

Original Article

A study on blood pressure in relation to age, sex, weight and social class of two populations of Kanpur

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A number of factors such as age, sex, weight, occupation, social class, residential status are known to influence blood pressure levels. Blood pressure levels in two population groups in an industrial town were studied in relation to native back ground, age, sex, weight and social class. The distribution of the blood pressure levels in the rural population, both systolic as well as diastolic, were lower as compared to those of urban population. The mean systolic and diastolic blood pressure of rural and urban population were 107 and 76 mm of Hg and 118 and 91 mm of Hg respectively. ($X^2 = 173.63$, $DF = 1$, $P < 0.001$, for systolic blood pressure and $X^2 = 733$, $DF = 1$, $P < 0.001$, for diastolic blood pressure). With increasing age, mean blood pressure levels, both systolic and diastolic, increased. The correlation (r) for systolic blood pressure and age for rural was +0.978 and for urban was +0.90. For diastolic blood pressure and age it was: rural + 0.967 and urban +0.935. With increase in weight there was a rise in both systolic and diastolic mean levels amongst both urban and rural population. Correlation (r) for systolic blood pressure and weight was +0.878 for urban and for rural +0.938. For diastolic blood pressure and weight rural was + 0.956 and urban 0.942. With change from a lower to next higher social class, mean systolic blood pressure levels also increased.

Keywords: Systolic blood pressure; diastolic blood pressure; artisans.

A number of environmental factors have been specifically implicated in the development of high blood pressure including salt intake, obesity, occupation, family size and crowding. These factors are all assumed to be important in the known rise of blood pressure with age in more affluent societies in contrast to the decline in blood pressure with age in more primitive cultures [1]. The present study was therefore undertaken to determine the effects of certain environmental factors, i.e., residential

status, age, sex, weight, literacy status, years of service (occupation), social class and family size on normal blood pressure levels as these are known to be influencing factors.

Material and methods

The study population comprised of 1191 individuals from rural area and 1312 individuals from an urban area of Kanpur. The individuals were

more than 15 years of age and were of both sexes. Both the populations comprised of 75% of the respective total population of that area.

Methodology: The present study is a community based cross sectional study of casual blood pressure of individuals, more than 15 years of age, belonging to already selected rural and urban areas of Kanpur. A questionnaire schedule was prepared. Systolic and diastolic blood pressure were included along with native background, age, sex, weight, literacy status, years of service of those who were having some occupation, social class and family size. Data was collected by examination of the individuals during the period of July 1985 to April 1986.

Background: This was classified into rural and urban depending on the nativity of the study population. The rural population comprised of those individuals who had settled in the area as farmers, petty job workers, artisans and labourers and had returned from the city. They had earlier been employed in the city and had returned home for various reasons.

The urban industrial population comprised of those who were presently engaged in industry and were residing in the urban areas along with their families even though many of them belong originally to rural areas. The minimum period of atleast one year stay in urban areas has been taken into consideration to categorize one as an urban dweller.

Sex: The sex has been grouped into male and female.

Educational status: This subset has been grouped into illiterate and literate. The literate groups have been further divided into four subgroups according to years of education. The literates who had studied upto primary and upper primary were grouped under one to five years of education. Those who had studied from middle class to high

school were grouped in the 11 to 14 years subgroup. Those who were postgraduates and doctorates were grouped in the 15 years and above subgroup.

Age: The population was above 15 years of age. The age groups were sub-grouped at 5 years group intervals from 15 years onwards. Age verification was not difficult from the urban industrial population as it was recorded in their service documents, but it was not possible to obtain the exact age of the rural population and it was ascertained from the historical events during subjects life time, from the skin texture, hair changes, teeth etc. It was decided to sub-group the age groups of the population into half a decade (on average it seems reasonable) to suppose that the entire age of an individual was over estimated no more often than it was under estimated.

Years of service: These were grouped at 5 years by class interval and sub-grouped in 8 sub-groups.

Family members: Number of family members in the respondent's family were grouped into 10 sub-groups according to number of family members.

Family income: It was found out from the respondent by interviewing the total family income obtained from all sources.

Social class: The social class was grouped into five classes based on the per capita income per month (Prasad, 1968) [2].

Results

It is the totality of certain variables which have close association or direct bearing, on the blood pressure levels of individuals. In the succeeding paragraphs important personal variables such as age, sex, weight, social class, income, education, occupation, family size have been presented with the blood pressure distribution accordingly.

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Table - 1a. Rural population by systolic and diastolic blood pressure

Systolic BP (mm Hg)	Diastolic Blood Pressure (mm Hg)												Total No.	Mean %
	60		61-70		71-80		81-90		91-100		101-110			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
90	60	5.04	11	0.92	7	0.59	0	0	0	0	0	0	78	6.35
91-100	10	0.84	345	28.97	58	4.87	6	0.50	0	0	0	0	419	35.18
101-110	0	0	98	8.23	364	30.56	33	2.77	0	0	0	0	495	41.56
111-120	0	0	9	0.76	81	6.80	60	5.04	8	0.67	1	0.08	159	13.35
121-130	0	0	0	0	5	0.42	11	0.93	11	0.93	1	0.08	28	2.35
131-140	0	0	0	0	1	0.08	1	0.08	8	0.67	0	0	10	0.84
141-150	0	0	0	0	0	0	0	0	1	0.08	0	0	1	0.08
151-160	0	0	0	0	0	0	0	0	0	0	1	0.08	1	0.08
Total	70	5.88	463	38.87	516	43.40	111	9.32	28	2.34	3	0.24	1191	100
Mean	91		102		110		117		126		140		107	

Table - 1b. Urban population by systolic and diastolic blood pressure

Systolic BP (mm of Hg)	Diastolic Blood Pressure mm Hg														Total No.	Mean %		
	60		61-70		71-80		81-90		91-100		101-110		111-120				121-130	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			No.	%
<90	7	0.53	09	0.69	25	1.91	0	0	0	0	0	0	0	0	0	0	41	3.13
91-100	6	0.46	33	2.52	179	13.64	49	3.73	0	0	0	0	0	0	0	0	267	20.35
101-110	0	0	26	1.98	124	9.45	129	9.83	56	4.27	0	0	0	0	0	0	335	25.53
110-120	0	0	13	0.1	25	1.91	141	10.75	127	9.68	11	0.84	0	0	0	0	317	24.16
121-130	0	0	7	0.53	4	0.30	13	1	96	7.32	47	3.58	3	0.23	0	0	170	12.95
131-140	0	0	0	0	1	0.08	6	0.46	27	2.06	43	3.28	12	0.91	0	0	89	6.78
141-150	0	0	0	0	0	0	2	0.16	14	1.07	23	1.75	6	0.46	3	0.24	48	3.66
151-160	0	0	0	0	0	0	0	0	1	0.08	7	0.53	5	0.38	1	0.08	14	1.07
161-170	0	0	0	0	0	0	0	0	0	0	1	0.08	7	0.53	3	0.24	11	0.84
171-180	0	0	0	0	1	0.08	0	0	2	0.16	2	0.16	6	0.46	2	0.16	13	0.99
181-190	0	0	0	0	0	0	0	0	0	0	4	0.32	0	0	0	0	4	0.30
191-200	0	0	0	0	0	0	0	0	0	0	1	0.08	1	0.08	1	0.08	3	0.23
Total	13	1	88	6.71	359	27.36	340	25.91	323	24.62	139	10.59	40	3.05	10	0.76	1312	100
Mean	94		107		105		114		125		140		151		198		118	

Table 1a, 1b, 2, 3 and 4 show the blood pressure distribution in the rural and urban population according to age, sex and weight. Table 2 confirms the well established fact that blood pressure rises as age advances. It is clearly seen that in both the rural and urban population both systolic and diastolic mean blood pressure levels showed a rise, being minimum in the youngest age group and maximum in the oldest age groups. The regression was statistically highly significant in both the populations (rural, $r = + 0.987$ $p < 0.05$) (urban, $r = + 0.99$, $p <$

0.05). However, an important difference in this rise of blood pressure is that in the rural populations, mean systolic and diastolic blood pressures in the youngest age group of 15-19 years was 104 and 72 mm of Hg and rose to 112 and 84 mm of Hg respectively in the oldest age group of 55 years and above. This indicates that rise of blood pressure with age in rural population is more or less within the normotensive range. In the urban population, higher levels of mean systolic and diastolic blood pressure levels were observed, being 116 and 87 mm of Hg in

the youngest age group and 125 and 92 mm of Hg respectively in the oldest age group. This indicates the presence of quite a few individuals being in pre hypertensive and hypertensive ranges specially in relation to diastolic blood pressure levels.

Table 3 shows the systolic and diastolic blood pressure levels among males and females in rural and urban population. It is seen that the systolic and diastolic blood pressure levels were very low amongst rural females as against their male

counter parts, being 103 and 73 to 111 and 79 mm of Hg respectively. The difference is statistically highly significant ($p < 0.01$). In the urban population too, the blood pressure levels were lower in females, however the difference was just significant ($p < 0.05$). It is important to note here that the number of females was sizeable (45.6%) in the rural population but their proportion was negligible (6.0%) in the working urban population. Sex ratio in both population is not unexpected.

Table No. 2. Blood pressure level by native background and age

Age (Years)	Native Background											
	Rural						Urban					
	Systolic			Diastolic			Systolic			Diastolic		
No.	%	Mean	SD	Mean	SD	No.	%	Mean	SD	Mean	SD	
15-19	162	13.60	104	6.97	72	6.93	23	1.75	116	12.42	87	9.47
20-24	172	14.44	105	7.86	73	7.90	70	5.34	117	11.81	88	9.95
25-29	187	15.70	106	6.79	74	6.82	105	8.00	118	15.11	89	11.86
30-34	150	12.59	107	7.14	75	7.16	90	6.85	119	15.78	90	11.62
35-39	130	10.91	108	8.84	76	9.60	137	10.44	120	16.12	91	12.03
40-44	99	8.31	109	9.01	77	7.40	346	26.37	121	16.92	91	12.43
45-49	83	6.97	110	10.05	82	8.14	265	20.20	122	19.61	91	12.27
50-54	73	6.13	111	6.83	83	8.47	143	10.89	124	20.36	91	12.85
55+	135	11.33	112	11.21	84	8.97	126	9.60	125	21.48	92	12.56
Total	1191	100.00	107	8.00	76	8.00	1312	100.00	118	17.00	91	12.00

Correlation (r) Systolic BP and Age - Rural + 0.978 Diastolic BP and Age - Rural + 0.967
 Urban + 0.99 Urban + 0.935

Table No. 3. Blood pressure level by native background and sex

Sex	Native Background											
	Rural						Urban					
	Systolic			Diastolic			Systolic			Diastolic		
No.	%	Mean	SD	Mean	SD	No.	%	Mean	SD	Mean	SD	
Male	648	54.50	111	8.21	79	8.34	1232	94	118	17.52	91	12.62
Female	543	45.60	103	8.27	73	8.42	80	6	115	16.00	85	12.13
Total	1191	100.00	107	8.00	76	8.00	1312	100.00	118	17.00	91	12.00

Systolic Blood Pressure Male Rural and Urban = 15.42 $p < 0.05$ HS
 Female Rural and Urban = 6.56 $p < 0.05$ HS
 $p < 0.05$ Significant $p < 0.01$ Highly Significant $p > 0.05$ Not Significant

Diastolic Blood Pressure Male Rural and Urban = 28.57 $p < 0.05$ HS
 Female Rural and Urban = 6.98 $p < 0.05$ HS

Table No. 4. Blood pressure level by native background and weight

Body wt. (kg)	Native Background											
	Rural						Urban					
	Systolic		Diastolic		Systolic		Diastolic		Systolic		Diastolic	
No.	%	Mean	SD	Mean	SD	No.	%	Mean	SD	Mean	SD	
30-34	144	12.09	96	6.75	69	5.67	4	0.30	110	0	81	0
35-39	358	30.06	106	6.88	70	6.88	44	3.35	114	16.35	84	11.39
40-45	385	32.32	109	5.56	72	4.84	150	11.43	116	17.59	86	11.69
45-49	160	13.43	112	6.13	73	5.47	248	18.98	115	16.86	90	12.05
50-54	92	7.72	116	6.92	74	7.03	300	22.87	117	16.22	92	12.05
55-59	36	3.02	120	10.43	78	9.54	205	15.63	119	16.99	93	12.31
60-64	4	0.76	125	7.07	85	11.18	169	12.88	120	20.05	93	13.40
65-69	4	0.34	138	21.65	90	7.07	95	7.24	119	16.56	92	12.10
70+	3	0.25	120	0	90	0	96	7.31	125	18.63	99	12.74
Total	1191	100.00	107	8.00	76	8.00	1312	100.00	118	17.00	91	12.00

Mean Weight - Rural 46.92 kg, Urban 56.74 kg

Correlation (r) - S.B.P. & Weight Rural = +0.878, Urban = +0.938 D.B.P. & Weight Rural = +0.956, Urban = +0.942

Table 4 shows the systolic and diastolic blood pressure levels by native background and weight. It is quite evident from the Table that there is definite rise in both the mean systolic and diastolic blood pressure level with every 5 kg rise in body weight. In the rural population, those individuals who were in the weight group of 30-40 kg, had a mean systolic and diastolic blood pressure of 96 ± 6.75 and 69 ± 5.67 mm of Hg respectively. There was a gradual rise of both mean systolic and diastolic blood pressure with rise in body weight. It was 112 ± 6.1 and 73 ± 5.47 mm of Hg in the mean weight range of 46.92 kg in the rural population and it rose to 138 ± 21.65 and 90 ± 7.07 mm of Hg in the 65 - 69 kg weight group. There was also a gradual rise in both mean systolic and diastolic blood pressure with every 5 kg increase in body weight. 54.74 kg was the mean weight of the urban population and the mean systolic and diastolic blood pressure in this body weight group was 119 ± 16.94 and 93 ± 12.31 mm of Hg respectively and it started rising further and it was 125 ± 18.63 and 99 ± 12.74 mm of Hg in those individuals in the urban population who were weighing 70 kg or more. There was a significant positive correlation between systolic blood pressure and rural

population ($r = +0.874$) and urban population ($r = +0.938$) whereas correlation for diastolic pressure and weight in rural population was $r = +0.956$ in urban population $r = +0.942$.

Table 5 shows the mean blood pressure by native background and social class. It is quite evident from this Table that there was significant difference between the mean systolic blood pressure and diastolic blood pressure between the lower and higher social class in the rural population but the mean systolic and diastolic blood pressure did not rise more than 116/80 mm of Hg respectively. But it was just the other way in the urban population. There was no significant difference in the systolic and diastolic blood pressure between the lower and higher socio economic status, but mean diastolic blood pressure was 92 ± 12.58 mm of Hg among the urban population of social class I where as it was only 88 ± 9.97 mm of Hg among social class IV of the urban population.

Discussion

Age and blood pressure. Gradual but continuous rise in the mean blood pressure levels,

Table No. 5. Blood pressure level by native background social class

Social Class	Native Background											
	Rural						Urban					
	Systolic		Diastolic		Systolic		Diastolic		Systolic		Diastolic	
No.	%	Mean	SD	Mean	SD	No.	%	Mean	SD	Mean	SD	
I	16	1.34	116	13.42	80	11.87	254	19.36	118	17.15	92	12.58
II	112	9.40	108	7.74	78	6.94	355	27.05	118	18.46	92	12.58
III	673	56.50	107	8.55	76	8.10	631	48.09	118	17.31	91	12.68
IV	390	32.95	106	8	74	7.80	72	5.47	117	14.11	88	9.97
V	0	0	0	0	0	0	0	0	0	0	0	0
Total	1191	100.00	107	8.00	76	8.00	1312	100.00	118	17.00	91	12.00

both systolic and diastolic, is observed with rise in age in both rural and urban populations (Table 2). In the younger age groups, the increase of systolic levels with age was small, but it was more marked in later years. Thus the rate of rise increased with age. The mean systolic level observed in the present study for the age group 20-24 years was 105 mm of Hg for rural group, and 117 mm Hg for urban group and was lower than the mean of 104 mm Hg and 116 mm Hg and among rural and urban population respectively which gradually increased to 112 mm of Hg and 125 mm of Hg respectively with increase of age. Again in the younger age groups, the increase of systolic levels with age was small in both populations. However, it was more marked in later years in the urban population, thus indicating the influence of certain factors influencing the rise of blood pressure in urban population which was not seen in their rural counterparts. This also negates the role of age in influencing the blood pressure rise to some extent according to this significant difference. However, compared to others, the mean BP of 112 mm of Hg for rural, 125 mm of Hg for urban population for the age group 55-59 years, was lower than the mean 132.2 mm of Hg observed by the different workers for the same age group.

Rise of blood pressure with increase in age had been noted by many workers like Boc et al (1957) [3] in the Bergen study, Gordon (1964)

[4] in USA, Kagan (1996) [5], and in prospective studies by Miall and Lovell (1967) [6], and Celine and Mathur (1970) in Central Indian population [7].

In some studies arterial pressure was not found to rise with age. This was seen mostly in studies conducted in tropical countries. Among studies in Western countries Alwares (1923), Dahl and Sutherland (1925) and Boyton and Todd (1947) failed to find any rise of blood pressure with age. Similarly Padmavati and Gupta (1958) [8] in a study conducted in industrial and rural workers of Delhi, did not find rise of systolic pressure with age in low socio economic group while a consistent rise was noted in the blood pressure levels of high socio economic groups. These reports lend support to the observation of the present study relating to rural population.

Sex and blood pressure: In the present study the mean systolic and diastolic blood pressures of the females in the rural area is lower than those of the males and as well as the blood pressure recorded for the male and female population of the urban area. It was quite natural that female population in rural areas will be having low blood pressure and such a population has also brought down the mean blood pressure level of the male population in the rural area. In the urban area the female population being less in number (6.1%), did not alter the mean blood pressure

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level of urban male population. However, their mean blood pressure was more than that of the rural females because they were industrial employees, being employed in place of their deceased husbands and having more family responsibilities and unmet needs.

Tiwari (1974) [9] in rural population of Allahabad, Celine and Mathur (1970) [10] in Central India, Boe et al (1957) [3] in the Bergen studies had also reported lower blood pressure level in females.

Weight and blood pressure: It was observed in the present study that there is a rise in the mean blood pressure, both systolic and diastolic, with increase in weight (Table 4) in both the rural and urban population. These observations were similar to Shah and Kunjannam (1959) [11] who recorded higher prevalence of hypertension in overweight persons. Robinson et al (1940) also observed hypertension more frequent in overweight individuals. Doyce and Lovell (1961) [12] found that heavier Australians had on the average high blood pressure. In the urban population those individuals having more than 70 kg weight were having a systolic and diastolic blood pressure of 125 ± 18.63 and 99 ± 12.74 mm of Hg.

Social class and blood pressure: It was observed in the present study that with increase in the social status the mean systolic blood pressure levels showed marked rise. The mean systolic blood pressure level among the social class I of rural population was 116 mm of Hg where as it was 118 mm of Hg amongst the urban population. In the social class IV, in the rural population the mean systolic blood pressure was 106 mm of Hg and in the urban population it was 117 mm of Hg. The diastolic blood pressure also showed a similar trend. Celine and Mathur (1970) [7] observed that both systolic and diastolic blood pressure levels were higher in high socio economic groups compared to the lower socio economic groups.

Thus, it seems that social status plays some role in the determination of blood pressure levels. The cause of blood pressure of mean levels in higher social class individuals may be due to their sedentary habits and higher caloric intake leading to higher weight range.

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