Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(2C):540-545 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2016.v04i02.044

Original Research Article

Study of Relationship of anthropometric measurements with blood pressure among endogamous groups of Punjab & Haryana

Kamaljeet Kaur[1], Jasveen Kaur[1], Nidhi Puri[2]
[1]Assistant professor, Department of Anatomy, Punjab institute of Medical Sciences, Jalandhar, Punjab, India.
[2]Professor & Head, Department of Anatomy, MMIMMSR, Mullana, Ambala, Haryana, India.

***Corresponding author**
Dr Kamaljeet Kaur
Email: kamaljeetkaurvij@gmail.com

Abstract: The present study was done on 1200 young adult unmarried females belonging to age group 18-35 years residing in Haryana and Punjab region. The study was done on subjects of two sects of these two regions, i.e. Jat and Baniya. Present study was undertaken to study the correlation of anthropometric measurements in young unmarried females with blood pressure and to find out effectiveness of anthropometric indicators as predictors of high blood pressure. A positive correlation of weight, BMI, WC, WHR and WHtR with SBP & DBP was observed and it was found to be highly significant. In the present study it was found that BMI, WC, WHR and WHtR can be used as predictors of blood pressure in Haryana and Punjab region. When seen specifically in endogamous groups, WC was found to be stronger predictor of DBP in Punjabi Baniya females with variance of 25% and in Haryanvi Baniya with variance of 10%. BMI showed strong predicting power in Punjabi Baniya females for SBP with 19% variance, while WHtR was found as strong predictor of DBP in Jat Sikh females of Punjab with 21% variance.
Keywords: Anthropometric measurements, Endogamous population, Blood pressure.

INTRODUCTION

Anthropometric measurements are a set of non-invasive, quantitative techniques of determining an individual's body fat composition by measuring, recording and analyzing specific dimensions of the body. Despite the modern techniques, anthropometric measurements such as height (HT), weight (WT), body mass index (BMI) and waist-hip circumference ratio (WHR) etc. are traditionally important methods to study the genetic structure and prediction of risk factors of many complex diseases in human health [1].

Obesity is the most prevalent nutritional disorder in which there is excessive storage of energy in the form of fat as per height, weight, race and gender [2]. Obesity is prevalent among all age groups and is on the rise among adults especially the women worldwide in both developed and developing countries [3]. WC and BMI are highly correlated. Each is useful in predicting cardiovascular risk. WC is a better predictor than BMI and waist hip ratio is not as useful as other measurements [4].

Body mass index (BMI), as an indicator of obesity, has been found to be consistently associated with increased risk of hypertension and other chronic diseases [5]. BMI does not account for variation in body fat distribution and abdominal fat mass, which can differ greatly across populations and can vary substantially within a narrow range of BMI.[6] Excess intra-abdominal fat is associated with greater risk of obesity-related morbidity than is overall adiposity and its association shows a significant gender difference. [7] Thus measurements of waist circumference and waist-hip ratio (WHR) have been viewed as alternatives to BMI. Waist circumference has been shown to be the best simple measure of both intra-abdominal fat mass and total fat.[8]

WHO has opined that lower cut-off points than currently recommended should be used in some populations, especially in Asia, this is attributed to body fat distribution. Asian Indians tend to have more visceral adipose tissue despite having lean BMI. [9] Obesity and hypertension are on the rise in the world. Hypertension seems to be the most common obesity-related health problem and visceral obesity seems to be the major culprit. [10]

Hypertension is a disease of complex aetiology, affecting 972 million people worldwide. It is estimated that the worldwide prevalence of hypertension could increase from 26.4% in 2000 to 29.2% in 2025[11]. Hypertension is an important risk

factor for cardiovascular disease (CVD) and has become a major global burden on public health[12]. Obesity and weight gain have been identified as the most important determinants of hypertension[13]. The association between obesity and hypertension forms part of broader relationship between body weight and blood pressure (BP)[14]. Hypertension is an important public health problem in India. Studies among Indians have shown a high prevalence of hypertension[15].

Thus rapid urbanization, life style modification, demanding and stressful employment, sedentary life style and low rates of physical activity have increased the risk of obesity and hypertension in females. Therefore it has become very important to screen the population at risk at an early age so as to apply preventive strategies. Present study is undertaken to study the correlation of anthropometric measurements in young unmarried females with blood pressure and to find out effectiveness of anthropometric indicators as predictors to different grades of high blood pressure.

MATERIALS AND METHODS

STUDY POPULATION

The present study was done on 1200 young adult unmarried females belonging to age group 18-35 years residing in Haryana and Punjab region. The study was done on subjects of two sects of these two regions, i.e. Jat and Baniya. So, this study comprised of four equal groups, i.e. Punjab Jat Sikh (300) and Punjab Baniya (300) from Punjab region and Haryana Jat (300) and Haryana Baniya (300) from Haryana region. To perform this study, prior informed consent was obtained from the qualifying subjects, in writing (both in English & Vernacular). The subjects for this study were chosen mainly from the colleges and the surrounding areas from both Punjab and Haryana. Females aged < 18 years and > 35 years, wheel chair bound or had difficulty in standing were excluded. The subjects already diagnosed having heart disease, chronic diseases of the major organs and endocrine disorders were excluded from the study.

ANTHROPOMETRIC MEASUREMENTS

Height (m) was measured as maximum distance from floor to the highest point on head. Weight (kg) of the subject was taken on calibrated weighing scale. Pulse rate (PR) was felt on the radial artery with subject seated comfortably after a relaxing time of 5 minutes and was counted for a full one minute. Blood pressure (mmHg) was measured by following the standard guidelines for measurement of blood pressure. The individual was made comfortable and sit for at least 5 minutes in the chair before measurement.. Two readings were taken with interval of 5 minutes and if BP was recorded high, another reading was taken after half an hour and the average of the three readings taken was entered in the record. Waist circumference (cm) was measured at the level midway between the lower rib margin and iliac crest. Hip circumference (cm) was measured at the level of greatest protrusion of buttocks. The anthropometric measurements of the subjects were taken with the standard instruments like Mercury sphygmomanometer, Stethoscope, Weighing scale & Flexible metallic measuring tape. Measurements were taken according to anthropometric standards. After taking all parameters the following indices like BMI, WHR & WHtR were derived from the measurements taken.

STATISTICAL ANALYSIS

All the recorded data was entered in the Microsoft Office Excel Worksheet to create the "Master Chart". For statistical analysis, the data was imported in the SPSS 16 statistical software and was analysed for descriptive frequencies of all the variables. Then the correlates of anthropometric parameters and systolic blood pressure and diastolic blood pressure were analysed to look for any statistical significant association among them.

RESULTS

Results are shown in following tables.

TABLE: 1 GENERAL FEATURE OF STUDY POPULATION PUNJAB / HARYANA

VARIABLES	PUNJAB (N=600)	HARYANA (N=600)
AGE(y)	20.42 ± 2.42**	19.94 ± 1.93
HT (m)	1.59 ± 0.05	1.59 ± 0.05
WT (kg)	54.03 ± 10.01	53.58 ± 9.95
PR (per min.)	74.03 ± 4.11**	73.45 ± 3.29
SBP(mmHg)	119.0 ± 8.28	119.18 ± 8.36
DBP(mmHg)	79.85 ± 5.66**	78.94 ± 4.66
BMI(Kg/m^2)	21.36 ± 3.96	21.19 ± 3.89
WC(cm)	70.18 ± 9.08**	68.90 ± 8.79
WHR	0.75 ± 0.05	0.75 ± 0.05
WHtR	0.44 ± 0.05*	0.43 ± 0.05

**** p value significant at 0.01 level, * p value significant at 0.05 level**

Mean age of study population was 20.42 ± 2.42 (Punjab) and 19.94 ± 1.93(Haryana) and the difference was statistically significant. Mean height (m) was similar in both the groups (1.59 ± 0.05). Mean weight was more in Punjabi females as compared to Haryanvi females though it was not statistically significant (p >0.05).

Female subjects of Punjab had greater mean DBP, WC and WHtR than female subjects of Haryana and the difference was statistically significant (Table 1).

TABLE 2 GENERAL FEATURES IN ENDOGAMOUS GROUPS OF PUNJAB AND HARYANA

VARIABLES	PB JAT SIKH (N=300)	HR JAT (N=300)	PB BANIYA (N=300)	HR BANIYA (N=300)
AGE(y)	20.50 ±2.73**	19.63 ± 1.64	20.34 ± 2.07	20.24 ± 2.14
HT (m)	1.60 ± 0.05	1.60 ± 0.05	1.59 ± 0.04	1.58 ± 0.04
WT (kg)	51.99 ± 8.72	51.10 ± 8.98	56.07 ± 10.75	56.06 ± 10.27
PULSE RATE	75.71 ±4.24**	73.90 ± 2.94	72.36 ± 3.19	72.99 ± 3.56*
SBP (mmHg)	117.91 ± 9.59	119.81 ± 9.53	120.10 ± 6.56**	118.55 ± 6.94
DBP (mmHg)	79.66 ± 5.70**	79.17 ± 4.02	80.03 ± 5.63**	78.71 ± 5.21
BMI	20.47 ± 3.60	20.05 ± 3.40	22.25 ± 4.11	22.33 ±4.03
WC(cm)	67.28 ± 7.76**	65.26 ± 7.50	73.09 ± 9.38*	72.55 ± 8.47
WHR	0.73 ± 0.05	0.73 ± 0.04	0.77 ± 0.04	0.77 ± 0.04

**** P Value significant at 0.01 level, * p Value significant at 0.05 level**

Average DBP, WC and WHtR was higher in Jat Sikh female subjects of Punjab as compared to Jat females of Haryana. Baniya female subjects of Punjab had higher mean of SBP, DBP, WC and WHtR than their counter parts of Haryana (Table 2).

TABLE 3 CORRELATIONS OF ANTHROPOMETRIC VARIABLES WITH BLOOD PRESSURE AMONG ENDOGAMOUS GROUPS OF PUNJAB AND HARYANA

	SBP				DBP			
	PB JS	HR JT	PB BN	HR BN	PB JS	HR JT	PB BN	HR BN
WT	0.193**	0.138*	0.411**	0.234**	0.154**	0.164**	0.500**	0.335**
BMI (Kg/m^2)	0.247**	0.113	0.413**	0.210**	0.194**	0.172**	0.499**	0.316**
WC(cm)	0.140*	0.132*	0.438**	0.184**	0.200**	0.142*	0.508**	0.326**
WHR	0.145*	0.135*	0.335**	0.097	0.146*	0.035	0.348**	0.242**
WHtR	0.172**	0.113	0.431**	0.160**	0.097	0.144*	0.496**	0.301**

**** p value significant at 0.01 level, * p value significant at 0.05 level**

A positive correlation of weight, BMI, WC, WHR and WHtR with SBP & DBP was observed and it was found to be highly significant. There was a strong positive correlation between blood pressure and WHR, WHtR in Punjabi Baniya females while only DBP has positive correlation with WHR in Haryanvi baniyas whereas highly significant positive correlation of Blood pressure with BMI was seen in Punjabi females. (TABLE 3)

Regression Analysis of Obesity Measures With Blood Pressure

TABLE 4 DEPENDENT VARIABLE SYSTOLIC BLOOD PRESSURE (SBP)

GROUPS	PREDICTORS	B	R^2	SIGNIFICANCE
PB	BMI	0.687	0.108	0.001
HR	BMI	0.266	0.015	0.002
PB-JSKH	BMI	0.658	0.061	0.001
HR-JAT	WHR	25.85	0.018	0.020
PB-BAN	WC	0.307	0.192	0.001
HR-BAN	BMI	0.363	0.044	0.001

In this study, BMI showed better predictability for systolic blood pressure in females of Punjab as compared to Haryana females. Among endogamous groups, the good predictor of systolic blood pressure for Punjab jatsikh and Haryana baniya was BMI, for Haryana Jat WHR and for Punjab baniya waist circumference. WC showed the strongest predictability than BMI and WHR for SBP in Punjab Baniya (Table 4).

TABLE 5 DEPENDENT VARIABLE DIASTOLIC BLOOD PRESSURES (DBP)

GROUPS	PREDICTORS	B	R^2	SIGNIFICANCE
PB	WC	0.223	0.127	0.001
HR	BMI	0.278	0.054	0.001
PB-JSKH	WHtR	23.39	0.216	0.001
HR-JAT	BMI	0.204	0.030	0.003
PB-BAN	WC	0.305	0.258	0.001
HR-BAN	WC	0.200	0.106	0.001

In the present study population BMI and WC are better predictors of diastolic blood pressure in Haryana and Punjab. Among the endogamous groups WC and WHtr are strong predictors of DBP in Punjab Baniya and Jatsikh females. While in Haryana Jat and Baniya females BMI and WC were found to be better predictor of DBP (Table 5).

DISCUSSION

Obesity is prevalent among all age groups and is on rise among adults especially; women both in developed and developing countries [3]. Waist circumference (WC) and body mass index (BMI) are associated with cardiovascular disease independently of traditional cardiovascular risk factors. WC and BMI are highly correlated. Each is useful in predicting cardiovascular risk. Obesity results from interaction of genes and lifestyle. Obesity and overweight have a potential detrimental effect on blood pressure [4]. Anthropometry is a simple non-invasive method that study relationship between body composition and health risk. As prevalence of obesity is increasing both in developed and developing countries and it is found to be highest among the north Indian states of India [15]. Present study is thus taken to suggest preventive strategies for health care at early age.

A total of 1200 young unmarried females in the age group of 18-40 yrs were chosen for the study belonging to known endogamous groups of Punjab and Haryana. Study group was subdivided into four subgroups with 300 female's subjects in each group, Jat and Baniya from Haryana and Jat Sikh and Baniya from Punjab. Mean weight was higher among Baniya females of Punjab and Haryana but difference was not significant ($p = 0.99$) (Table 2). Our results are similar to results reported in another study done on Sikh and Hindu population of Punjab. [16]

A positive correlation was observed between blood pressure and anthropometric parameters and their derived indices. Correlation was significant in all except correlation of BMI with SBP in Jat females of Haryana, WHR and WHtR with DBP and SBP in Haryanvi females respectively. Whereas correlation of WHtR with DBP in Punjabi Jat Sikh females was not significant. Strong positive correlation of all anthropometric parameters (wt, BMI, WC, WHR and WHtR) with both SBP and DBP seen in case of Baniya females of Punjab (Table 3).

TABLE 6 COMPARISON OF CORRELATION COEFFICIENT BETWEEN PRESENT STUDY AND STUDY DONE IN AMRITSAR

	BADARUDDOZA *et al.;* [16]				PRESENT STUDY			
VARIABLES	SIKH		HINDU		JAT SIKH		PB-BAN	
	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
WT(Kg)	0.48**	0.32**	0.30**	0.21**	0.19**	0.15**	0.41**	0.41**
BMI(Kg/m^2)	0.48**	0.33**	0.32**	0.23**	0.24**	0.19**	0.41**	0.41**
WC(cm)	0.50**	0.32**	0.36**	0.24**	0.14**	0.20**	0.43**	0.43**
WHR	0.27**	0.15**	0.31**	0.18**	0.14**	0.14**	0.33**	0.09**

Study done in university going Sikh and Hindu females of Amritsar district had shown higher correlation coefficients [16] than present study, reason could be no specific caste group included in the study whereas in present study specific endogamous groups are studied. Baniya females of present study have shown stronger correlation of all anthropometric parameters with blood pressure. Study done on adults

(20-30yrs) of Amritsar district have shown greater mean WC, BMI, WHR and WHtR in individuals with positive family history of hypertension as compared to control group [17].

In the present study it was found that BMI, WC, WHR and WHtR can be used as predictors of blood pressure in Haryana and Punjab region. When seen specifically in endogamous groups, WC was found to be stronger predictor of DBP in Punjabi Baniya females with variance of 25% and in Haryanvi Baniya with variance of 10%. BMI showed strong predicting power in Punjabi Baniya females for SBP with 19% variance, while WHtR was found as strong predictor of DBP in Jat Sikh females of Punjab with 21% variance. (Table 4 & 5) Badaruddoza *et al.;* indicated in their study on Punjabi Sikh and Hindu females that BMI and WHR would be the good predictor for the chronic diseases like Hypertension [16]. Study done in rural Wardha reported BMI and WC to be very important predictors of hypertension [18]. Study done in rural and urban Jat females of Haryana have shown that WC and BMI as important predictors of hypertension in urban females and BMI in case of rural jat females [19]. In study done on Bishnoi, Sikh and Hindu females WC was found to be significant predictor of cardiovascular diseases across all the three populations [20]. Meenal Dhall *et al.;* found BMI to be effective predictor of cardiovascular health among adult Jain females [21].

There is strong correlation between blood pressure and anthropometric parameters and derived indices like BMI, WC, WHR and WHtR etc. WC is good predictor of blood pressure in Baniyas of Punjab as well as Haryana.

CONCLUSION

Study was done with the aim of finding correlation of anthropometric parameters with blood pressure. To provide anthropometric predictors of hypertension in Punjab and Haryana in the known endogamous groups of the two region chosen in the study. All anthropometric parameters were strongly correlated with blood pressure in the study population but significantly higher correlation observed in case of Punjabi baniyas. WC was found to be stronger predictor of hypertension in Baniya females followed by BMI while WHtR was better predictor in Jat Sikh females and BMI and WHR in Jat females of Haryana.

REFERENCES

1. Seidell JC, Kahn HS, Williamson DF, Lissner L, Valdez R; Report from a centres for disease control and prevention workshop on use of adult anthropometry for public health and primary health care. Am J Clin Nutr. 2001; 73: 123-6.
2. World Health Organization. Obesity and Overweight. Fact sheet Nº 311. May2012 (http://www.who.int/mediacentre/factsheets/fs311/en/). Accessed on June 5, 2012.
3. Flegal KM; Epidemiological aspects of overweight and obesity in United States. Physiol Behav. 2005 Dec; 86 (5): 599-602.
4. Wang Z, Hoy WE; Waist circumference, body mass index, hip circumference and waist to hip ratio as predictors of cardiovascular disease in Aboriginal people. Eur J Clin Nutr. 2004; 58: 888-93.
5. Field AE, Coakley EH, Must A, Spadano JL, Laird N, Dietz WH *et al.;* Impact of overweight on the risk of developing common chronic diseases during a 10-year period. Arch Int Med. 2001; 161 (13):1581–6.
6. World Health Organization. Obesity – Preventing and Managing the Global Epidemic: Report of a WHO Consultation on Obesity. Geneva: World Health Organization; 1998.
7. Ho SC, Chen YM, Woo JL, Leung SS, Lam TH, Janus ED; Association between simple anthropometric indices and cardiovascular risk factors. Int J Obes Relat Metab Disord. 2001; 25 (11):1689–97.
8. Han TS, McNeill G, Seidell JC, Lean ME; Predicting intra-abdominal fatness from anthropometric measures: the influence of stature. Int J Obes Relat Metab Disord. 1997; 21(7): 587–93.
9. Snehlata C, Viswanathan V, Ramachandran A; Cutoff values for normal anthropometric variables in asian Indian adults. Diabetes care. 2003; 26: 1380-4.
10. Kurukulasuriya LR, Stas S, Lastra G, Manrique C, Sowers JR; Hypertension in Obesity. Med Clin North Am. 2011; 95(5):903-17.
11. Kearny PM, Whelton M, Reyonlds K, Munner P, Whelton PK, He J; Global burden of hypertension: analysis of worldwide data. Lancet. 2005; 365(9455): 217-23.
12. Lawes CM, Vander Hoorn S, Law MR, Elliott P, MacMohan S, Rodgers A; Blood pressure and the global burden of disease 2000. Part II: estimates of attributable burden. J Hypertens. 2000; 24:423-43.
13. Diaz ME. Hypertension and obesity. J Hum Hypertens. 2002; 16 (suuply 1):S18-S22.
14. Christensen DL, Eis J, Hansen AW, Larsson MW, Mwaniki DL, Kilonzo B *et al.;* Obesity and regional fat distribution in Kenyan population: impact of ethnicity and urbanization. Ann Hum Biol. 2008; 35(2): 232-49.
15. Gupta R, AI-Odat NA, Gupta VP; Hypertension epidemiology in India. Meta-analysis of fifty-year prevalence rates and blood pressure trends. J Hum Hypertens. 1996; 10(7): 465-72.
16. Badaruddoza, Kaur N, Barna B; Inter-relationship of waist-to-hip ratio(WHR), body mass index(BMI) and subcutaneous fat with blood

pressure among university-going Punjabi sikh and Hindu females. Int. J. Med. Med. Sc .2010; 2(1): 5-11.

17. Khanna N, Sharma RS, Sidhu RS; A study of the basic and derived anthropometric indices among the healthy adults (20-30 yrs of age) of Amritsar city (Punjab) having family history of hypertension. Int J Biol Med Res. 2011; 2(3): 743-46.
18. Deshmukh PR, Gupta SS, Dongre AR, Bharambe MS, Maliye C, Kaur S, Garg BS; Relationship of anthropometric indicators with blood pressure levels in rural Wardha. Indian J Med Res. 2006; 123(5): 657-64.
19. Kaur M; Impact of hypertension on morpho-physiologic traits in rural and urban Jat females of Haryana, North India. Anthropologist. 2012; 14(5): 485-89.
20. Pai DM, Halani MG; High blood pressure in slum dwellers. In: Clinical Hypertension- Proceedings of the International Congress on Hypertension Bombay. 1977. N.J. Shah and P. Singhri (Eds.). New Thackers Fine Art Press, Bombay (1980).
21. Dhall M, Gupta S, Bhuker M, Sharma P, Kapoor S; Effectiveness of various anthropometric indices in prediction of cardiovascular risk among adult jains. The Open Anthropology Journal. 2011; 4: 33-39.