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Comparison of Anthropometric Characteristics and Blood Pressure Phenotypes between Pre-and Post-menopausal Punjabi Women

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ABSTRACT The association between blood pressure phenotypes and menopause with respect to certain other metric variables were examined in a random sample of 489 pre- and 191 post-menopausal Punjabi women. Post-menopausal women had a higher blood pressure and pulse rate than pre-menopausal women (<0.001). The metric measurements such as weight, BMI, waist and hip circumferences, WHR were also higher in post-menopausal women (<0.001). In addition to that estimates of correlation and stepwise multiple regressions for blood pressure with other metric variables among pre- and post-menopausal women have been carried out.

INTRODUCTION

It is well established that hypertension is one of the major health burden among menopausal women. However, the etiologic factors contributing to rise of blood pressure in women after menopause are not well known. Many investigators (Colditz et al. 1987; Staessen et al. 1989; Kaur and Mogra 2006) have shown positive and significant association between menopause and blood pressure with adiposity and body measurements. However, the question that blood pressure increases independent of BMI, WHR and age following menopause has remained unanswered (Lindguist 1982; Lindguist et al. 1985). In the view of the remaining uncertainty, in the present study an attempt have been made to investigate the association between menopause and blood pressure phenotypes with respect to age, height, BMI, waist and hip circumferences, waist hip ratio and pulse rate in a random samples of Punjabi women.

MATERIALS AND METHODS

A random sample of 489 pre- and post-menopausal women was ascertained to study. Women from 20 to 55 years old are included in the present analysis. The data were collected through subsequent visit at home and worksites. A self-designed questionnaire was adopted to note the menstrual status and other information of the participants. The natural menopause was defined once she has gone twelve full months with no flow at all and it is a part of women's normal ageing process. Almost all subjects are primarily vegetarian and non-alcoholic. They are living in patrilocal family system and similar household. Blood pressure of all women measured with mercury sphygmomanometer and a stethoscope in a sitting position on with the right fore arm placed horizontal on the table by following the recommendations of American Heart Association (1981). Mean arterial blood pressure (MBP) is the average blood pressure level during the cardiac cycle. MBP was simply estimated as DBP + (SBP-DBP)/3 (Perusse et al. 1989) and the pulse rate count over 1 minute. The anthropometric variables included height, weight, BMI, waist and hip circumferences and WHR. The waist-hip ratio (WHR) was calculated as waist circumference divided by hip circumference and the body mass index (BMI) was calculated using the standard equation: BMI= weight (kg) / height^2 (m^2). The techniques were used for anthropometric measurements as described by Weiner and Lourie (1981) for the International Biological Programme and Singh and Bhasin (1968). The measurements were taken using standard anthropometric tools. Average of repeated measurements was taken for statistical analysis. Student's t test was used for comparing means of group. Pearson's correlation coefficient was used to determine the association of blood pressure phenotypes and metric variables with

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pre- and post-menopause women. Significant covariates of blood pressure phenotypes were identified by step-wise multiple regression model.

RESULTS

Table 1 shows means with standard deviations and comparison of different measurements of pre- and post-menopausal women. The means of all variables except height were significantly ($p<0.001$) higher in post-menopausal than pre-menopausal women. Estimates of Pearson's correlation coefficients among age, height, weight, BMI, waist and hip circumferences, WHR and pulse rate for SBP, DBP and MBP between pre- and post-menopausal women are presented in table 2. Age was significant and positively associated with blood pressures (SBP, DBP and MBP) for both pre- and post-menopausal women. The correlation coefficients of waist and hip circumferences were found to be significant with DBP and MBP among pre-menopausal women and with only DBP for post-menopausal women. In multiple regression models, the standardized regression coefficient with associated standard error and the percent of variance accounted by the regressions (R^2) for blood pressure phenotypes are given in the table 3 among pre- and post-menopausal women. All regression coefficients except height, WHR are significant ($p <0.001$) for SBP and DBP among pre-menopausal women whereas, only weight and pulse rate for both SBP and DBP, BMI for SBP, waist and hip circumferences for DBP are found significant ($p<0.05$) among post menopausal women. However, negligible percent of variances for blood pressure phenotypes almost all other variables have been found among both groups. The results of the stepwise regression analyses are presented in table 4. It has been seen that other than weight for SBP and BMI for DBP, age and pulse rate are the common important predictors for SBP and DBP among pre-menopausal women whereas, other than BMI for SBP and hip circumference for DBP, pulse rate are the significant common predictors among post menopausal women. Nonlinear trend in age is also found in the present study.

Table 1: Descriptive statistics for different characteristics of 489 pre- and 191 post-menopausal Punjabi women

Variables	*Pre-menopausal Mean ± SD*	*Post-menopausal Mean ± SD*	*t*	*P*
Age (years)	28.17 ± 6.09	46.29 ± 3.04	40.27	<0.001
Height (cm)	159.48 ± 7.16	158.45 ± 6.20	1.77	NS
Weight (kg)	59.28 ± 7.79	64.75 ± 9.16	8.04	<0.001
BMI (kg/m^2)	23.19 ± 2.43	25.73 ± 3.26	11.24	<0.001
Waist Circumference (cm)	83.06 ± 7.91	91.29 ± 9.96	11.43	<0.001
Hip Circumference (cm)	97.19 ± 10.24	105.39 ± 9.84	9.62	<0.001
WHR	0.85 ± 0.04	0.86 ± 0.03	3.12	<0.001
SBP (mmHg)	123.33 ± 11.06	146.09 ± 23.77	17.23	<0.001
DBP (mmHg)	79.62 ± 7.44	88.32 ± 7.72	13.81	<0.001
MBP (mmHg)	94.22 ± 7.81	107.67 ± 11.75	17.69	<0.001
Pulse Rate	81.73 ± 7.39	86.89 ± 7.58	8.32	<0.001

Table 2: Comparison of Pearson's correlation coefficients for blood pressure with other metric variables among pre- and post- menopausal Punjabi women

Variables	*Pre- menopausal women (n = 489)*			*Post-menopausal women(n =191)*		
	SBP	*DBP*	*MBP*	*SBP*	*DBP*	*MBP*
Age (years)	0.078	0.354**	0.414**	0.078	0.017	0.060
Height (cm)	0.061	0.056	0.063	0.061	0.040	0.053
Weight (kg)	0.178*	0.241**	0.316**	0.178*	0.152*	0.202**
BMI (kg/m^2)	0.170*	0.252**	0.324**	0.170*	0.156*	0.204**
Waist circumference (cm)	0.090	0.235**	0.297**	0.090	0.148*	0.133
Hip circumference (cm)	0.117	0.207**	0.270**	0.117	0.176*	0.167*
WHR	0.005	-0.011	-0.018	0.005	0.009	0.004
Pulse Rate	0.459**	0.482**	0.514**	0.459**	0.426**	0.494**

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 3: Standardized regression coefficients and standard error with significant level and percent of variance (R^2) for different variables for blood pressure phenotypes in the multiple regression model among pre- and post- menopausal Punjabi women

Variables	*Pre- menopausal women (n = 489)*				*Post-menopausal women (n =191)*			
	SBP		*DBP*		*SBP*		*DBP*	
	Coefficient	R^2	*Coefficient*	R^2	*Coefficient*	R^2	*Coefficient*	R^2
Age (years)	0.735 ± 0.075**	0.164	0.433 ± 0.052**	0.125	0.607 ± 0.567	0.006	0.044 ± 0.185	0.00
Height (cm)	0.177 ± 0.106	0.003	0.0584 ± 0.047	0.003	0.234 ± 0.278	0.004	0.40 ± 0.90	0.002
Weight (kg)	0.492 ± 0.060**	0.120	0.231 ± 0.042**	0.058	0.464 ± 0.187*	0.032	0.152 ± 0.061*	0.023
BMI (kg/m^2)	1.592 ± 0.193**	0.123	0.770 ± 0.134**	0.061	0.529 ± 0.170*	0.029	0.368 ± 0.170	0.024
Waist-circumference (cm)	0.439 ± 0.60**	0.099	0.221 ± 0.41**	0.055	0.214 ± 0.173	0.008	0.141 ± 0.056*	0.022
Hip circumference (cm)	0.322 ± 0.047**	0.089	0.150 ± 0.02**	0.043	0.282 ± 0.175	0.014	0.176 ± 0.056*	0.031
WHR	-7.002 ± 5.344	0.001	-1.820 ± 0.982	0.00	1.629 ± 0.935	0.00	0.893 ± 0.637	.00
Pulse Rate	0.656 ± 0.061**	0.192	0.486 ± 0.040**	0.233	1.436 ± 0.203**	0.210	0.434 ± 0.067**	0.181

** Regression coefficient is significant at the 0.001 level (2-tailed), * Regression coefficient is significant at the 0.05 level (2-tailed).

Table 4: Results of stepwise regression analysis: significant predictor variables and regression coefficients.

Variables	*Pre- menopausal women (n = 489)*								*Post-menopausal women (n =191)*							
	SBP				*DBP*				*SBP*				*DBP*			
	Coeffi-cent	*SE*	*F*	*P*	*Coeffi-cent*	*SE*	*F*	*P*	*Coeffi-cent*	*SE*	*F*	*P*	*Coeffi-cent*	*SE*	*F*	*P*
Age	0.449	0.74	36.89	<.001	0.244	0.05	22.14	<.001	-	-	-	-	-	-	-	-
Weight	0.295	0.06	27.38	<.001	-	-	-	-	-	-	-	-	-	-	-	-
BMI	-	-	-	-	0.340	0.13	7.20	<.001	1.045	0.47	4.88	<.001	-	-	-	-
Hip circumference	-	-	-	-	-	-	-	-	-	-	-	-	0.105	0.05	4.17	<.04
Pulse Rate	0.499	0.05	72.16	<.001	0.413	0.04	106.88	<.001	1.409	0.20	49.05	<.001	0.420	0.07	39.48	<.001

DISCUSSION

The present study has shown that the general level of blood pressure is significantly higher in post-menopausal women. The increment proportion is more pronounced on SBP than DBP. The significant effects of menopause on blood pressure have been found in many other studies (Staessen et al. 1989; Pelt et al. 2001; Garauet 2002; Sipila 2003; Skrzypezak and Szwed 2005; Kaur and Mogra 2006). The results have indicated women with higher BMI and WHR would have more chances of having cardiovascular disease after menopause. A significant increasing trend was observed for pulse rate in post-menopausal women. Many studies have found that body mass index, WHR and several anthropometric measurements were significantly higher in post-menopausal than in pre-menopausal women (Pasquali et al. 1994; Perry et al. 1997; Azizi et al. 2005; Skrzypezak and Szwed 2005; Yannakoulia et al. 2007). In general, age is found to have a significant effect on blood pressure (Majumder 1990; Badaruddoza and Afzal 1999, 2000). It may however, be pointed out that in the present study, in multiple regression model age is found to be significant with SBP and DBP among pre-menopausal women but not in post-menopausal women. Furthermore, stepwise multiple regression analysis results also showed that age did not significantly add to the ability of the equation to predict blood pressure in post-menopausal women. Therefore, the trend of increasing of blood pressure in the menopausal transition may be associated with higher concentration of cholesterol and triglyceride (Graff-Iversen et al. 2008; Lopez et al. 2008). The data from the present study demonstrated that the variables such as age, height, weight, waist and hip circumferences were not found to be significantly associated with increase of blood pressure among post-menopausal women. The stepwise regression analysis of the current study demonstrate the possible confounding effects of age, weight and pulse rate on blood pressure among pre-menopausal women, whereas, only hip circumference and pulse rate have significant effects on blood pressure among post-menopausal women. Therefore, the significant development of blood pressure or body weight is may not be associated with menopausal status (Graff-Iversen et al. 2008). However, the report suggested that increasing of blood pressure in menopause with age is due to the stiffness of the arteries (Staessen et al. 1989). This may be a one of the confounding factors in general population. Hence, the reasons responsible for increasing of blood pressure in post-menopausal women are multi-factorial and complex interrelated. Hence the findings of the present study are in agreement with the hypothesis that the drop of female sex steroids and increase of androgen after menopause affect the balance between different vasoactive hormones in the female body (Sundsfjord et al. 1972; M'Buyamba-Kabagu et al. 1885). This may lead to increase blood pressure with menopause.

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