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Original Research Paper

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EFFECT OF VISCERAL OBESITY INDICES ON BLOOD PRESSURE IN SCHOOL GOING FEMALE ADOLESCENT SUBJECTS: A CROSS SECTIONAL STUDY

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ABSTRACT

Background & Objectives: Limited data are available from Jodhpur city (Rajasthan) regarding the distribution and profile of visceral obesity and blood pressure. The present study was conducted to determine the association between visceral obesity indices WC, WHR, with BP in obese and non-obese.

Methods: The study was carried out among 70 female subjects aged between 14 to 17 years were enrolled for present study after they had signed written consent. The anthropometric data i.e. waist circumference (WC), hip circumference (HC), to calculate waist hip ratio (WHR), waist stature ratio (WSR) of subjects was taken followed by measurements of blood pressure. All the subjects were divided into two groups according to WC, WHR and WSR. The observed valued obtained was then analyzed by students- t test and the data for blood pressure in both groups i.e. on basis of WC, WHR was then compared by pearson's coefficient correlation.

Results: The visceral obesity indices are WC showed 41% subjects were obese (WC≥80cm) (WC Mean = 88.34±6.44). Waist Hip Ratio (WHR>0.80) was found in 45% (WHR Mean = 0.88±0.02). Obese group presented with continuous faster blood Pressure was significantly positively correlated with obesity indices WC, WHR (SBPsup. r = 0.80, DBPsup. r = 0.72, SBPsup. r = 0.0.35, DBPsup. r = 0.40, respectively).

Conclusion: Blood Pressure had higher values and significantly positive correlation with obesity indices among obese group compared to non-obese group (p<0.05).

KEYWORDS : Waist Circumference (WC), Hip Circumference (HC), Waist Hip Ratio (WHR), Blood Pressure (BP)

INTRODUCTION

Overweight is growing worldwide people health problems among children and adolescents [1]. It caused by energy-dense foods, combined with increasingly sedentary lifestyles such as prolonged time spent watching television, playing video games or using computers and found in families from higher socio economic status. [2]. Childhood and adolescent obesity is associated with various cardiovascular risk factors like high BP, dyslipidaemia, abnormalities in endothelial function, and hyperinsulinaemia [3]. Abdominal obesity is also related to cardiovascular and metabolic risk factors [4]. In India, the prevalence of obesity among adolescent school children from affluent families was found to be 7.4% [5]. The childhood BP is notable predictor of adult BP [6].

The mechanism linking abdominal obesity with hypertension explained by the activation of the renin–angiotensin–aldosterone system, which leads to the activation of the sympathetic activity, promotion of the leptin resistance by increased procoagulatory activity. The cumulative effect of the cascade is endothelial dysfunction and inflammatory changes. Additional mechanism includes the enhanced renal sodium reabsorption with increase in volume expansion observed in abdominally obese patients [7].

WC, and WHR is a simple parameter and which estimate the level of visceral fat or central obesity [8]. Information on the pattern of obesity and its influence on blood pressure levels in urban Indian population is limited so the present study was aimed to investigate the effect of body composition and adiposity on blood pressure in adolescent individual and correlation of blood pressure with WC, WHR.

MATERIALS AND METHODS

The present study was conducted during the year of 2018-2019. 70 female school going children (Age between 14-17 years) of Jodhpur, Rajasthan were included in the sample size. Institutional ethical clearance achieved before commencement of the study. Conscious consent was taken from each subject during the research. The participants were first given clarification about the plan and method of the experiment.

Inclusion Criteria

- Age between 14-17 years.
- Physically and mentally fit.
- Not suffering from any known medical problems.

Exclusion Criteria:

- Age below 14 years and above 17 years.
- Not physically fit.
- Uncooperative.

The anthropometric data i.e. HT, WC, HC, to calculate WHR, of subjects was taken followed by measurements of blood pressure. All the subjects were divided into two groups according to WC, WHR. Written informed consent achieved from each participant's parent or guardian.

Procedure for Measurement:

Waist Circumference - measured using a measuring tape (cm) in standing position at the level mid-point between the rib margin and the iliac crest in a horizontal plane, at the end of normal expiration.

Hip circumference - measured in standing position at the widest point over the buttocks.

Waist Hip Ratio - It calculated by dividing waist measurement by the hip measurement.

$$WHR = \frac{WC(cm)}{HC(cm)}$$

The BP was measured by using mercury sphygmomanometer. BP was measured in seated position on right hand with appropriate size of cuff (covering approximately 2/3 of upper arm) after 10minute rest.

Statistical analysis

Mean and standard deviation of all measured parameters with blood pressure of all subjects were calculated by Microsoft Excel. The data were computed by student t test in 'Open Epi' software and Pearson's correlation analysis. The $p<0.05$ was considered as statistically significant.

RESULTS

Table-1: Descriptive analysis based on WC of School going of normal and obese group of female subjects of adolescent (14-17 Years)

Parameters	WC<80cm Normal Weight (N=41)	WC>80cm Obese (N=29)	Students -t- test	
	Mean ±SD	Mean± SD	T value	P value
Age	15.46±1.09	16.06±0.99	-2.35	<0.05S.
Height (kg)	154.53±5.86	155.24±6.39	-0.48	>0.05N.S.
Weight (kg)	49.31±7.76	64.68±8.52	-7.83	<0.01H.S.
Waist Circumference (cm)	71.8±5.68	88.34±6.44	-11.34	<0.01H.S.
Hip Circumference (cm)	90.21±6.86	105.03±6.33	-9.18	<0.01H.S.
Waist Hip Ratio	0.79±0.04	0.83±0.04	-4.12	<0.01H.S.
Waist Stature Ratio	0.46±0.05	0.57±0.06	-8.34	<0.01H.S.

Note- S- Significant, N.S. Non significant, H. S. Highly significant

Table-2: Cardiovascular parameter *based on WC* of School going of normal & obese group of female subjects of adolescent (14-17 years)

Parameters	WC < 80 cm Normal Weight (N=41)	WC> 80 cm Obese (N=29)	Students -t- test	
	Mean ± SD	Mean ± SD	T value	P Value
SBP (Supine)	119.95±5.32	131.93±4.22	-9.24	<0.01 H.S.
DBP (Supine)	73±3.51	78.72±3.12	-7.02	<0.01 H.S.

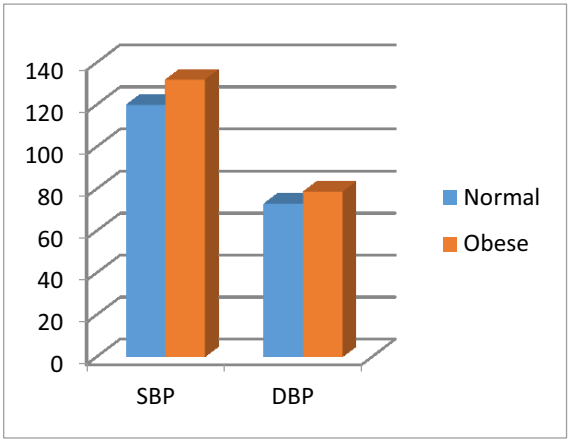

Fig-1: Cardiovascular Parameters of Normal & Obese Female subjects

Table- 2 & Fig 1: showing descriptive analysis of normal and obese female subjects selected as per WC status. Both the groups are showing significant difference between weight, height and WC.

Table-3: Descriptive analysis based on WHR of school going of normal and obese group of female subjects (14-17 Years)

Parameters	WHR < 0.80 Normal Weight (N=38)	WHR > 0.80 Obese (N=32)	Students -t- test	
	Mean ± SD	Mean ± SD	T value	P value
Age	15.51±1.16	15.73±1.08	-0.66	>0.05N.S.
Height (cm)	164.64±7.69	164.36±6.8	0.13	>0.05N.S.
Weight (kg)	56.12±9.7	65.57±11.17	-3.15	<0.01H.S.
Waist Circumference (cm)	74.48±7.81	90.52±7.56	-7.13	<0.01H.S.
Hip Circumference (cm)	92.67±7.13	101.94±7.97	-4.26	<0.01H.S.
Waist Hip Ratio	0.8±0.03	0.88±0.02	10.28	<0.01H.S.
Waist Stature Ratio	0.48±0.07	0.53±0.08	-11.73	<0.01H.S.

Table- 4: Cardiovascular parameter based on WHR of School going of normal & obese group of female subjects (14-17 years)

Parameters	WHR < 0.80 Normal Weight (N=38)	WHR > 0.80 Obese (N=32)	Students -t- test	
	Mean± SD	Mean± SD	T value	P value
SBP (supine)	122.71±7.16	128.62±6.75	-2.33	<0.05 S.
DBP (supine)	74.21±4.3	76.75±4.01	-2.53	<0.05 S.

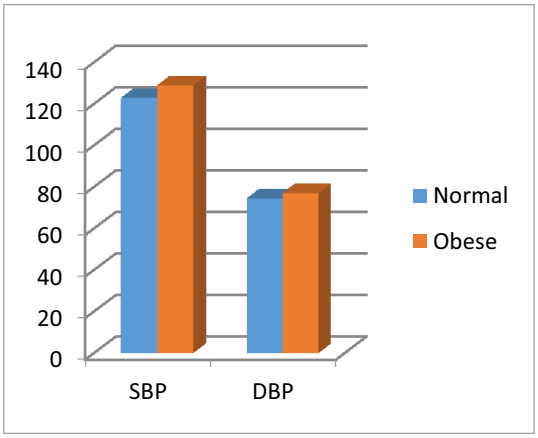

Fig-2: Cardiovascular Parameters of Normal & Obese Female subjects

Table - 4 and Fig – 2 the obese group of B.P. is showing raised level of Systolic, Diastolic, in supine posture.

Table- 5: Correlation of obesity indices with Blood Pressure in female subjects

Name of parameters	WC	WHR
SBP (supine)	0.80	0.35
DBP (supine)	0.72	0.40

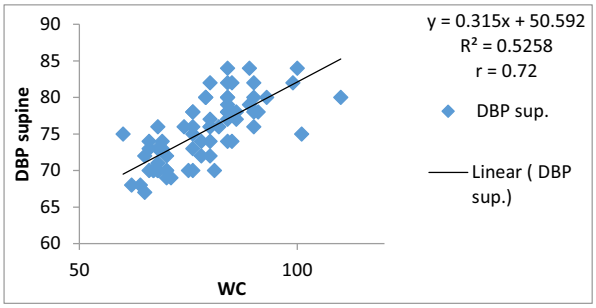

Fig-3: Correlation of WC with DBP (Supine) in female subjects

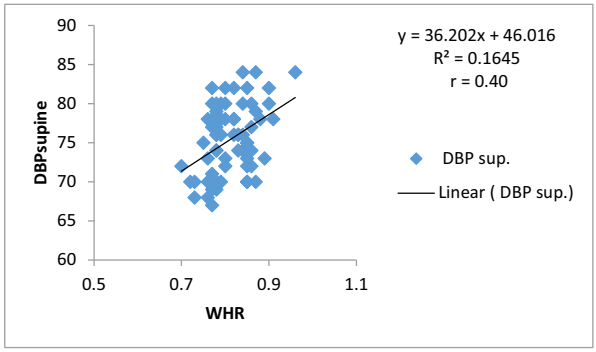

Fig-4: Correlation of WHR with DBP (Supine) in female subjects

Fig: 3 is showing the correlation of WC with DBP in supine posture in female subjects. WC explained 72% of cases of DBP in supine posture respectively and **Fig: 4** is showing the correlation of WHR with DBP in supine posture in female subjects. WHR explained 40% of cases of DBP in supine posture respectively.

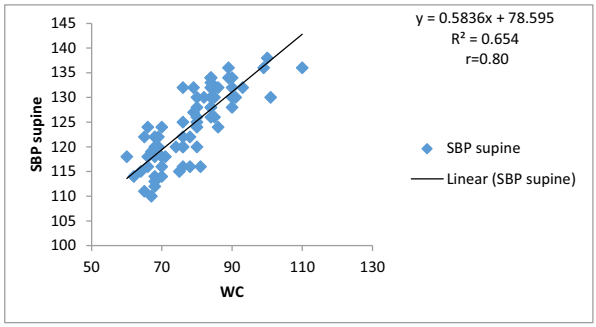

Fig-5: Correlation of WC with SBP (Supine) in female subjects

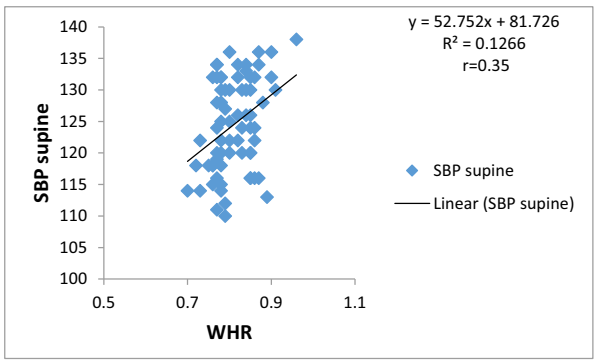

Fig-6: Correlation of WHR with SBP (Supine) in female subjects

Fig: 5 Shows the correlation of WC with SBP in supine posture in female subjects. WC explained 80% of cases of SBP in supine posture respectively and **Fig: 6** the correlation of WHR with SBP in supine posture in female subjects. WHR explained 35% of cases of SBP in supine posture respectively.

DISCUSSION

To our knowledge there are very less studies investigating the relationship between indices of visceral obesity and blood pressure in Indian school going female subjects (14-17 years). To best our knowledge this study might be the first to assess relationship of blood pressure with visceral obesity among school going female subjects (14-17 years).

The present study carried out in 70 healthy female school going children in the age range of 14-17 years, to assess the effect of visceral obesity on blood pressure. The subjects were distributed into 2 groups. Out of total 70 subjects, using the WC criteria 41(58%) subjects were of normal category and 29(41%) were found under obese category and WHR showed 38(54%) subjects in normal group and 32(45%) comes under obese group.

In our present study the BP was significantly greater in 41% subjects having i.e. WC > 80 cm and 45% on based on WHR > 0.80 as compared to non-obese subjects.

On applying Pearson's coefficient-correlation we observed a significant correlation of BP with WC in the SBP & DBP in supine posture, explained as 80% SBP & 72% DBP variation. This increase may be due to increased sympathetic nerve activity. Other reason may be increase insulin level and activity of rennin angiotensin aldosterone system that also contribute to increase in BP.

Waist circumference is a measure of central obesity, also known as visceral or abdominal obesity. The Waist Circumference of obese group of subjects found more than waist circumference of normal weight group of subjects. Increased Waist Circumference in obese group is an indicator of abdominal fat distribution in abdominal areas. Waist Circumference measures intra-abdominal or visceral fat and total fat and has been recognized as an independent risk factor for arterial hypertension.

Waist Hip Ratio is also used to indicate the abdominal fat accumulated is found to be more predictive than BMI, Waist Hip Ratio measure or indicates the truncal obesity which is comparatively higher in obese group of subjects compared to normal weight group of subjects.

Table 6 showing the comparison of our study with the study of Al- Sendi et al [9].

Table- 6: Showing the comparison of present study with previous study mentioned in literature.

Present study	Place	Population studied	Type of study	Aims	Findings
	Jodhpur	70 school going female subjects aged (14-17 years)	Cross sectional	To determine the association between abdominal obesity and cardiovas-cular parameter in obese and non-obese.	In female subjects multiple regression analysis shows that WHR was important contributor for SBP & DBP in supine posture compared to other obesity indices.
Al-Sendi et al [9]	Bahrain	504 Bahraini school children aged 12-17 years (249 boys and 255 girls)	Cross sectional	Examine the relationship between body composition and BP.	Adoles-cents with high WHR or WC, as indicators for CO, tended to have higher BP values.

CONCLUSION

According to our data, a high prevalence of high BP was observed among 14–17year-old school going female subjects. Visceral obesity significantly associated with Blood Pressure

in obese group female subjects compared to normal weight group subjects. These findings useful in the development of public health programs for reducing risk factors of cardiovascular diseases and important for the prevention, management, and treatment of high BP among school going female subjects.

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Conflict of interest: None.

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