ORIGINAL ARTICLE

Blood Pressure in Rural and Urban Adult Healthy Females of Jat Sikh Community in Punjab, North India: An Epidemiologic Profile

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Summary

Blood pressure readings were collected from 1042 adult females of rural and urban Jat Sikh community of Punjab, a north Indian State. Anthropometric measurements like height, weight and skinfold thickness were also collected. The difference between rural and urban females in systolic, diastolic and mean arterial blood pressure was found to be statistically significant. All anthropometric variables and age have a significant positive association with blood pressure. The effects of anthropometric variables on blood pressure were assessed simultaneously through stepwise multiple regression analysis. All 'F' ratios have been found highly significant ($p < 0.001$) among both rural and urban female population.

Key Words: Blood pressure, Punjabi females, Rural and Urban, Correlation

Introduction

Blood pressure (BP), an important physiological marker, attained great etiological significance in the epidemiology of cardio-vascular disease. The determinants of hypertension in addition to genetic predisposition have been thoroughly explored in many of the western populations. Yet, it has been difficult to determine the genetic etiological background of BP due to its sensitiveness to numerous aspects of the physical and social environment like diet, stress, smoking, age, sex, physiological differences and anthropometric variations[1-8].

Epidemiological studies for essential hypertension have also been thoroughly explored in western populations. Whereas, the study of this in the Indian population is very scanty[9-12]. Therefore the present cross-sectional study was designed to survey healthy adult females in a Jat Sikh community in Amritsar district in Punjab, a North Indian State.

In most western populations, socioeconomic status generally has negative associations with blood pressure. It has been noticed that higher income groups have lower blood pressure than those in the working class[13, 14]. However, large body size, obesity, urban life, social stresses, high sodium and high fat diets are generally associated with high blood pressure in industrialized nations[15-18]. The purpose of this paper is to examine the relationships between anthropometric measurements and blood pressure with rural and urban differences in life styles as reflected in a Punjabi female population.

Materials and Methods

The study location is in the state of Punjab, North India. A total 1042 adult females (rural, 503 and urban, 539) were measured for height, weight, body mass index, three skinfold thicknesses (biceps, triceps and

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subscapular) and blood pressure. A two stage stratified sampling design was implemented. In the first stage, all locations (in urban and rural) of the Jat Sikh community in Amritsar district were randomly selected. In the second stage, the subjects were stratified by age, gender and location. Thus, only adult (≥ 20 years of age) females were selected for the study. The data was collected during summer, in the year 2001. Weight was measured using a standard bathroom scale (Soehnle, West Germany) with minimum clothes adjustment. Since measurements were taken in summer, when the weather is very warm in North India, no weight correction was thus made. Weight was measured to the nearest ± 0.1 Kg. Height was measured to the nearest ± 0.5 cm by using a portable stadiometer. Skinfold thicknesses were measured to the nearest ± 0.2 mm by using a skinfold caliper following the general procedure as given by Weiner and Lourie[19]. The body mass index (BMIs) was calculated by taking Kg (weight)/ m^2 (height) for each individual.

The right arm was used for the manual measurement of blood pressure with a standard clinical mercury sphygmomanometer by ausculatory method[20] after the subject had rested for at least 15 minutes. Three consecutive readings were taken with a gap of five minutes and the mean of three readings was used for analysis. The blood pressure measurement was taken with the subject sitting with the right arm supported horizontally at the heart level. Every effort was made to stave off the possible influence factors like subjects suffering from any major tension were omitted (the major tension was a personal assessment of the respondents of immediate psychological stress). Individuals under treatment for hypertension were not included in the data analysis. The mean arterial blood pressure was calculated by the formula: 0.33 (SBP) + 0.67 (DBP).

All the measurements were performed by non-medical students with proper training in anthropometric and physiometric measurements under direct supervision of the first and second authors.

For most of the urban subjects, age could be verified from school records and for the rural subjects, the error of age estimation was minimised by personal observation and genealogical checks. The adult (≥ 20 years of age) urban Jat Sikh females were mainly teachers, clerks and housewives. In most of the houses, modern household facilities were available. Their diet was mainly based on refined foods. Whereas, Jat Sikh females residing in rural areas were engaged in physical labour. They assist their men folk on the farms and take care of their households and rear cattle etc. Therefore, there was plenty of milk, butter in their diet. The vast majority of the rural females (85%) were illiterate.

The relationship among anthropometric measurements and blood pressure in adult Jat Sikh females was assessed by product-moment correlation coefficients. The effects of these variables are evaluated through analysis of variance (F-ratio). Finally, anthropometric variables were used to predict blood pressure in adult Jat Sikh females using stepwise multiple regressions model.

Results

Age adjusted systolic and diastolic blood pressures in rural and urban areas are presented in Figure 1. In both cases, an upward trend with age is found. Therefore, age trend is primarily linear for systolic and diastolic in both rural and urban areas. The changes of mean for age- adjusted blood pressures in rural and urban areas are also shown in Table I. Consistent increase of mean values of SBP, DBP and MBP with the increase of age in both urban and rural areas has been observed. The differences between the means of urban and rural areas were found to be statistically significant at the 5% significance level. Females in urban areas have relatively higher rate of increase in the levels of systolic and diastolic blood pressure with advancing age as compared with their rural counterparts.

Table II shows age adjusted anthropometric measurements of the study population. The heights of urban and rural Jat Sikh women were significantly different ($p < 0.05$). No such trend was observed for weight, whereas, BMI and the three skinfold thicknesses were significantly different ($p < 0.05$) in the first three age groups.

Pearson product moment correlation coefficients for age adjusted blood pressure, age and anthropometric variables in adult Jat Sikh females from rural and urban areas are shown in Table III. Systolic and diastolic blood pressures are highly correlated in both areas. The age, height, weight, biceps, triceps and subscapular skinfold were significantly ($p < 0.001$) correlated with systolic and diastolic blood pressure in both rural and urban areas, whereas, all correlation

coefficient values except weight for systolic blood pressure are significantly higher ($p < 0.05$) in urban than rural areas. However, the reverse trend is found in the case of diastolic blood pressure although systolic blood pressure is more eco-sensitive than diastolic blood pressure.

To evaluate the effects of the anthropometric variables on blood pressure simultaneously, a stepwise multiple regression was carried out with age adjusted systolic and diastolic blood pressure as dependent variables and age adjusted anthropometric variables as independent variables (Table IV). It is assumed that weight acts as constant significant predictor of systolic and diastolic blood pressure. Therefore it can be inferred through the differences in values of R^2 that BMI is better related in systolic blood pressure in both urban and rural areas, whereas, for diastolic blood pressure, weight and height for urban areas and weight and triceps skinfold for rural areas are better predictors. All the 'F' ratios for both areas are highly significant ($p<0.001$). All R^2 values also highly significant ($p<0.001$) for urban and rural areas. Therefore, it is difficult to assess the difference of the effects of these anthropometric variables on their blood pressures in area wise (rural /urban) among the Jat Sikh female population.

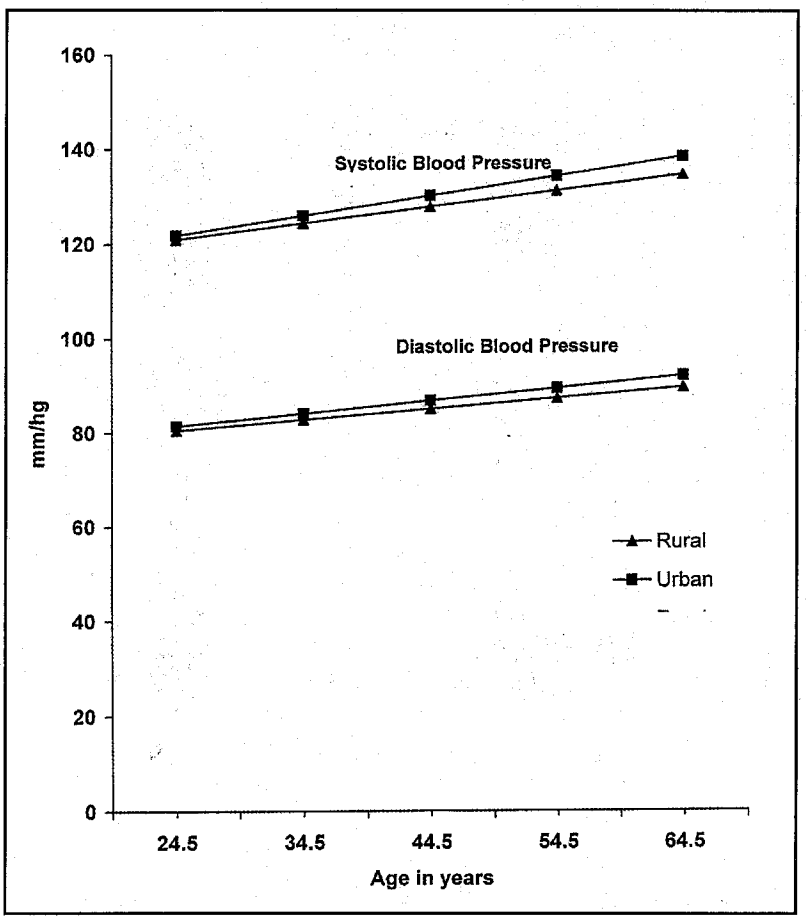

Fig. 1: Age adjusted systolic and diastolic blood pressure readings in Jat Sikh female popualtion

Table I

Age-adjusted blood pressures of Jat Sikh females in rural and urban areas of Amritsar district in Punjab, India (Mean ± S.D.)

Age group (years)	No.		Systolic Blood Pressure (SBP) (mm/hg)		Diastolic Blood Pressure (DBP) (mmHg)		Mean arterial blood pressure (MBP) (mmHG)	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
20-29	115	120	120.89 ± 4.10	121.75* ± 5.50	80.45 ± 2.85	81.39* ± 3.36	93.93 ± 3.03	94.85* ± 3.42
30-39	105	115	124.21 ± 4.21	125.80* ± 5.78	82.67 ± 3.07	83.99* ± 3.45	96.52 ± 4.01	97.93* ± 4.89
40-49	120	118	127.53 ± 4.89	129.85* ± 5.67	84.88 ± 3.87	86.61* ± 4.51	99.10 ± 4.87	101.02* ± 4.62
50-59	85	101	130.85 ± 5.01	133.90* ± 6.02	87.10 ± 4.45	89.21* ± 4.62	101.68 ± 5.01	104.11* ± 5.33
60-69	78	85	134.16 ± 5.07	137.95* ± 6.72	89.32 ± 6.70	91.82* ± 5.17	104.27 ± 5.71	107.19* ± 5.87

* Significant difference between rural and urban population at the 5% level ($p<0.05$)

Table II

Age adjusted anthropometric measurements among Jat Sikh females in rural and urban areas of Amritsar district in Punjab, India (Mean ± S.D.)

Age Group (Years)	No		Height (cm)		Weight (kg)		Body Mass Index (kg/m²)		Biceps skinfold (mm)		Triceps skinfold (mm)		Sub scap. skin fold (mm)	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
20-29	115	120	155.85 ±5.39	151.62* ±4.92	54.77 ±5.50	55.83 ±5.36	21.38 ±2.92	23.04* ±3.22	9.05 ±3.25	10.97* ±3.66	14.88 ±3.87	16.66* ±4.07	11.20 ±3.63	12.45* ±3.78
30-39	105	115	154.65 ±5.70	150.95* ±4.32	58.14 ±5.67	59.32 ±6.01	23.11 ±3.42	24.14* ±2.52	9.78 ±3.77	10.88* ±3.41	16.79 ±4.02	17.63 ±4.27	11.94 ±3.96	13.27* ±3.56
40-49	120	118	154.44 ±5.10	150.28* ±4.87	61.50 ±6.23	61.50 ±6.69	24.84 ±4.99	25.24 ±4.36	10.22 ±3.87	10.79 ±3.56	17.96 ±4.05	18.60 ±4.94	12.68 ±4.12	13.78* ±4.07
50-59	85	101	153.24 ±5.33	149.61* ±5.39	64.86 ±8.71	63.68 ±7.02	26.58 ±4.52	26.33 ±4.59	10.67 ±3.88	10.69 ±4.10	19.13 ±4.51	19.57 ±4.18	13.14 ±3.41	14.29 ±4.71
60-69	78	85	152.03 ±4.94	148.94* ±5.55	68.23 ±6.70	65.85* ±7.50	28.31 ±4.70	27.44 ±5.31	11.11 ±2.97	10.60 ±4.21	20.29 ±4.49	20.54 ±4.70	14.15 ±4.17	14.84 ±4.35

* Significant difference between rural and urban population at the 5% level ($p<0.05$)

Table III

The Correlation Coefficients of systolic and diastolic blood pressure in relation to age and anthropometric variable among Jat Sikh adult females in rural and urban areas of Amritsar district in Punjab, India

Variables	Systolic Blood Pressure				Diastolic Blood Pressure			
	Rural		Urban		Rural		Urban	
	r	p values	r	p values	r	p values	r	p values
Diastolic blood pressure	0.605	<0.001	0.858	<0.001	-	-	-	-
Mean Arterial blood pressure	0.726	<0.001	0.706	<0.001	0.764	<0.001	0.468	<0.001
Age	0.264	<0.001	0.415	<0.001	0.631	<0.001	0.561	<0.001
Height	0.221	<0.001	0.418	<0.001	0.363	<0.001	0.345	<0.001
Weight	0.339	<0.001	0.278	<0.001	0.582	<0.001	0.258	<0.001
BMI	0.097	<0.05	0.130	<0.05	0.087	<0.05	0.084	<0.05
Biceps skinfold	0.293	<0.001	0.670	<0.001	0.693	<0.001	0.520	<0.001
Triceps skinfold	0.131	<0.001	0.329	<0.001	0.654	<0.001	0.269	<0.001
Subscapular skinfold	0.244	<0.001	0.321	<0.001	0.792	<0.001	0.479	<0.001

Table IV

Distribution of coefficient of determinations (R^2) and variance ratio (F) through stepwise multiple regression analysis for SBP and DBP for weight model with the other variables among Jat Sikh females in rural and urban areas of Amritsar district in Punjab, India

Blood pressure model with the other variables (assumed weight as a constant predictor)	R^2				'F' ratio			
	Systolic blood pressure*		Diastolic blood pressure*		Systolic blood pressure*		Diastolic blood pressure*	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Weight, Height	0.455	0.475	0.765	0.782	153.77	153.35	492.29	502.25
Weight, BMI	0.515	0.788	0.577	0.745	187.83	519.72	231.81	418.56
Weight, Biceps skinfold	0.250	0.323	0.682	0.714	71.47	90.16	341.72	364.13
Weight, Triceps skinfold	0.227	0.528	0.739	0.783	114.58	183.02	436.35	505.93
Weight, subscapular skinfold	0.376	0.689	0.612	0.689	117.36	327.92	262.23	327.92

* All values are significant at $p < 0.001$

Discussion

In the present study, the rise in blood pressure with age is moderate among rural and urban Jat Sikh females. There was a general tendency of systolic and diastolic levels of blood pressure to increase with advancing age in both rural and urban populations. The observations of the difference of systolic, diastolic and mean arterial blood pressure in the rural and urban areas have been found to be statistically significant ($p<0.05$). A consistent increasing trend of systolic, diastolic and mean arterial blood pressure has been found in urban females. This suggests that environmental differences, life style, diet habit, stress and strain have a positive effect to increase of the blood pressure. Therefore, the present study is consistent with the findings reported by several studies[17,21-25]. However, Lewis[26] has reported no significant difference in blood pressure between rural and urban populations and he argued that specific ecological circumstances combined with a particular social organisation made life in traditional areas more stressful than in urban areas. Whereas, Silval et al.[27] studied the Brazilian population and reported that residence in a more modernised community is associated with higher blood pressure.

It is also apparent from the present study that there is a trend of increase in weight, body mass index, and skinfold thickness with advancement of age among rural and urban Jat Sikh females. But, the variable height shows a reverse pattern i.e. a decrease in height is observed from youngest age group to oldest age group. A similar trend of decrease in stature is observed by Singhal and Sidhu[28]. The difference of height among rural and urban Jat Sikh females has been found statistically significant ($p<0.05$). Rural Jat Sikh females are taller, with broad shoulders and hips than the urban counterpart. Whereas, the differences of other variables like weight, BMI and three skinfold thicknesses were statistically significant ($p<0.05$) only for certain early age groups.

A highly significant positive effect ($p<0.001$) of age and anthropometric variables have been found on systolic and diastolic pressure in rural and urban Jat Sikh females. Females have great variability in blood pressure especially in the middle age group and onwards. This phenomenon is plausibly related with menstruation, pregnancy, parity and menopause[29-30]. It is also observed by Schall[31] that females 45 years and older have a tenfold increased risk for hypertension as compared to younger women.

However, the associations of various body habitus like height, weight, body mass index and skinfold thickness with blood pressure appear to be more similar across rural and urban female population. Therefore, the present study suggests that the age associated changes with all the studied anthropometric variables are inevitable for women[32-35]. These changes are associated with physiological and hormonal change that are more specific and prominent in women. To test this hypothesis, anthoropometric variables were used to predict blood pressure in a stepwise multiple regression analysis in rural and urban population separately. All anthropometric variables appear significant predictors of blood pressure and enter the regression equations in both the populations.

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