©Human Biology Review
www.humanbiologyjournal.com

Human Biology Review (ISSN 2277 4424) 2 (4) 2013
Original scientific paper (Khokhar et al. pp. 349-358)
Revised and Accepted on September 17, 2013

Differences in Anthropometric and Physiological variables of Normotensive and Hypertensive Working Punjabi Premenopausal Women

Kawaljit Kaur Khokhar [1], Gurcharan Kaur [2], Sharda Sidhu[3]

[1] Dept. of Human Genetics, Guru Nanak Dev University, Amritsar, 143005, Punjab, India, Mob. No.- 941499460 e-mail: virk.khokhar@yahoo.com
[2]Dept. of Biotechnology, Guru Nanak Dev University, Amritsar 143005, Punjab, India
e-mail: kgurcharan.neuro@yahoo.com
[3] Dept. of Human Genetics, Guru Nanak Dev University, Amritsar, 143005, Punjab, India
e-mail: shardasidhu@hotmail.com

Corresponding Author: Kawaljit Kaur Khokhar, Dept. of Human Genetics, Guru Nanak Dev University, Amritsar, 143005, Punjab, India, Mob. No.- 941499460 e-mail: virk.khokhar@yahoo.com

Citation: Khokhar KK, Kaur G and Sidhu S. 2013. Differences in Anthropometric and Physiological variables of Normotensive and Hypertensive Working Punjabi Premenopausal Women. Hum Bio Rev, 2 (4), 349-358.

ABSTRACT
Prevalence of hypertension is on the rise in the today's society, especially among working women. Present study was aimed to compare the anthropometric and physiological variables of normotensive and hypertensive premenopausal women so as to ascertain the possible changes occurring in these variables among hypertensive women. 330 premenopausal Punjabi working women were randomly selected. A questionnaire was designed to note down the required details. Anthropometric variables like weight, height, waist circumference, hip circumference, skin folds and physiological variables like systolic and diastolic blood pressure were taken with standardized methods. Normotensive (241) and hypertensive (89) subjects were compared for these variables. Significantly higher mean values of weight, waist circumference, hip circumference, skin folds, BMI, waist hip ratio, waist stature ratio, percent body fat, blood pressure, pulse pressure were observed among hypertensive subjects. Higher mean values of all anthropometric variables and physiological variables of hypertensive subjects point towards the unhealthy changes occurring in all body parameters of hypertensive subjects. It is suggested that if these changes are noticed at earlier stage and taken seriously, the prevalence of hypertension can be reduced. In working women, work stress might further be contributing towards its higher prevalence.

Key Words- *Premenopausal women, Postmenopausal women, Hypertension, Obesity, Anthropometric, Physiological variables*

INTRODUCTION

Hypertension is a major public health problem in India and the world. It is the commonest cardiovascular disorder affecting about 20% adult populations worldwide. It is an important risk factor for cardiovascular mortality (WHO, 1996). WHO has regarded it as 'silent killer' because it remains hidden, being generally asymptomatic during its clinical course. The National Health and Nutrition Examination Survey (NHANES) data has provided important epidemiologic information on the prevalence and control of hypertension in the United States between 1960 and 2008 (Burt et al., 1995; Egan et al., 2010; CDC Reports, 2011). Overall, the prevalence is higher in older individuals, non-Hispanic blacks, and women. Compared with the year 2000, the number of adults with hypertension is predicted to increase by ∼60% to a total of 1.56 billion by the year 2025 at global level. Reports suggest that the prevalence of hypertension is rapidly increasing in developing countries and is one of the leading causes of death and disability in developing countries (Kearney et al., 2005). The prevalence of hypertension in India is reported as ranging from 10 to 30.9 % (Padmavati, 2002) and the cardiovascular diseases are projected to cause 4.6 million deaths in India by 2020 (Rodgers et al, 2000).

One possible explanation for the increased prevalence of hypertension reported in the latest survey data is that, over the last decade, there has been a marked increase in obesity and average body mass index (BMI) (Hajjar and Kotchen, 2003). It is estimated, for example, that one-half of the relative increased prevalence of hypertension may be due to an increased weight of the average individual. Excess body weight is the sixth most important risk factor contributing to the overall burden of disease worldwide (Haslam and James, 2005). Increase in weight leads to increase in BMI and overall obesity among the individuals. The relationship between the risk of metabolic-cardiovascular diseases, including arterial hypertension, and body fat distribution indices such as the waist-to-hip ratio (WHR), rather than measures of the degree of body fatness as expressed by BMI, has long been recognized (Kissebah et al., 1982; Kalkhoff et al.1983). Waist circumference (WC) is closely related to BMI but relates better than BMI to health risks, because it also contains information about central distribution of body fat and it is not influenced by height (Han et al. 1995).

The growing prevalence of obesity is increasingly recognized as one of the most important risk factors for the development of hypertension. Obesity and in particular central obesity have been consistently associated with hypertension and increased cardiovascular risk. Based on population studies, risk estimates indicate that at least two-thirds of the prevalence of hypertension can be directly attributed to obesity (Krause et al. 1998). Given the close link between obesity and cardiovascular disease, it has been suggested that current trends in obesity might lead to a decline of the life expectancy in the USA in the 21st century (Olshansky et al. 2005). Similar trends are likely to occur in other countries also.

Keeping this data in mind, the present study was designed to assess the variations in various body parameters associated with obesity among normotensive (non-hypertensive) and hypertensive female subjects. Among women, visible variations in anthropometric parameters occur among postmenopausal women as compared to their premenopausal counterparts. As menopause in itself is the root cause of various metabolic disorders, changes appear in the form of higher BMI, WC, WHR, blood pressure (BP), etc. So, in the present study only premenopausal women were chosen to rule out the possibility of any change associated with menopause and make sure that the changes observed in hypertensive women as compared to their normotensive counterparts are associated with their hypertensive status only.

MATERIALS AND METHODS

For the present cross-sectional study, 330 premenopausal women, belonging to Jalandhar were selected at random. A questionnaire was designed to meet the goal of the study. Subjects were personally interviewed. Their body measurements like weight, height, WC, Hip Circumference (HC) were taken with standardized methods (Weiner and Lourie, 1981). Their blood pressure was checked using auscultatory method with mercury sphygmomanometer (Diamond Deluxe BP Apparatus, Pune, India) and stethoscope as per recommendations of Rose and Blackburn (1968). Skin folds like biceps, triceps, subscapular and supra-iliac were taken with Lange Skinfold Caliper. Every detail was noted down in the questionnaire. BMI, WHR, Waist stature ratio

(WSR), Pulse pressure (PP) and percent body fat (PBF) were calculated. Body fat was calculated according the table given in Mayo Clinic Diet Manual Fifth Edition (modified from Durnin and womersley, 1974). It gives age wise value of fat as a percentage of body weight for a range of values for the sum of four skin folds (biceps, triceps, suprailiac, and subscapular) of males and females. Subjects were divided into two groups; normotensive and hypertensive. The hypertensive status was assessed as per guidelines given by JNC-VII and reported by Chobanian et al. (2003).

Statistical Analysis

Data was maintained on excel spread sheet. Analysis was performed using SPSS (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, USA)) version 16 for windows. Results were presented as mean± S.D. The differences in anthropometric and physiological variables between normotensive and hypertensive premenopausal women were calculated with Student's *t*-test. P values <0.05 were considered as statistically significant.

RESULTS

It is reflected from **Table 1** that hypertensive women were of significantly higher age ($p<0.001$). Their weight, WC, HC were also higher ($p<0.001$) than the normotensive subjects. The mean values of derived variables like BMI, WHR and WSR were significantly higher ($p<0.001$) among hypertensive subjects as compared to their normotensive counterparts. As the mean values of biceps, triceps, sub-scapular and supra-iliac were also significantly higher ($p<0.001$) in hypertensive women, their PBF and total body fat was significantly higher in them ($p<0.001$). The mean values of Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and pulse pressure (PP) were also higher ($p<0.001$) among hypertensive women.

DISCUSSION

Significantly higher mean values of various anthropometric and physiological variables in hypertensive women as compared to normotensive counterparts reflect towards the unhealthy changes occurring among hypertensive subjects. A BMI cutoff of 23 has been widely used to identify a moderate to high risk of cardiovascular disease in Asians (WHO, 2000). Hypertension may be under diagnosed given that BP varies with age, gender, and height. In our previous studies on the same subjects, we observed that the prevalence of obesity according to BMI, WC and WHR among these premenopausal women was 70.30%, 89.05% and 87.92%, respectively (Khokhar et al. 2010) whereas, the prevalence of hypertension was noticed as 15.45% in the same subjects (Khokhar et al.2009). It has been suggested that the obesity is associated with metabolic disorders like; hypertension and diabetes. Khokhar et al. (2012) observed in their

Table 1: Mean values of Anthropometric and Physiological variables of normotensive and hypertensive women.

Variables	Normotensive N=241			Hypertensive N=89			P-value
	Mean	SD	SEM	Mean	SD	SEM	
Age (Yrs.)	38.81	4.75	0.69	45.61	5.40	0.70	<0.001
Weight (kg)	50.47	6.19	0.89	71.77	13.81	1.77	<0.001
Height (cm)	157.44	6.24	0.90	157.22	4.32	0.55	NS
WC (cm)	74.28	6.93	1.00	95.87	13.23	1.69	<0.001
HC (cm)	90.75	4.61	0.67	105.14	10.29	1.32	<0.001
Biceps (mm)	12.77	3.82	0.55	22.92	7.76	0.99	<0.001
Triceps (mm)	16.88	5.28	0.76	25.79	9.86	1.26	<0.001
Supra iliac (mm)	13.69	3.09	0.44	25.56	7.85	1.01	<0.001
Sub scapular (mm)	12.13	3.32	0.48	23.05	7.99	1.02	<0.001
SBP (mm/Hg)	112.00	10.55	1.52	146.95	13.64	1.75	<0.001
DBP (mm/Hg)	73.04	8.00	1.15	98.38	8.58	1.20	<0.001
PP(mm/Hg)	38.96	8.45	1.22	49.26	13.45	1.72	<0.001
BMI (kg/m^2)	20.43	1.79	0.26	29.05	5.09	0.65	<0.001
WHR	0.82	0.06	0.01	0.91	0.08	0.01	<0.001
WSR	0.52	0.06	0.00	0.58	0.07	0.01	<0.001
PBF	31.61	5.51	0.80	40.65	4.05	0.52	<0.001
Total Body Fat (kg)	15.89	3.78	0.55	29.55	7.72	0.99	<0.001

studies that the prevalence of pre-hypertension was 3.44 % and 13.24%, and hypertension as 5.17% and 17.65%, respectively among non-obese and obese premenopausal subjects. Similarly, among non-obese and obese postmenopausal women, the prevalence of pre-hypertension was 7.40% and 13.03%, and hypertension as 14.82% and 30.25%, respectively.

BMI, WC, WHR and PBF are considered as the indicators of obesity. As obesity is supposed to be associated with hypertension, it is assumed that the mean values of these parameters are on higher side among hypertensive subjects as observed in this study. In the present study, it is observed that the BMI of normotensive and hypertensive subjects is 20.43 kg/m^2 and 29.05 kg/m^2, respectively. Similarly WC is 74.28 and 95.87 cm, HC as 90.75 and 105.14 cm, WHR is 0.82 and 0.91, WSR is 0.52 and 0.58 whereas, SBP is 112 and 146.95 mm/Hg and DBP as 73.04 and 98.38 mm/Hg, respectively. It is concluded that among normotensive subjects, the mean values of all the variables are in normal range whereas among hypertensive women these values are statistically on higher side. So, it can be suggested that when any of the body parameters show any sort of increment, that should not be ignored.

According to the Centers for Disease Control and Prevention (2011), BMI and hypertension, or high blood pressure, are related. Various studies in literature support a strong relationship between BMI and BP across developed and developing countries (Tesfaye et al., 2007; Wang et al. 2010; Raj et al. 2010). In overweight/obese subjects, adipose tissue might be playing role in the genesis of hypertension. Data from NHANES show a remarkable and linear relationship between rise in BMI and systolic, diastolic, and pulse pressures in the American population. In regression models corrected for age-related rise in BP, a BMI gain of 1.7 kg/m^2 in men and 1.25 kg/m^2 in women corresponds to an increase in SBP of 1 mmHg (Kissebah and Krakower, 1994).

BMI is a measure of the health of an individual's weight. Being overweight is associated with high BP. Conversely, losing weight can help decrease BP. Therefore, it is important to monitor both BMI and BP. Since obesity is a risk factor for hypertension, and BMI is a predictor of obesity, BMI and hypertension are associated. When BMI is above normal, hypertension is also more likely. The report by the United States Department of Health and Human Services recommends overweight and obese individuals take steps to decrease their BMI to within the normal range.

Elevated levels of BMI, WC, weight, WHR, WST, SBP, DBP, PBF and total body fat content are responsible for progression towards hypertension. WC, HC, WHR, WSR, PBF are all associated with obesity and if it is tried to keep a check on BMI, hopefully, rest of the parameters also remain in recommended range. In women particular, health care should be taken at priority because due to hormonal changes they are always at risk to become obese and suffer from various metabolic disorders associated with obesity. The subjects under study are working women. Work stress might also be contributing towards higher BMI and hypertension. Literature reports relationship between work stress and obesity and hypertension. Stress and obesity relationship has also been reported by Nishitani and Sakakibara (2006) among Japanese males. So, as an attempt to justify both professional and personal fronts, the study group is under stress which may be one of the major contributors of obesity among them. The stress-hypertension association involves a sympathetic nervous system response, in which release of catecholamines leads to increased heart rate, cardiac output, and BP (Spruill, 2010). So, stress management is necessary in the workplace for the prevention of obesity.

Clinicians should recommend their patients to loose their body weight, take healthy diet so that their anthropometric variables remain in recommended measures. This will lead towards normal SBP and DBP among them and hypertension can be controlled. High BP is called the "silent killer" because it often has no warning signs or symptoms, and many people don't realize they have it. That's why it's important to get your BP checked regularly as well.

Conflict of Interest: None

REFERENCES

Burt VL, Whelton P, Roccella EJ, Brown C, Cutler JA, Higgins M, Horan MJ, Labarthe D. 1995. Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey, 1988-1991. *Hypertension* **25**:305-313.

Centers for Disease Control and Prevention (CDC). 2011.Vital signs: prevalence, treatment, and control of hypertension--United States, 1999-2002 and 2005-2008. *MMWR* **60**:103-108.

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jones DW, Materson BJ, Oparil S, Wright JT, and Roccella EJ. 2003. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report. *JAMA* **289**: 2560-72.

Durnin, JV and Womersley J. 1974. Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *Br J Nutr* **32**: 77-97.

Egan BM, Zhao Y, Axon RN. 2010. US trends in prevalence, awareness, treatment, and control of hypertension, 1988-2008. *JAMA* **303**:2043-50.

Hajjar I, Kotchen TA. 2003. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *JAMA* **290**:199-206.

Han TS, van Leer EM, Seidell JC, Lean MEJ. 1995. Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample. *Br Med J* **311**: 1401-1405.

Haslam DW, James WP. 2005. Obesity. *Lancet* **366**: 1197–1209.

Kalkhoff RK, Hartz AH, Rupley D, Kissebah AH, Kelber S. 1983. Relationship of body fat distribution to blood pressure, carbohydrate tolerance, and plasma lipid in healthy obese women. *J Lab Clin Med* **102**: 621-627.

Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. 2005. Global burden of hypertension: analysis of worldwide data. *Lancet* **365**: 217-23.

Khokhar K, Sidhu S and Kaur G. 2009. Prevalence of Hypertension in working Pre- and Postmenopausal women of Jalandhar City (Punjab). *Indian Journal of Physical Anthropology and Human Genetics* **28 (1-2)**:161-168.

Khokhar K, Kaur G and Sidhu S. 2010. Prevalence of Obesity in Working Premenopausal and Postmenopausal Women of Jalandhar District, Punjab. *Journal of Human Ecology* **29 (1)**; 57-62.

Khokhar KK, Kaur G and Sidhu. 2012. Association of obesity with hypertension and type 2 diabetes and the role of the menopausal status. *Human Biology Review* **1(2).**2012:123-137.

Kissebah AH and Krakower GR. 1994. Regional adiposity and morbidity. *Physiol Rev* **74**:761–811.

Kissebah AH, Vydelingum N, Murray R, Evans DJ, Hartz AJ, Kalkhoff RK, Adams PW. 1982. Relation of body fat distribution to metabolic complications of obesity. *J Clin Endocrinol Metab* **54**: 254-260.

Krause RM, Winston M, Fletcher BJ, Grundy SM. 1998. Obesity:Impact on cardiovascular disease. *Circulation* **98**: 1472–1476.

Nishitani, N and Sakakibara H. 2006. Relationship of obesity to job stress and eating behavior in male Japanese workers. *Int J Obes (Lond)* **30**: 528-533.

Olshansky SJ, Passaro DJ, Hershow RC, Laden J, Carnes BA, Brody J, Hayflick L, Butler RN, Allison DB, Ludwig DS. 2005: A potential decline in life expectancy in the United States in the 21st century. *N Engl J Med* 352:1138–1145.

Padmavati S. 2002. A meta-analysis-National Heart Institute, New Delhi. Ind Heart J **54**:99-102.

Rodgers A, Lawes C, MacMahon S. 2000. Reducing the global burden of blood pressure related cardiovascular disease. *J Hypertens* 18:S3-6.

Raj M, Sundaram KR, Paul M, Sudhakar A and Kumar RK. 2010. Body mass index trend and its association with blood pressure distribution in children. *J Hum Hypertens* **24**: 652-658.

Rose GA and Blackburn H.1968. Cardiovascular Survey Method. *WHO Monograph Series* **56**:90-95.

Spruill, TM.2010. Chronic psychosocial stress and hypertension. *Curr Hypertens Rep* **12**: 10-16.

Tesfaye F, Nawi NG, Van Minh H, Byass P, Berhane Y, Bonita R and Wall S. 2007. Association between body mass index and blood pressure across three populations in Africa and Asia. *J Hum Hypertens* **21**: 28-37.

Wang H, Cao J, Li J, Chen J, Wu X, Duan X, Huang J and Gu D. 2010. Blood pressure, body mass index and risk of cardiovascular disease in Chinese men and women. *BMC Public Health* **10**: 189.

Weiner JS, Lourie JA, eds. 1981. *Practical human biology*. London: Academic Press. 1981.

WHO. 1996. Hypertension control. Technical Report Series: World Health Organization. Report No.: 862.

WHO. 2000. *The Asia- Pacific Perspective. Redefining Obesity and its Treatment*. International Diabetes Institute. Health communication Australia Pvt. Ltd., Geneva.