%) | 72 (24%) | 8 (2.66%) |

R=rural U=urban

values than their rural counterparts at all ages, but the statistically significant ($p < 0.01$) difference was witnessed only at 46–50 years.

Prevalence of hypertension among rural and urban Jat women

Table 2 summarizes frequency distribution of different categories of hypertension (as per JNC–VII criteria)

among both the rural and urban groups of Jat women. It is clear from the table that prevalence of hypertension was increasing with advancing age in rural as well as urban women. The lowest prevalence of hypertension was in the age group 40–45 and highest was witnessed in the age group 66–70 in both the groups of Jat women. Overall 77% of rural and 53% of urban women had normal blood pressure, whereas 14% of rural and 20.33% of urban women were in pre hypertensive category. The prev-

alence of stage 1 and 2 hypertension was 8.66%, 0.33% in rural and 24%, 2.66% in urban women respectively. So, hypertension was three times more prevalent among urban women than their rural counterparts.

Correlation between blood pressure and obesity indicators

Values of total correlation coefficient (r) showing association of blood pressure (systolic and diastolic) of rural and urban Jat women with various obesity indicators (WC, BMI and WHR) are presented in Table 3. In rural women a positive and significant total correlation coefficient of systolic blood pressure was observed with body mass index ($r=0.157^{**}$), while waist circumference and waist to hip ratio demonstrated positive but non-significant association. Body mass index of urban women also presented a positive and significant association with systolic blood pressure ($r=0.158^{**}$) only, whereas waist circumference in urban women displayed a positive and significant correlation with systolic ($r=0.183^{**}$) and diastolic ($r=0.151^{**}$) blood pressure. Waist hip ratio among urban women correlated negatively with blood pressure.

Age related pattern of pulse rate

Pulse rate of both the groups of Jat women exhibited an age related increase, except for minor fluctuation observed at 51-55 years in urban women. Pulse rate ranged from 77.38 to 83.95 beats per minutes in rural and 78.70 to 84.16 beats per minutes in urban women (Table 1). Urban women registered higher mean values for pulse rate at all age groups under study than rural women. t -value revealed statistically non-significant differences at all age groups except at 46-50 years, where significant differences ($p<0.001$) had been reported.

Discussion

In the present study both the rural as well as urban Jat women demonstrated an age related increase in the mean values of systolic and diastolic blood pressure. Todkar et al.⁸ reported that the rise of blood pressure with age is said to be due to aging process, atherosclerotic changes in blood vessels, stress and strain and unknown factors. Overall mean value of systolic blood pressure (133.93 vs. 130.79, $p<0.001$) and diastolic blood pressure (84.34 vs. 82.81, $p<0.01$) of urban women of current study was found to be significantly higher than their ru-

ral counterparts. Hence, both the groups of Jat women showed an age associated increase in systolic and diastolic blood pressure particularly higher in the urban women. Similar findings were noticed in numerous existing studies⁹⁻¹⁵. Henry and Cassel¹⁶ observed that when social conditions change average blood pressure levels increase and there is a marked increase in blood pressure with age. So, age related increase was predominantly influenced by environmental factors as certain tribal population, who follow a primitive life style did not exhibit age related increase in blood pressure¹⁷. Likewise Gupta¹⁸ also observed that the less acculturated (nonwesternised) Indian tribal and rural populations had only a small increase in hypertension prevalence, while among the urban populations who are exposed to the stress of acculturation and have adopted unhealthy lifestyles, the hypertension prevalence rates have increased by more than five times in the last 50 years. These findings derive strength from the observations of Trowel and Burkett¹⁹ and Waldron et al.²⁰ who reported that raised blood pressure was related to several aspect of modern life style including western diet, lack of exercise and increased psychological stress. Changes in the life style due to industrialization and urbanization leads to constant increase in the prevalence of hypertension, thus modernity is taken to indicate environmental adversity from the cardiovascular point of view.

The present study reported that prevalence of hypertension increased with increasing age in both the groups of Jat women. According to the studies performed in U.S, aging adults were disproportionately impacted by hypertension, with approximately 81percent of all US adults having hypertension were at least 45 years of age, even though this group comprised only forty six percent of the US population. The size of this group is expected to continue to increase, making age-dependency of hypertension prevalence even more important²¹. The present study demonstrated that prevalence of hypertension was significantly higher in urban (26.66%) than in the rural women (9%). Modern lifestyle of urban women including more stress, less manual work, physical inactivity and faulty dietary habits may be the important reasons for higher prevalence of hypertension. Similar trend had been observed by a number of previous studies^{11,14,22,23}. Gupta¹⁸ also reported that hypertension prevalence was lower in the rural as compared to urban Indian population. Prevalence of hypertension was not compared with

TABLE 3
TOTAL CORRELATION COEFFICIENT (R) SHOWING ASSOCIATION OF BLOOD PRESSURE (SYSTOLIC AND DIASTOLIC) OF RURAL AND URBAN JAT WOMEN WITH OBESITY INDICATORS

| Obesity Indicators | Rural Jat Women | | Urban Jat Women | |
|---------------------|-------------------------|--------------------------|-------------------------|--------------------------|
| | Systolic blood pressure | Diastolic blood pressure | Systolic blood pressure | Diastolic blood pressure |
| Body mass index | 0.157** | 0.066 | 0.158** | 0.105 |
| Waist circumference | 0.030 | 0.020 | 0.183** | 0.151** |
| Waist/hip ratio | 0.029 | 0.023 | -0.059 | -0.075 |

previous studies because various operation definitions and methodologies were adopted to define hypertension. So, only general trend was compared. The overall prevalence of hypertension based on WHO criteria (17.6 vs. 5.0%) and Joint National Committee fifth report criteria (34.0 vs. 10.1%) were significantly higher among urban than among rural subjects. Kaur and Talwar¹⁵ also reported higher prevalence of hypertension among urban (25.71%) than rural Brahmin women (18%). Similar results were observed in Zulu women (rural=10.75%, urban=27%)²⁴; Punjabi women (rural=4.2%, urban=10%)⁹; Cameroonian women (rural=5.9%, urban=12.1%)²⁵; Chamar women (rural=4.03%, urban=6.6%)¹².

Present research had documented 14% rural and 20.33% urban Jat participants in prehypertensive category, indicating the elevated risk of developing hypertension. Vasen et al.²⁶ observed that prehypertensive and even normal blood pressure frequently progress to clinical hypertension over several years especially in older adults. So, these subjects were of great interest because they had a possibility to increase the prevalence of hypertension if appropriate preventive measures were not put forward to lower their blood pressure level to normal level. The percentage of awareness of hypertension (meaning, symptoms and ill-effects) was quite low among rural (37%) than urban (72%) women. This may be attributed to better medical services, public health, and better awareness due to education available to urban women, on the other hand rural women had limited opportunities.

In the present cross-sectional study both rural as well as urban Jat women revealed a positive and significant correlation coefficient of systolic blood pressure with body mass index. The previous studies of He et al.²⁷ and Dalton et al.²⁸ also reported a significant association of blood pressure with body mass index (BMI). Waist circumference of urban women only showed a positive and significant association with systolic and diastolic blood pressure. Rural urban differences in correlation of systolic and diastolic blood pressure with waist circumfer-

ence could be attributed to their differential physical activity associated with dietary habits and lifestyle pattern. Deshmukh et al.²⁹ also suggested that BMI and waist circumference were important predictor of hypertension. Similar finding had been reported by many previous studies on elderly population^{28,30,31}.

Rural and urban women of present cross-sectional study showed an increase in pulse rate as the age advances with some minor fluctuations and it was compatible with the studies of Wolanski and Pyzuk³², Singal et al.¹⁰, and Kaur³³. This increase in pulse rate may be due to age associated decrease in vagal tone (parasympathetic system), leading to increase in heart rate. On the contrary Hussain³⁴ and Bagga³⁵ reported that pulse rate was not significantly correlated with age, since their subjects showed a fluctuating trend.

In conclusion, the results indicated a gradual and continuous increase in average values of systolic and diastolic blood pressure with advancing age in both the rural and urban Jat women. Hypertension was highly prevalent in urban areas of Haryana. It was three times more prevalent in the urban than in the rural Jat women. Popkin et al.³⁶ reported that although the burden of infectious diseases has fallen, changes in life style and diet and an increase in life expectancy have resulted in a greatly increased burden of cardiovascular diseases (CVD) and other chronic diseases. The prevention and management of hypertension are major public health challenges. Therefore, there is a need for nationwide programmes to improve detection, awareness and treatment of hypertension.

Acknowledgements

Author (Maninder Kaur) is thankful to the Department of Science and Technology (New Delhi) for the financial support under Women Scientist Scheme (SR/WOS-A/LS-60/2005) to carry out this work.

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TREND KRVNOG TLAKA I HIPERTENZIJA MEĐU RURALNIM I URBANIM JAT ŽENAMA HARYANA, INDIJA

SAŽETAK

Hipertenzija je važan javnozdravstveni problem i glavni uzrok kardiovaskularnog morbiditeta i mortaliteta među starijom populacijom Indije. Sadašnja studija pokušaj je povezivanja starosne dobi s trendom kretanja krvnog tlaka te prevalencije hipertenzije među ruralnim i urbanim ženama te povezati krvni tlak s indikatorima pretilosti (opseg struka (WC), indeks tjelesne mase (BMI) i omjer struka i bokova (WHR)). Podaci za sadašnju poprečnu studiju prikupljeni su ciljanim prikupljanjem uzoraka za šest stotina Jat žena (300 ruralnih i 300 urbanih), u dobi od 40 do 70 godina. Karl Pearson-ov koeficijent korelacije (r) korišten je kako bi odredio povezanost između krvnog tlaka i indikatora pretilosti. Rezultati otkrivaju kako se s dobi povećavaju prosječne vrijednosti sistoličkog i dijastoličkog krvnog tlaka kod ruralnih i urbanih žena. Urbane žene pokazuju značajno veći prosjek sistoličkog (mm/Hg) (133,93 vs. 130,79, $p < 0,001$), dijastoličkog krvnog tlaka (mm/Hg) (84,34 vs. 82,81, $p < 0,001$) i pulsa ($81,72 \pm 6,27$ vs. $80,94 \pm 9,06$, $p > 0,05$) u usporedbi s onim ruralnim. Ukupna prevalencija hipertenzije iznosi 9% kod ruralnih i 26,66% kod urbanih žena po JNC VII kriteriju. Istaknuta povezanost hipertenzije među urbanim Jat ženama možda se može pripisati njihovom modernom načinu života i povećanom stresu, smanjenom fizičkom radu te lošim prehrambenim navikama. Uočena je jako slaba osviještenost o problemu hipertenzije kod ruralnih ispitanica (37%), za razliku od onih urbanih (72%). Kod jednih i drugih pokazuje se pozitivna i značajna povezanost sistoličkog krvnog tlaka s indeksom tjelesne mase, a jedino urbane žene pokazuju pozitivnu korelaciju opsega struka sa sistoličkim ($r = 0,183^{**}$) i dijastoličkim ($r = 0,151^{**}$) krvnim tlakom.