



PREVALENCE OF CARDIOVASCULAR DISEASES RISK FACTORS AND THEIR CORRELATIONS WITH ANTHROPOMETRIC INDICATORS IN YOUNG ADULTS OF PAKISTAN

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ABSTRACT

Background: Globally, Cardiovascular diseases are the major health problems. Around 17 million people die due to cardiac diseases annually. In Pakistan, the major public health problem of concern is cardiovascular diseases. The major cardiovascular diseases risk factors are gender, obesity, dyslipidemia and hypertension. However, the association of anthropometric indices with CVD risks factors has been an understudied subject in this part of the world.. This study was set up to find out the cardiovascular diseases risk factor associated with anthropometric indicators among the Hyderabad population.

Materials & Methods: This observational cross-sectional study was conducted on approximately 150 participants who were living in Hyderabad areas, Pakistan. The age group range was from 18-25 years. 10 ml of blood was collected from the participants who had fasting for atleast 8 -10 hours in EDTA vacutainers from antecubital vein using aseptic technique. Diastolic blood pressure (DBP) and Systolic blood Pressure (SBP) was taken using sphygmomanometer. For the assessment of Cholesterol and Fasting Blood Sugar (FBS), a biochemical analysis was conducted by standard kit method. Anthropometry measurements were taken by trained person. Height was measured with a wall mounted stadiometer. Body weight was measured by using digital scale. BMI was measured from height in meters and weight in Kg. Waist hip ratio (WHR), Waist Circumference (WC), and Waist Height Ratio (WHtR) were measured by placing a non – stretchable measuring tape. Before data collection consent was obtained. For statistical analysis, SPSS version 28 was used.

Results: Total 150 participants having the age range from 18 – 25 were selected from both genders. Out of 150, 76 (50.67) were males and 74 (49.33) were females. Male participants had a significantly mean values ($p < 0.05$) which were higher for Waist Hip ratio (WHR), waist circumference (WC), and Waist Height ratio (WHtR). No significant difference was observed for BMI among male and female participants ($p > 0.05$). Male had significantly higher mean value for FBS, SBP and DBP ($p < 0.05$). However, no significant difference was observed ($p > 0.05$) regarding mean cholesterol concentration among males and females. Weight Height Ratio (WHtR) had very strong correlation with BMI. All among studies anthropometric parameter BMI showed a

strong and significant correlation ($p < 0.001$) with FBS, SBP DBP and cholesterol followed by WHtR, Waist circumference and WHR both in male and female participants.

Conclusion: In conclusion, males were at more risk of CVD risk factor than females. WHtR could be used as alternative of BMI and we used for the assessment of CVD risk factors.

KEYWORDS: Cardiovascular diseases, Pakistani young adults, coronary artery disease, cardiovascular risk factors, BMI, WHtR

INTRODUCTION

Globally, cardiovascular risk factors serve as primary health indicators for the emergence of heart-related issues and are the principal causes of death and morbidity in both developing and developed nations¹. Annually, around 17 million individuals succumb to cardiovascular illnesses². Cardiovascular diseases encompass vascular conditions, including cerebrovascular, peripheral vascular, pericardial, and heart valve diseases³. In emerging nations, cardiovascular diseases impact public health and prosperity, indicating a state of alarm⁴. Several studies have suggested that South Asian people are at more risk of suffering from Cardiovascular diseases (CVD) and cardiac related deaths⁵⁻⁷.

A 2008 study revealed that 25% of deaths in India are attributable only to cardiovascular illnesses⁸. A 2016 study indicated that India is experiencing significant losses in public health and economic growth due to the rising burden of cardiovascular illnesses⁹. South Asian countries are at the highest risk of mortality and morbidity from cardiovascular illnesses worldwide. Recent statistics indicate the necessity of mitigating the burden of cardiovascular diseases by assessing risk factors¹⁰. A study conducted in karachi in 2022 reported that Non communicable diseases (NCDs) kills annually million of people, However, among them Cardiovascular diseases account for the most NCDs deaths and it kills 17.9 million people annually¹¹. A cross sectional study conducted in Bangladesh reported that Overweight/obesity, diabetes, hypertension and dyslipidemia are at high prevalence¹². The foremost challenge confronting the globe now is the mitigation of non-communicable diseases. A 2022 study indicated that cardiovascular disorders rank first among non-communicable diseases. The rising prevalence of chronic diseases, particularly cardiovascular conditions, results in significant losses and adversely impacts the health, economy, and development of the nation. Numerous research indicate a heightened prevalence of cardiovascular illnesses in Pakistan. Numerous variables elevate the risk of cardiovascular illnesses. The shift from rural to urban settings significantly affects cardiovascular risk factors¹³.

Cardiac diseases are preventable because risk factors appear long before the disease appear, this is why it is easily preventable if risk factors are controlled within normal range. Cardiovascular risk factors are divided in to “Modifiable cardiovascular risk factors” and “Non-modifiable cardiovascular risk factors”. Modifiable risk factors are those that can be managed and addressed. It can mitigate the load of cardiovascular risk factors. They include hypertension, poor dietary habits, physical inactivity, obesity, smoking, diabetes, hyperlipidaemia, and low socioeconomic level. Non-modifiable risk factors are those that cannot be altered to reduce cardiovascular risk. The criteria include race, gender, heredity, and age¹⁴.

These modifiable and non-modifiable risk factors together raise the likelihood of cardiovascular illnesses. Conditions such as hypertension, dyslipidaemia, and obesity, elevate the risk of cardiovascular illnesses¹⁵. Hypertension constitutes a significant global health issue. It is a critical risk factor for cardiovascular disease¹⁶. A 2010 study characterised pre-hypertension in adults as a blood pressure (systolic) from 120 mm Hg to 139 mm Hg and a blood pressure (diastolic) between 80 mm Hg and 89 mm Hg. As age advances, the incidence of hypertension escalates, thus elevating the danger of cardiovascular disorders¹⁷.

Dyslipidaemia is characterised by low-density lipoprotein (LDL) cholesterol levels or elevated total or high-density lipoprotein (HDL) cholesterol diminished levels. It is a significant indicator of

cardiovascular disorders¹⁸. A 2020 study indicated that over 50% of the adult population worldwide suffers from dyslipidaemia, placing them at elevated risk for cardiovascular illnesses. A diet high in fat and calories induces dyslipidaemia and damages the endothelium¹⁹.

Obesity constitutes a significant public health issue, serving as the primary cause of mortality and adversely impacting life expectancy. Globally, obesity has emerged as a prominent issue, resulting in 2.6 million fatalities each year. Obesity is an independent cardiovascular illnesses risk factor²⁰. Obesity is assessed with BMI and Waist circumference²¹. However WHR and WHtR are the alternative anthropometric parameter for assessment of obesity²².

There is insufficient data concerning the prevalence and risk factors among the youth on a broad scale. It is crucial to cultivate awareness at a young age concerning safety measures for mitigating the prevalence of cardiovascular diseases. Understanding the risk factors of cardiovascular disease will enhance socioeconomic status. The issue is alarming as lifestyle changes elevate the risk factors for cardiovascular illnesses. It is essential to eliminate risk factors to reduce the complications associated with cardiovascular illnesses. It is accomplished through appropriate blood screening, anthropometric measurements, and effective education on lifestyle choices, as risk factors can be mitigated by altering individual's lifestyles. The evolving lifestyle significantly influences dietary practices and physical activity habits. It also influenced the incidence of cardiovascular illnesses. Consequently, it is essential to study the cardiovascular illnesses risk factors.

MATERIALS AND METHODS

Study design and setting: This was the Cross-Sectional Study. All healthy adult teachers selected from the schools and colleges who were willing to participate in the study were included. The total sample size was 150 persons who were living in Hyderabad areas, Pakistan.

Sampling Technique: Convenient Random Sampling

Subjects: In this study the healthy adult teachers of different schools and colleges of Hyderabad, Pakistan were included. Individuals were assessed on the basis of history having no underline diseases such as diabetes, hypertension, cardiovascular diseases, cancer, asthma and allergies. Participants who were taking any form of medication or who did not agree to take part in the study were not included. Data were gathered using a structured questionnaire that had been prepared beforehand. The questionnaire was used to obtain details about socio-demographic characteristics, dietary habits, and any relevant family history of illness.

Inclusion criteria: Age: 18-25 Years, Gender: Male and Females, Subject: Adult working in schools and colleges were included,

Exclusion criteria: Individuals having underline disease, Individual having medications, pregnant females, Handicapped individual were excluded.

Data Collection

Biochemical Analysion: Informed consent was taken from all participants. Complete history and examination was done. Blood 10 ml was collected who had fasting for at least 8-10 hours in EDTA vacutainers from antecubital vein using aseptic technique. By centrifuging the samples serum was obtained at 5,000 rpm upto 5 minutes. Then serum was kept at -20 °C until it analysed. Samples are analysed using Micro lab -300 analyzer. For the assessment of Cholesterol and Fasting Blood Sugar (FBS), biochemical analysis was carried out, and was measured using standard kit method. Blood pressure was measured using mercury sphygmomanometer and record SBP and DBP.

Anthropometry measurements: Anthropometry measurements were taken by trained person. Study subjects asked to remove their shoes and slippers and for wearing simple plain clothes during the measurements. Body weight was measured by using digital scale. Height was measured with a wall mounted stadiometer. BMI was calculated from height in meters and weight in Kg. Waist hip

ratio (WHR), Waist Circumference (WC) and Waist Height Ratio (WHR) were measured by placing a non – stretchable measuring tape. Sitting blood pressure is measured using mercury sphygmomanometer and record the Systolic blood Pressure (SBP) and Diastolic blood pressure (DBP).

Ethical Consideration: Ethical approval was obtained from the ethical review committee of the institute before starting of the data collection.

Statistical Data Analysis: After the data was collected, it was transferred to SPSS spread sheet and then it was edited before analysis. SPSS version 28 was used. Data was respresented as mean $\pm$ standard error of mean (SEM). Bivariate correlation was used for association. The t-test was used for the quantitative analysis. Chi square was used for categorical variables. P value(< 0.05) was used as statistically significant.

RESULTS

Table 1 shows, total participants were 150, out of 150, 76 (50.67) were males and 74 (49.33) were females. In BMI, there was no significant difference between female and male. However, the central obesity using the waist circumference indicated that male had significantly higher waist circumference ($P < 0.0001$) than female and similiarly male had a significantly ($P < 0.0001$) higher waist hip ratio than a female. According to the waist height ratio male had a significantly higher ($P < 0.0001$) waist height ratio than a female. These results suggest an overall higher mean values of anthropometric indicators for males than females.

Table 1. Anthropometric measurements among male and female Participants

CVD Risk Factors	Male (n=76) Mean $\pm$ SD	Female (n= 74) Mean $\pm$ SD	P- Value
BMI (Kg/ m ²)	22.9 $\pm$ 4.08	22.45 $\pm$ 4.38	0.450
Waist Circumference(WC) (cm)	81.8 $\pm$ 10.89	69.59 $\pm$ 9.83	0.000
Waist Hip Ratio (WHR)	0.905 $\pm$ 0.05	0.79 $\pm$ 0.73	0.000
Waist Height Ratio(WHtR)	0.501 $\pm$ 0.067	0.44 $\pm$ 0.66	0.000

According to the Table No 2, the CVD risk factors are higher among male. The fasting blood sugar mean value was higher among male than female and it shows a significant trait. Both the diastolic blood pressure and systolic blood pressure mean vales were higher among male than female.and it was statistically significant. However, the difference of mean values of cholesterol among male and female did not show any significant difference ($P > 0.05$).

Table 2. Blood Parameters measurements among male and female Participants

CVD Risk Factors	Male (n=76) Mean $\pm$ SD	Female (n= 74) Mean $\pm$ SD	P- Value
Fasting Blood Sugar (FBS)	90.78 $\pm$ 13.13	86.76 $\pm$ 11.71	0.052
Systolic Blood Pressure (SBP)	117.04 $\pm$ 10.10	107.85 $\pm$ 15.10	0.000
Diastolic Blood Pressure (DBP)	79.74 $\pm$ 6.971	72.65 $\pm$ 9.127	0.000
Cholesterol	155.46 $\pm$ 46.19	152.64 $\pm$ 47.171	0.711

Table No 3 indicates the correlation between anthropometric variables. Both BMI and waist circumference, anthropometric indicators are widely used for the assessment of overweight and obesity. In this table the correlation between the anthropometric variable is statistically significant.

BMI shows very strong correlation with waist circumference ($r = 0.805$, $P < 0.0001$) followed by waist hip ratio ($r = 0.440$, $P < 0.0001$) and then waist height ratio ($r = 0.779$, $P < 0.0001$).

Table No 3. Correlation between anthropometric variables among Male

Gender	Anthropometric Variables	BMI	Waist circumference(WC)	Waist Hip Ratio (WHR)	Waist height Ratio (WHtR)
Male	BMI (Kg/m ²)	1	0.805**	0.440**	0.779**
	WC (cm)	0.805**	1	0.656**	0.946**
	WHR	0.440*	0.656**	1	0.653*
	WHtR	0.779**	0.946**	0.653**	1

**P value < 0.0001

According to the table no 4, The Correlation between anthropometric indicators among females indicated that BMI had a very strong correlation with waist height ratio slightly followed by waist circumference and then by the waist hip ratio. This also suggest that the waist height ratio could also be an alternative for the BMI.

Table 4. Correlation between anthropometric variables among females

Gender	Anthropometric Variables	BMI	Waist circumference (WC)	Waist Hip Ratio (WHR)	Waist height Ratio (WHtR)
Females	BMI	1	0.806**	0.365**	0.807**
	WC	0.806**	1	0.733**	0.949**
	WHR	0.365**	0.733**	1	0.764**
	WHtR	0.807**	0.949**	0.764**	1

Table No 5 indicated the correlation of an anthropometric indicators with CVD risk factors. This suggest that BMI, waist height ratio and waist circumference. These three anthropometric indicators are significantly correlated with CVD risk factors such as FBS, SBP, DBP and cholesterol. However waist hip ratio is only significantly correlated with the SBP and no significant difference was observed in correlation of waist height ratio with FBS, DBP and cholesterol ($P > 0.05$)

Table No 5. Correlation between anthropometric variables and CVD risk Factors among Males

Gender	Anthropometric variable	FBS mmHg	SBP (mg/dl)	DBP (mg/dl)	Cholesterol (mg/dl)
Male	BMI (Kg/m ²)	0.588**	0.714**	0.622**	0.497**
	WC (cm)	0.452**	0.612**	0.484**	0.411**
	WHR	0.160	0.301**	0.158	0.101
	WHtR	0.374**	0.537**	0.411**	0.281*

In Table 6, The correlation between the anthropometric parameters and CVD risk factors among female shows that BMI, waist circumference and waist height ratio. All three are significantly correlated with FBS, SBP, DBP and cholesterol. However, waist hip ratio shows the significant correlation with SBP, DBP and cholesterol. And no any significant correlation was observed between waist hip ratio and FBS among female participants ($P > 0.05$).

Table 6. Correlation between anthropometric variables and CVD risk Factors among Females

Gender	Anthropometric variable	FBS mmHg	SBP (mg/dl)	DBP (mg/dl)	Cholesterol (mg/dl)
Female	BMI (Kg/m ²)	0.482**	0.727**	0.637**	0.644**
	WC (cm)	0.398**	0.643**	0.550**	0.533**
	WHR	0.136	0.380**	0.263*	0.238*
	WHtR	0.361**	0.610**	0.491**	0.51**

DISCUSSION

The risk factors are very important to know, which are the main reasons for the morbidity and mortality of the very alarming cardiovascular diseases especially in young adults whose life in early stages and very precious for their families. In this current study, Males reported more risk factors of cardiovascular system than females and risk factors at an earlier age were developed. Our study supported by a comparable study conducted in 2023 that male possess a heightened likelihood of experiencing cardiovascular problems²³. According to the Tran et al., males are at higher cardiovascular diseases risk and prevalence of risk factors are increasing with age. It is very alarming²⁴. Males in younger to middle age exhibit clinical atherosclerotic cardiovascular disease that is coronary artery disease approximately 7-10 years earlier than women²⁵. A similar study conducted in 2023 reported that Young males showed a higher presence of lifestyle patterns and conditions that placed them at greater risk for cardiovascular disease. They were less likely to have adequate health insurance and more likely to report hypertension, elevated cholesterol levels, and being overweight-trends that appeared more pronounced in younger men compared to women²⁶.

In this study that the most common risk factors are obesity and overweight as evident by high significant values by applying the Pearson's correlation test. In this current study we did the assessment of correlation of the different anthropometric indices to find the risk factors in cardiovascular diseases. Overweight and obesity are increasing at alarming rate. In our study the mean of BMI in male was $22.9 \pm 4.08 \text{ kg/m}^2$ and in females was $22.45 \pm 4.38 \text{ kg/m}^2$ with insignificant p value 0.450, but significant correlation seen when analysed with Pearson's test that Waist Hip Ratio (WHR) 0.440, waist circumference (WC) 0.805 and Waist height Ratio (WHtR) 0.779 in males. Whereas in female values were 0.806, 0.365, 0.807 respectively. These results are consistent with BMI is the most reliable indicator of impending CVD disease risk factor as already reported by various studies²⁷. BMI is a useful anthropometric indicator. However, it does assess the fat distribution.

Other risk factors like Cholesterol, fasting blood sugar levels and Systolic and Diastolic blood pressure observed in this study were also significantly correlated in male and female participants. These findings also seen in the study on young normal adults at Malaysia, findings conceding their alertness for health care by lifestyle improving via maintaining body weight and blood pressure to avoid obesity related diseases²⁸.

Waist Circumference is also crucial solely variable in forecasting future cardiovascular events its increment indicated the fat deposition in abdomen, in our study population its values were significantly correlated to cholesterol 0.411 in males and 0.533 in females, agreed with Canadian study²⁹. Similar study supported that increase waist circumference indicates central obesity and heightened cardiovascular disease mortality³⁰.

Previous studies also emphasis the measurement of Waist Hip Ratio (WHR) that has also attracted the attention of researcher that this parameters should not be underestimated because it has also been significantly correlated with systolic blood pressure for CVDs in our study it was 0.301 in males and 0.380 in females, these finding are also verifying the observations of Anjaneyulu SR et al³¹.

Increased Waist Hip Ratio has also strong concern with future CVDs, this study also alarming the general population that WHR should be kept in mind, disturbing this can lead to mortality and morbidity, routine daily exercise and healthy eating habits can secure the life, our study shows some correlation with the other anthropometrics. A study conducted in 2019 strongly emphasis that waist hip ratio is also the alternative screening tool for cardiovascular diseases risk factors³².

However, A comparable study corroborated that Waist height ratio (WHtR) is also an effective technique for early diagnosis of cardiovascular disease risk factors in younger age³³. This study support our current study result that there is a strong statistically correlation of WHtR with FBS, SBP, DBP and Cholesterol in males and similarly strong correlation seen with females.

This study's dual evaluation of laboratory and anthropometric factors, which offers a thorough analysis, is a major advantage. This is significant because the entire range of these factors has not been investigated simultaneously in prior research. It is not possible to establish a causal relationship between the variables examined due to cross-sectional design of this study. Nonetheless, the study successfully identified for atherosclerotic heart disease risk factors. To better understand the risk factors associated with this condition, longitudinal studies, such as cohort studies, could be specifically created among Iranian patients. It is important to remember that this study did not address some potential confounding factors, such as dietary habits and physical activity. Future studies may be helpful in producing more broadly applicable conclusions about the variables raising the risk of heart disease in young adults.

CONCLUSION

In conclusion, Male are significantly at higher risk of suffering from CVD risk factors than females and for the anthropometric correlation, there is a strong correlation of BMI, waist circumference with waist height ratio suggested with waist height ratio could also be used as alternative indicator for the assessment of CVD risk factors among both male and female participant.

Conflict of Interest: All the authors declare that there is no any conflict of interest.

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