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Original Article

Study of Blood Pressure in Rural and Urban Population of Jamshedpur (Jharkhand)

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Abstract

Introduction: The blood pressure (BP) is the lateral pressure exerted on the wall of the vessels by the contained blood (Samson Wright). It is mainly depends on cardiac output, peripheral resistance and blood viscosity, and regulated by of a variety of interdependent mechanism - ionic, hormonal, and proprioceptive reflexes from the vascular system, locally acting substances, and the state of the central nervous system.

Materials and Methods: The study of BP of rural and urban area of Jharkhand is an observational, cross-sectional study investigating the mean and percentile of BP distribution, and the prevalence of hypertension in people of age group 20-70 years. Measurement of BP done by sphygmomanometer of cuff size 23 cm × 12.5 cm.

Result: In rural area and urban slum group, there was lower rise in systolic and diastolic BP. The rise of BP among rural and urban slum was not found till 40 years of age. The rise is only seen in 5th, 6th, and 7th decades of life.

Conclusion: The BP of urban population is higher than that of the rural population in Jamshedpur, and its neighborhood is not in lower range. Intervention and preventive activities could initially be directed toward urban population, among whom the prevalence of hypertension and of other risk factors are higher and are thus most at risk of related morbidity.

Key words: Blood pressure, Hypertension, Risk factor, Rural and urban population, Sphygmomanometer

INTRODUCTION

The blood pressure (BP) level at which a person can be labeled hypertensive remains unsettled till today. Since there no dividing line between normal and high BP, arbitrary levels have been established to define those who have an increased risk of developing a morbid cardiovascular events and/or will clearly benefit from the medical therapy. These definitions should consider not only the level of diastolic and systolic pressure but also age, sex, and race.[1-6]

When hypertension is suspected, BP should be measured at least twice during two separate examination after the initial examination.

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Classification of BP for adults aged 18 years or more (Joint National Committee-7 guidelines for classification and management of hypertension in adults).[2]

BP classification	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal	<120 and	<80
Pre-hypertension	120-139 or	80-89
Stage I Hypertension	140-159 or	90-99
State II Hypertension	>160 or	>100

BP: Blood pressure

JNC-7 introduced the concept of pre-hypertension and recommended a more aggressive approach to patients in this range with an emphasis on lifestyle modification to prevent cardiovascular diseases (CVDs).

Hypertension is silent until it causes complication and until the advent of screening in recent years, it usually first comes to light through the occurrence of heart attack or stroke. This means that for knowledge of its early development and its risks we must turn to population-based studies.[6-8]

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The relationship between BP and risk of CVD event is continuous, consistent, and independent of other risk factor. The higher the BP, the greater the chance of myocardial infarction, heart failure, stroke, and kidney disease. For individuals aged 40-70 years, each increment of 20 mmHg in systolic or 10 mmHg in diastolic BP doubles the risk of CVDs.[8,9]

The significance of recognizing the different level of BP in a population is further increased by the fact that hypertension is a preventable as well as treatable condition. Two veterans administration antihypertensive trial and the hypertension detection, and follow-up program have conclusively demonstrated that highly systemized antihypertensive drug treatment significantly reduced the mortality.[10]

A number of studies have been concluded on the prevalence of hypertension in India. The one in Rohtak represents the urban population and the other in a village in Haryana to represent rural population in India. The prevalence of hypertension was 59.9 and 69.9 per 1000 in males and females, respectively, in the urban population and 35.5 and 35.9 per 1000 in males and females, respectively, in the rural population.[11]

Several other studies have shown difference between urban and rural populations. Some report significant differences among rural and urban women or men only while in other population, rural people had higher. In some studies, no regional or urban/rural differences were seen in systolic or systolic.[12]

The Yi Migrant study in 1989 demonstrated an important effect of migration on the prevalence of hypertension and the rise of BP with age in China. Poulter *et al.* in 1990, also studied the rise of BP in Kenyan Luo migrant.

Many studies have been done to determine the difference in mean BP of children (male and female) residing in urban and rural areas. Observed mean systolic and diastolic BP rates were elevated in rural when compared to urban children in both sexes between 10 and 15 year of age.[13-15]

To confirm the effect of environmental influences on the mean BP and the prevalence of hypertension as well as to examine the prevalence of other risk factors such as obesity, physical activity, and cigarette smoking in urban and rural population, we have conducted a population-based study in urban and rural area of Jharkhand (Jamshedpur).

MATERIALS AND METHODS

Study Design

This was a cross-sectional study, study period - January 2016 to December 2016.

Setting

Department of Physiology, MGM Medical College and Hospital, Jamshedpur, for urban and slum urban population, and Juri Rural health center of MGM Medical College for rural population.

Study Tool

Sphygmomanometer and stethoscope, weight - scale, measuring - tape, and study population - 510 people were included in the study, of which 261 were female and 249 were male.

Exclusion Criteria

Participant having any current or previous chronic disease, history of heart disease, and hypertension malignancy.

RESULT

Total numbers of person studied were 510, out of which 210 were from the rural area, 138 from slum urban area, and 160 from urban area.

Out of 210 persons in rural area, 17 persons showed hypertension (8.10%) of 138 slum urban people, 12 persons showed hypertension (8.69%), and in 21 persons (13.12%) out of 160 urban people studied showed hypertension.

This study also shows a correlation of hypertension with higher body mass index (BMI) in upper age groups of urban population.

In rural and urban slum groups, there was lower rise in systolic and diastolic BP with age in both sexes. The rise of BP among rural and urban slum was not found till 40 years of age. The rise is only seen in 5th, 6th, and 7th decades of life.

In the urban area, the BMI and BP, systolic, and diastolic were higher in every decades than in rural and urban slum groups. There was a consistent rise in BP with age and BMI.

The rise in BMI with age among upper classes that was strikingly absent among the rural and urban slum (Tables 1-10 and Figures 1-11).

Table 1: Composition of participant according to sex

Sex	No. of participant (%)
Male	261 (51.18)
Female	249 (48.82)

Table 2: Mean BP in different age groups in rural male population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	40	20.39±2.7 16.9-25.5	115.4±8.7 90-130	75.12±6.7 60-80
30-39	27	21.07±2.3 19.1-25.00	114.03±1.4 95-130	76.37±6.7 70-100
40-49	21	22±4.66 15.1-36.7	125.95±17.27 100-170	79.6±7.5 70-79
50-59	8	21.85±3.2 17.87-26.1	122.5±7.3 110-130	72.55±12 50-90
60-69	10	21.34±2.3 15.9-23.5	127.5±26.3 110-190	77.6±9.17 60-90
70 and above	55	23.5±5.06 15.9-24.8	167.5±13.28 155-185	103±10.8 94-100

BP: Blood pressure, SD: Standard deviation

Table 3: Mean BP in different age groups in rural female population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	36	21.45±1.06 15.28-24.2	114.13±7.09 100-130	72.88±5.6 60-80
30-39	29	21.13±2.6 17.28-25.64	116±9.1 95-130	75.6±10.45 60-90
40-49	15	20.41±3.56 13.7-25.9	114.7±14.1 90-130	73.57±7.4 60-90
50-59	11	21.06±3.6 16.6-27.5	145±34.76 120-220	87.271±1.40 70-100
60-69	5	20.18±3.52 15.1-25.06	132.2±12.4 125-150	83.2±11.8 70-100
70 and above	5	23.09±4.1 15.98-24.8	138±31.14 130-180	84±11.40 70-90

BP: Blood pressure, SD: Standard deviation

Table 4: Mean BP in different age groups in urban slum male population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	17	20.28±2.1 17.09-24.7	110.71±2.3 70-126	72.5±7.3 60-80
30-39	20	22±2.18 18.2-25	116.25±6.7 110-120	76.25±6.2 60-90
40-49	11	20.6±5.8 22.7-42.2	120.8±8.7 110-140	77.8±7.4 71-90
50-59	7	23±3.75 19.48-24.69	132±22 110-140	74.2±9.75 70-90
60-69	7	22.5±1.9 20.2-24.8	1502±4.7 120-150	82.85±7.55 70-90
70 and above	4	22.79±2.8 19.93-23.32	133.75±14.93 115-150	87.5±5 80-90

BP: Blood pressure, SD: Standard deviation

DISCUSSION

An objective of our study was to find out the level of BP of the selected population sample. We could find a wide range of normal BP values even with the same sex and same age group. However, this is in consonance with that found in literature and as expected the value in younger age groups hover around the mythical 120/80 mmHg.[16-18] The intragroup variation observed in our studies may be because of many factors, such as hereditary, environment, salt sensitivity, and insulin resistance.

Genetic factors have long been assumed to be important in the production of BP. The inherited multifactorial or monogenic defect is the phenotypic expression of BP.

Table 5: Mean BP in different age groups in urban slum female population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	26	20.5±8 14.10-23.8	113.3±8.5 100-130	72.9±7.9 60-80
30-39	29	22.2±2 17.85-25.23	115.85±7.8 100-130	74±7.6 60-90
40-49	12	21.4±3.5 16.5-27.4	1229±0.9 104-140	76.8±7.64 60-90
50-59	5	21.5±2.13 17.9-23.2	1251±0 115-140	78±4.89 60-90
60-69	5	21.08±3.4 16.4-24.4	1291±9.3 104-160	78.3±11.69 60-80
70 and above	3	23.04±3.74 19.2-26.7	136.62±5.8 120-170	76.6±5.7 70-80

BP: Blood pressure, SD: Standard deviation

Table 6: Mean BP in different age groups in urban male population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	25	21.91±2.6 18-25.1	120.76±10.52 110-160	794±0.08 70-90
30-39	24	22.24±2.6 19.8-30.8	118.54+9.9 110-140	78.95±6.5 70-90
40-49	13	23.89±3.4 17-31	126.3±12.6 100-150	81.53±8 70-100
50-59	14	22.5±3.7 15.6-25.6	132±20.3 110-180	83.07±10.3 70-100
60-69	5	20.28±2.76 18.2-24.4	134±2.6 100-160	82±10.95 70-100
70 and above	3	29.13±13.2 21.7-44.4	140±17.32 120-150	90±10 80-100

BP: Blood pressure, SD: Standard deviation

Table 7: Mean BP in different age groups in urban female population

Age group (years)	No. of cases	Body mass index±SD with range	Mean systolic BP (mmHg)±SD with range	Mean diastolic BP (mmHg)±SD with range
20-29	22	22.79±5.01 17.8-40.8	121.13±13.1 100-160	77.72±6.85 70-90
30-39	23	21.9±3.1 17.31-26.3	120.211±1.1 110-150	75.9±6.7 70-90
40-49	10	22.78±3.2 19-30	127±11.5 110-140	80.5±9.5 70-100
50-59	10	22.07±2.76 18.2-23.12	125.5±21.1 110-140	82.5±6.34 70-90
60-69	8	27.90±9.1 24.4-46.6	145.25±20.5 110-130	84.62±9.98 80-100
70 and above	3	25.1±4.8 20.4-30.1	140±20 120-160	90±10 80-100

BP: Blood pressure, SD: Standard deviation

Considering this, it seems natural that the BP will not have any fixed value.

Environmental factors, such as salt intake, obesity, occupation, alcohol intake, family size, and crowding all have their influence on BP. A physician has therefore little choice than starting intervention for hypertension form the arbitrary value of 140/90 mmHg. Be a physician or a physiologist, he has to depend on the working definition of hypertension as the BP, which when left untreated has the likelihood of developing morbid cardiovascular event and/or that will clearly benefit form medical therapy.[19-23]

Salt intake influences BP and there is a wide variation in salt intake. This is further compounded by the variable Renin level. Insulin level has its role to play as well. Therefore,

Table 8: Prevalence of hypertension in rural, slum urban, and urban population

Total no. of participants in Rural area=210	No. of participants showing blood pressure blood pressure 140/90 mmHg and above=17	Percentage=8.01%
Total no. of participants in slum rural area=136	No. of participants showing blood pressure blood pressure 140/90 mmHg and above=12	Percentage=8.69%
Total no. of participants in urban area=160	No. of participants showing hypertension=21	Percentage=13.12%

Table 9: Mean systolic blood pressure according to age, sex, and area urban and urban population

Age group (years)	No.	Mean BP±SD in rural people	No.	Mean BP±SD in slum rural	No.	Mean BP±SD in urban people
Men						
20-29	40	115.4±8.7	17	110.7±12.3	25	120.76±10.52
30-39	27	114.03±1.4	20	116.25±6.7	24	118.54 ±9.9
40-49	21	125.95±17.2	11	120.8±8.7	13	126.3±12.6
50-59	8	122.5±7.3	7	132±22	14	132±20.3
60-69	10	127.5±26.3	7	150±24.7	5	134±26
70 and above	5	167.5±13.28	4	133.75±14.9	5	140±17.32
Women						
20-29	36	114.13±7.09	26	113.3±8.5	22	121.13±13.1
30-39	29	116±9.1	20	115.85±7.8	23	120.21±11.1
40-49	15	114.7±14.1	12	122±9.9	10	127±11.5
50-59	11	145±34.76	5	125±10	10	125±12.1
60-69	5	132.2±12.4	6	129±19.3	8	145.25±20.5
70 and above	5	138±31.14	3	136.6±25.8	3	140±20

BP: Blood pressure, SD: Standard deviation

Table 10: Mean systolic blood pressure according to age, sex, and area

Age group (years)	No.	Mean BP±SD in rural people	No.	Mean BP±SD in slum rural	No.	Mean BP±SD in urban people
Men						
20-29	40	75.12±6.7	17	72.5±7.3	26	79±4.08
30-39	27	76.37±6.7	20	76.25±6.2	20	78.95±6.5
40-49	21	79.6±7.5	11	77.8±7.4	12	81.53±8
50-59	8	72.5±12	7	74.2+9.75	5	83.07±10.3
60-69	10	77.6±9.17	7	82.85±7.5	6	82±10.95
70 and above	5	103±10.8	4	87.5±5	3	90±10
Women						
20-29	36	72.88±5.6	26	72.9±7.9	22	77.72±6.85
30-39	29	75.6±10.45	20	74±7.6	23	75.91±6.7
40-49	15	73.57±7.4	12	76.8±7.64	10	80.5±9.5
50-59	11	87.27±11.4	5	78+4.89	10	82.5±6.34
60-69	5	83.2±11.8	6	78.3±11.69	8	84.62±9.98
70 and above	5	84±11.40	3	76.6±5.7	3	90±10

BP: Blood pressure, SD: Standard deviation

variable BP level should be taken as a rule rather than an exception.

Our study has also pointed out an association of raised BMI with hypertension. The numbers of hypertensive were more in cities, and some of them incidentally are having higher BMI. Obesity is a cause of hypertension and reduction of obesity causes lowering of BP and also lowers a risk of atherosclerosis.[24] It is difficult to find out whether the hypertension of urban people was solely due to higher BMI, that is obesity, or some other factors. However, in our studies, the BMI was not that higher as to be labeled as frankly obese and their body weight not much higher. Thus, although the date is insufficient, it seems probable that factors other than obesity were responsible for hypertension or higher normal BP in urban population, as compared to their rural counterparts.[25]

A fact that should be borne in mind is that the urban population, especially people of higher socioeconomic class has now become health conscious and have learned to avoid the known risk factors of hypertension, that is, obesity, diabetes, hypercholesterolemia, and hyperlipidemia. Restriction is done to diets, exercise undertaken, cigarettes given up, limit is done to alcohol, yoga, and various other healthy practices followed. Thus, our three groups had not

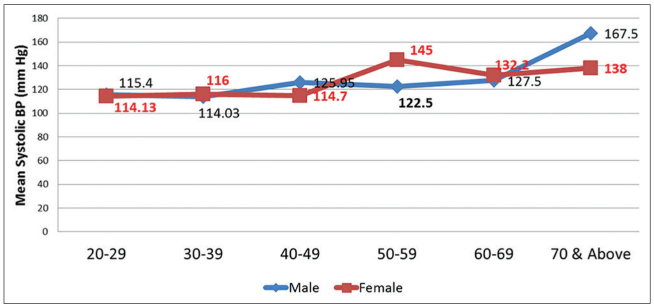

Figure 1: Mean systolic blood pressure with age in rural population - male and female

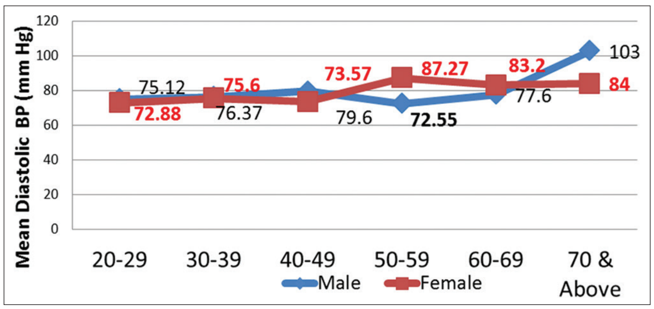

Figure 2: Mean diastolic blood pressure with age in rural population - male and female

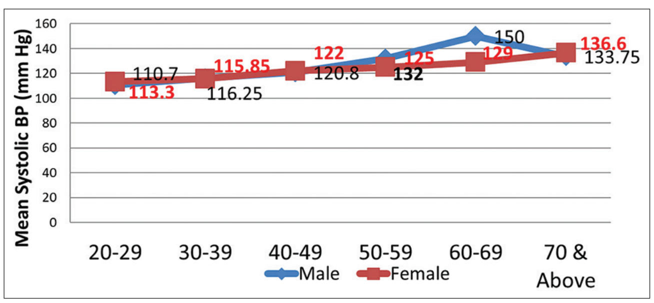

Figure 3: Mean systolic blood pressure with age in slum urban population - male and female

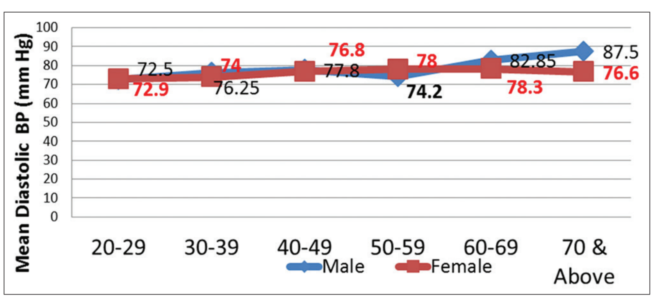

Figure 4: Mean diastolic blood pressure with age in slum urban population - male and female

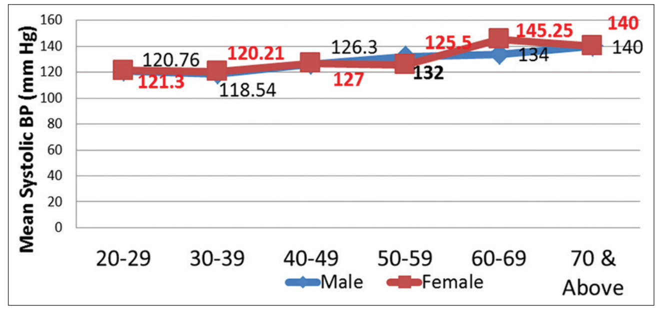

Figure 5: Mean systolic blood pressure with age in urban population - male and female

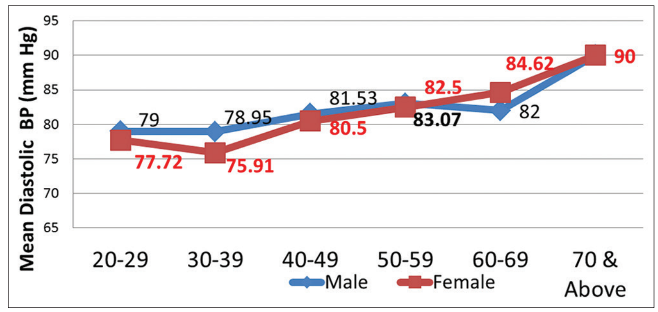

Figure 6: Mean diastolic blood pressure with age in urban population - male and female

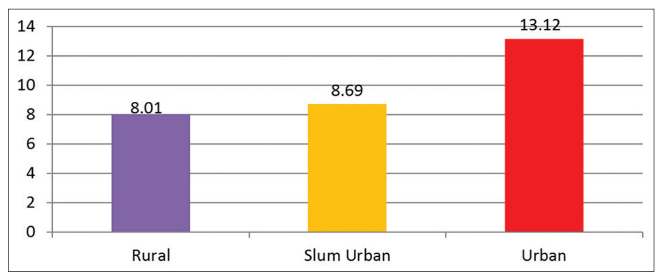

Figure 7: Prevalence of hypertension in rural, slum urban, and urban population

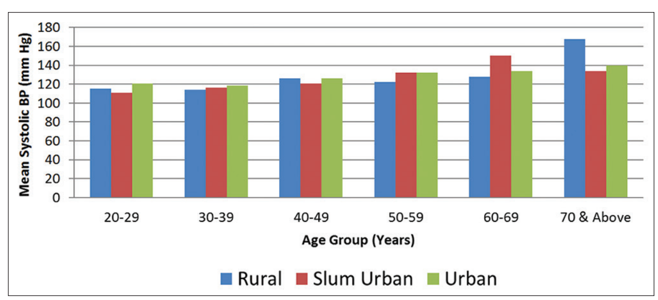

Figure 8: Mean systolic blood pressure according to age and area - male

had the same environmental background. This could well be reason of still not higher prevalence of hypertension and higher normal BP in the urban upper socioeconomic group.[26]

Higher BP was recorded in the rural male population of age over 70, however that was not found in rural female population of age above 70. It is difficult to explain the reason of such variation, under the limited scope, and resources of our study. However, we predict that rural poverty and negligence have certain role to play. In comparable urban group, medical attention would have been sought and BP brought under control. In

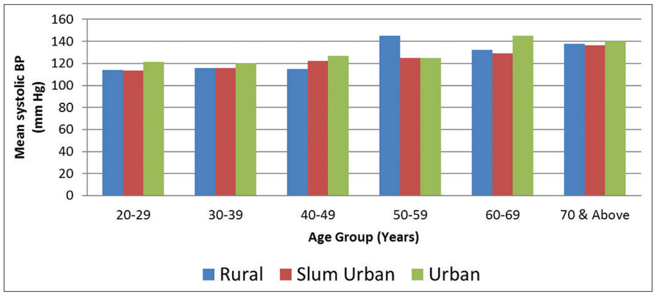

Figure 9: Mean systolic blood pressure according to age and area - female

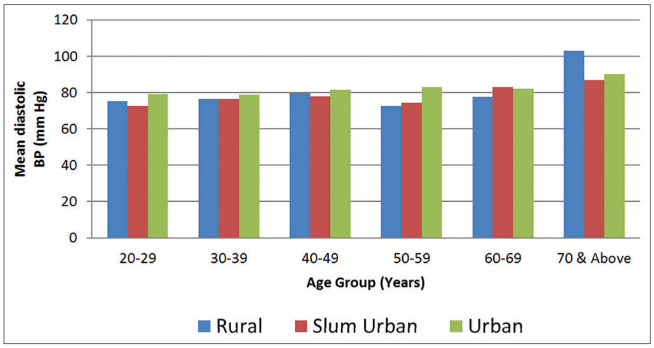

Figure 10: Mean systolic blood pressure according to age and area - male

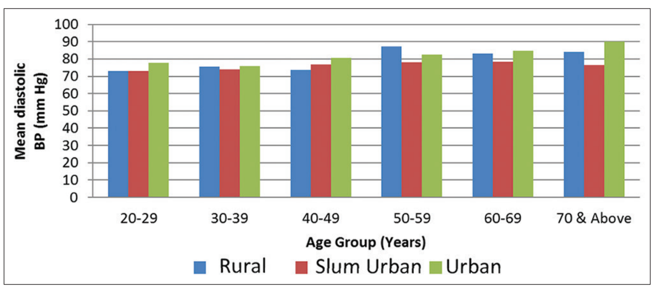

Figure 11: Mean systolic blood pressure according to age and area - female

rural population, such group is not possibly aware of his hypertension and presented themselves as normal. A significant rise of BP was reported by Joshi *et al.*[8] in rural community due to operation of some lifestyle risk factors, but such factors were inoperative in our studies and lack of awareness of underlying disease seems to be dominant factor behind excessive rise of BP in rural post-70 males.[27]

The change in arterial BP is one of the generally known physiological changes in aging of man. A continuous increase in BP levels during adulthood is one of the major health concerns in all modern societies. Aging causes structural, functional, and biochemical changes in the body and these changes, in turn, are influenced by various environmental and genetic factors. There are many studies on this aspect of BP, and our result that BP increases with age is in conformity with Padmavat *et al.* (1959),[20] Gupta *et al.* (1979),[9,10] and Rao *et al.* (1979 and 1980)[21,22] of our country.[28,29]

Further, it is also observed that age has more influence on systolic BP rather than diastolic BP unlike the reports of Mahalakshmi. However, the difference between the systolic and diastolic BP that we observed was small.

There have been studies on tribal communities in various parts of the world where there was no or little increase in adult BP (Maddoxs, 1961; Lowenstein, 1961).[24,25] However, some of the tribal population group which migrate to urbanized areas or undergo modernization or change in their occupation, *in situ*, have shown tendencies toward an increase in BP with aging (Cruz-Coke *et al.,* 1964; Prior 1970).[26,27] However, similar studies in our country are very few and we are not in a position to comment on the existence of such variation in any of our hundreds of tribal population.

In our study, significant differences between mean systolic and diastolic BP among urban and rural populations were seen; these associations were independent of age and sex. Mean BP and prevalence of hypertension increased with age in both sexes and both populations. Other studies have also shown that living in urban areas or more Westernized environments increases mean BP and prevalence of hypertension. Other variables such as dietary factors including sodium and potassium intake, obesity, and lower physical activity can account for some, but not all, higher BP found in the urban area. Alcohol intake is an important variable, but it is equally prevalent in urban and rural areas.

The positive gradients in BP have also been identified as function of educations, occupational rank or other measures of socioeconomic position, and psychosocial stress. These socioeconomic gradients are understood as antecedent to a set of more proximate risk factors, such as obesity and dietary Na-K ratio. In our study, the lower ranges of BP in rural setting may be due to the absence of above stressors. The stress in any stimulus or stimuli, experienced consciously or unconsciously, which is potentially harmful or threatening to the individual. The stress may originate in any one of a series of linked open systems physical, psychological, social, and cultural, but spill over and have ramification for the others.[30-33]

BP values, found in our study, were lower in urban poor slum dwellers when compared with urban higher socioeconomic class, but the value of urban poor was higher than what found in rural setting. This may well be due to intermediate level of stress and environmental variables. Our BP of 3 group data supports the hypothesis that there is a continuous distribution of hypertension prevalence from lean, low salt, high physical activity so cities to higher BMI, high salt, and low physical activity populations. Social and economic transformations occurring in emerging rural economy of Jharkhand, in the near future will bring the BP level up and closer to urban population. The epidemic is directly related to the pace of development of Jharkhand. As we find, in urban poor slum dwellers, who are mostly migrants from adjacent rural areas, due to their exposure to more risk factors in urban settings have higher BP values. The possibility shows that human being when exposecommon risk factors demonstrate similar response. There seems that no unique process such as race and ethnicity significantly affects susceptibility to changes in BP and it all depends on the extent of operation of established risk factors.

CONCLUSION

Finally, we conclude that the BP of urban population is higher that of rural population in Jharkhand. This study has also shown that BP of the people of Jamshedpur and its neighborhood is in higher range.

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