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The Association of Waist-Hip Ratio and Body Mass Index with Blood Pressure in Tribal and Non-Tribal Women

S. Putatunda and P. Dhara
Department of Human Physiology with Community Health, Vidyasagar University, Midnapore 721 102, West Bengal, India

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ABSTRACT In a cross sectional study on adult women blood pressure, weight, height, waist-hip ratio (WHR) and body mass index (BMI) have been determined in tribal and non-tribal populations. The mean weight, height and BMI in tribal women are significantly lower than that of non-tribal women. In non-tribal women WHR and BMI have higher degree of correlation with blood pressure than that in tribal women.

INDRODUCTION

Blood pressure is an important indicator of cardiovascular functioning. Blood pressure varies with age, sex, race, body weight, body fatness and several other factors (Kotchen et al., 1989; Gray and Fujoka, 1991; Palti et al., 1988; Rlmm et al., 1988).

In the present investigation body adiposity and blood pressure have been determined among tribal and non-tribal women. The body adiposity has been assessed by means of body mass index and waist-hip ratio. The systolic and diastolic blood pressure and the said anthropometric indices have been compared between tribal and non-tribal populations. The degree of association between the anthropometric indices and blood pressure have been evaluated for different age groups in two populations.

MATERIALS AND METHODS

Subjects : The investigation was made only on adult women. The subjects (n=150) were selected at random from the neighbouring areas of Midnapore town, West Bengal. The total subjects were divided into tribal (Santal) and non-tribal group. The latter group represented a mixed non-tribal population. Each group was subdivided into different age group, *viz.*, 20-30 years, 31-45 years and 46-65 years representing younger adults, older adults and old women group. The pregnant women were excluded from this study.

Blood Pressure : The systolic and diastolic blood pressures were determined by auscultatory method with the help of a sphygmomanometer. The measurements were taken in supine posture after a rest period of 15 minutes. The mean value of three readings was recorded. The subjects did not reported any symptoms of hypertension or hypotension during the study.

Anthropometric Measurements : Anthropometric measurements were taken from the subjects with minimum clothing and in each case the mean value of three readings was recorded.

Weight : The body weight of the subject was measured with the help of a standard portable weighing machine (Libra) with an acuracy of 0.5 kg.

Height : The measurement was taken with the subject standing against a vertical background surface in normal erect position, the shoulders, buttocks and heels lightly touching the background. Arranging the head in the

Frankfurt plane, the measurement was taken from the vertex of the head to the ground; an adjustable cross bar being brought down to the head and the measure taken from a Vertical Scale (Croney, 1981).

Waist Girth : Waist girth was measured by the steel tape. The subject stood erect, looking straight ahead, heels together, and weight distributed equally on both feet. The tape was placed in the horizontal plane and the circumference of the trunk was measured at the level of waist line, 1 inch (2.54 cm) above the umbilicus (Solar et al., 1988).

Anthropometric Indices : The body mass index (BMI) was determined by dividing the weight (in kg) by the squared value of height (in meter). The waist-hip ratio was determined by dividing the waist girth (cm) by the hip girth (cm).

Statistical Analysis : The chi square test for goodness of fit was applied to test whether or not the collected data had normal distribution. The significance of difference between the means of the observed parameters was evalued by 't-test' for independent samples when the data represented normal distribution and Mann-Whitney U test was applied to test the significance of difference between the observations in case of the data deviated from the normal distribution. The degree of association among different parameters was determined by Pearson's product moment correlation coefficient and Spearman's rank-difference correlation coefficient in case of data with normal distribution and without normal distribution respectively.

RESULTS

The mean values and standard deviations of anthropometric measurements and blood pressure for tribal and non-tribal populations have been presented in table 1. The correlation coefficients between waist hip ratio and blood pressure, and body mass index and blood pressure for tribal and non-tribal women have been given in table 2.

DISCUSSION

From the results shown in table 1, it may be noted that the mean body weight in middle age group (31-45 years) is higher than that of other age groups in both tribal and non-tribal women. The mean body weight of tribal women is significantly lower ($p<0.001$) than that of

Table 1 : Mean and SD of weight, height, systolic blood pressure (SBP), diastolic blood pressure (DBP), waist-hip ratio (WHR), and body mass index (BMI) for different age group of non-tribal and tribal women

Age (in years)	*Non-tribal Population*						
	No.	*Weight (kg)*	*Height (cm)*	*SBP (mm Hg)*	*DBP (mm Hg)*	*WHR*	*BMI*
20-30	35	45.93±5.37	152.05±6.83	109.77±6.48	70.11±6.08	0.78±0.06	19.98±2.75
31-45	20	49.62±9.96	152.32±6.16	116.00±10.95	72.80±6.50	0.80±0.05	21.36±4.38
46-65	20	43.84±8.90	148.97±7.47	143.20±13.45	78.60±12.85	0.83±0.09	20.18±2.87
20-65 (Total)	75	46.36±7.95	151.30±6.58	120.35±17.09	73.09±7.82	0.79±0.06	20.40±3.29
	Tribal Population						
20-30	34	39.81±3.61[3]	147.43±4.29[2]	113.23±8.70	68.29±6.51	0.82±0.04[1]	18.31±1.30[2]
31-45	24	41.64±4.96[2]	148.35±7.84	115.33±12.57	70.87±6.02	0.84±0.04[2]	18.79±2.02[1]
46-65	17	38.20±5.50[1]	146.61±3.90	127.29±16.77[2]	79.41±10.31	0.82±0.05	17.80±2.31[2]
20-65 (Total)	75	40.03±4.58[3]	147.54±4.40[2]	117.09±13.34	71.64±8.48	0.82±0.05[2]	18.35±1.82[3]

1. $P<0.05$, 2. $P<0.01$, 3. $P<0.001$

Table 2 : Correlation co-efficients between WHR and SBP, WHR and DBP, BMI and SBP and BMI and DBP in tribal and non-tribal women

Age (in years)	*Non-tribal women*				*Tribal women*			
	WHR & SBP	*WHR & DBP*	*BMI & SBP*	*BMI & DBP*	*WHR & SBP*	*WHR & DBP*	*BMI & SBP*	*BMI & DBP*
20-30	0.065	0.031	0.319	0.340[1]	0.047	0.257	0.239	0.343[1]
31-45	0.345	0.653[2]	0.540	0.620[2]	-0.449[1]	0.060	-0.085	0.030
46-65	0.676[2]	0.037	0.349	0.261	0.377	0.263	0.235	-0.033
20-65 (Total)	0.311[2]	0.199	0.270[1]	0.360[2]	-0.117	0.119	0.090	0.120

1. P<0.05, 2. P<0.01

their non- tribal counterpart. Such finding has been noted in all age groups.

The mean height of tribal women is found to be significantly lower (P<0.01) than that of non-tribal women when total population is considered. However, the middle and upper groups do not show significant difference in the mean values of height between the two ethnic groups, though tribals have got slightly lower values.

It may be observed from table 1 that the systolic and diastolic blood pressure increase with age in both tribal and non-tribal women. The mean value of diastolic blood pressure in tribal women do not differ significantly from that of non-tribal women; but the non-tribal women of older age group (46-65 years) show significantly (P<0.01) higher systolic blood pressure than that of tribal women. Other investigators also observed racial differences in blood pressure. Grim et al. (1980) investigated the variation of blood pressure in relation to the dietary intake of sodium and potassium between Black and White populations. Higher prevelance of hypertension was noticed among Blacks. Ekelund et al. (1990) also reported that the Black women had significantly higher diastolic pressure than that in White women. Greek adolescents had significantly higher blood pressure than that of Non-Greek American boys (Fordyce-Baun et al., 1987).

The waist-hip ratio (WHR) in tribal women represents significantly higher mean values (P<0.01) than that of non- tribal women though the age group of 46-65 years does not have difference (Table 1). In non-tribal group the waist-hip ratio is found to be increased with age. The waist-hip ratio is an indicator of body fatness. From table 2, it may noted that in non-tribal women systolic blood pressure is highly correlated with WHR in higher age group where the value of WHR is highest. Diastolic pressure is also associated with WHR in the middle age group. Gillum (1987) also observed significant association of WHR with blood pressure in women. Tribal women, however, do not show significant correlation between blood pressure and WHR except for middle age group which shows a negative correlation. The increase of blood pressure with higher values of WHR may be related to the higher blood lipid levels (Solar et al., 1988; Nye et al., 1991). The risk of cardiovascular diseases may be assessed by determining WHR (Kannel et al., 1991; Thompson et al., 1991).

Body mass index (BMI) is found to have significantly lower mean values in tribal women in all age groups than that of non-tribal women. According to the classification of Meltzer et al. (1988), BMI lesser than 19 corresponds to "thin" and BMI = 19-24 corresponds to "average" in women. Hence, from the results of the present study it appears that the tribal women may be classified as "thin" (BMI=18.35) and the non-tribal women women may be regarded as "average" (BMI=20.40).

BMI is found to be associated with systolic and diastolic blood pressure among non-tribal women (Table 2). The tribal women, on the other hand, exhibit poor association between BMI and blood pressure (systolic and diastolic). BMI may be used as an indicator of obesity. The percentage of body fat is found to be correlated with BMI (Gray and Fujoka, 1991). The correlation between BMI and blood lipid level (high density lipoprotein, cholesterol and low density lipoprotein) has been observed by Bonithon-Kopp et al. (1991). The influence BMI on blood pressure and other cardiovascular diseases has been shown by the other investigators also (Palti et al., 1988; Hoffman et al., 1988; Kennel et al., 1991).

In tribal women relatively lower correlation co-efficients have been observed in the present study. This may be due to the difference in physical activity levels between two groups of women. Tribal women exert greater physical activities in their day to day life than the sedentary non-tribal women. Beside this, other socioeconomic and nutritional factors may be related to the physical and physiological parameters and their degree of association. Further study is needed in this area.

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