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Original Research Article

Analysis between Waist- Height Ratio with Obesity and Cardiovascular Parameters

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Abstract

Introduction: The prevalence of obesity and cardiovascular dysfunction have increased significantly from before and it has been well noted that both the conditions, obesity and cardiovascular dysfunction, are well correlated. But there is a need to find out an effective predictor which can conveniently determine or predict the status of obesity or cardiovascular function. Waist-to-height ratio (WHtR) dimensions have attracted more consideration recently as anthropometric indicators of childhood obesity and cardiovascular status. They are child-safe monitoring techniques that are simple to use, affordable, and specific to visceral fat. However, there is no clinically supported perception of the parameters pertaining to obesity and cardiovascular function that can correlated with Waist-to-height ratio.

Aims and objectives: To find out the statistically significant correlation between parameters attributed to obesity and cardiovascular status, with that of WHtR.

Materials and Methods: This retrospective study has derived participants' data from health clinic centre and carried out statistical analysis to find out the objective. The parameters that were considered to be related with obesity are Body Mass Index (BMI) and percentage of body fat. Again, the parameters that were considered to be related with cardiovascular functions are pulse rate, systolic blood pressure and diastolic blood pressure. These parameters were considered for analyzing with Waist-Height ratio.

Results: The study found that the WHtR is a statistically significant predictor of both obesity and cardiovascular parameters, like percentage of body fat and systolic blood pressure ($p<0.05$).

Conclusion: The study has concluded that WHtR is a statitically significant predictor that can be used to predict the outcome of obesity and cardiovascular function.

Keywords: obesity, cardiovascular, waist-height ratio, body fat, predictor

Introduction

A persistent mismatch between calorie intake and energy usage leads to obesity [1]. Over the past 30 years, obesity has become more common throughout the world, maybe as a result of rising calorie consumption and a decline in exercise [2]. The rising incidence of pediatric obesity raises concerns since it affects not only the prevalence but also the onset age of chronic diseases linked to obesity, like cardiovascular illnesses and type-2 diabetes [3].

With rising obesity incidence in the majority of nations since the 1980s, the global obesity epidemic is widely recognized [3]. Type 2 diabetes, hypertension, dyslipidemia, and sleep problems are incident cardiovascular risk factors that are directly influenced by obesity. Independent of other cardiovascular threat aspects, obesity upsurges the threat of developing cardiovascular disease as well as dying from it. More current research emphasizes waist circumference measurements of abdominal obesity as a cardiovascular disease risk sign that is independent of body mass index [4]. Visceral adiposity and other imaging modalities used to describe body composition have also made great strides.

An improper or excessive accumulation of fat that could be harmful to one's health is referred to as obesity. The WHO stated that the location of fat buildup affects the likelihood of developing a health problem. Compared to individuals with subcutaneous fat, those with visceral fat additional inclined towards have long-lasting infection in addition to have a greater chance of developing major illnesses [5].

A major public health concern on a global scale is cardiovascular disease. Rendering towards the 2019 report on Cardiac Illnesses in India, there are 2.9 million people in India who are estimated to have cardiovascular disease, in addition to obesity has emerged as a significant danger influence contributing towards the rise in the incidence of heart illness. Particularly, abdominal obesity initiated through the buildup of visceral fat has been recognized as a separate danger aspect aimed at diseases and fatalities linked to obesity [6]. In addition to being good predictors of abdominal obesity, the waist circumference as well as waist-to-height ratio are also improved indications of danger aspects for heart illnesses. The American Heart Association (AHA) recommended ideal cardiovascular health as a way to prevent cardiovascular and cerebrovascular illnesses in 2010 [7].

It's critical to monitor visceral fat early on to stop childhood obesity from getting worse. Even though BMI has been used extensively towards gauge chubbiness, it has restrictions because it doesn't reveal body composition or the distribution of fat [8]. The most accurate way to measure visceral fat is via magnetic resonance imaging (MRI), however this method is pricy and unsuitable for everyday clinical settings or large-scale investigations [9].

Pediatricians should monitor changes in children's adiposity indices and warn parents prior to the onset of adiposity medical issues since childhood obesity prevention and early identification are crucial for public health. The most often used metrics for defining obesity and central adiposity is BMI and waist circumference (WC). Lesser cutoffs regarding BMI are utilized on behalf of Asians, besides the usage of WC cutoffs that are particular to an individual's ethnicity and sex is advised. The limit of increased cardio metabolic jeopardies can vary depending on sexual category as well as civilization [10].

Clinicians must use methods to establish cutoffs various age and sexual role for BMI and WC in children and adolescents because both measurements are strongly age-dependent. However, in crowded intensive outpatient program environments using tables aimed at every patient is

difficult, highlighting the need for an accurate but user-friendly adiposity index [8-10].

It's critical to monitor visceral fat early on to stop childhood obesity from getting worse. Waist circumference (WC) plus waist-to-height ratio (WHtR) dimensions have attracted more consideration recently as anthropometric indicators of childhood obesity. They are child-safe monitoring techniques that are simple to use, affordable, and specific to visceral fat. To determine childhood obesity, neither of the two measures has any international reference values [11].

Recently, the waist-to-height ratio (WHtR), which is determined through in-between waist circumference (WC) via height, has attracted interest as an anthropometric indicator aimed at assessing central adiposity. WHtR is a less expensive and simpler method of universal screening for health concerns than BMI. It was indicated that a WHtRcutoff of 0.5 can be utilized across racial and ethnic groupings, and that both children and adults can use the same cutoff. The advice to "WC should not be higher than 1/2 your height" may be very helpful both in clinical and public health contexts [12].

In addition to supporting the establishment of heart disease prevention and control programs, this journal article covers current papers that discuss the utility of WHtR as a preventative measure for obesity and associated cardio-metabolic risks when contrasted to BMI and WC. It also suggests WHtR is used in medical practice to test for adiposity in kids and teenagers.

Materials and Methods

Study Design

This current study is of retrospective design and the data was collected from health centre. The data used in this study belong to the participants who are healthy individuals.

The participants who were included in this study, have been healthy individuals, individuals who came for general check up with no chief complaint. The participants who did not give consent for this study were excluded from this study. The participants who were later found to have underlying disorders or any condition, were excluded. The parameters that were considered to be related with obesity are Body Mass Index (BMI) and percentage of body fat. Again, the parameters that were considered to be related with cardiovascular functions are pulse rate, systolic blood pressure and diastolic blood pressure. These parameters were considered for analyzing with Waist-Height ratio.

The original data was obtained and arranged in a database and it was analyzed according to the objectives of the study.

Statistics

The study used SPSS 25 and excel software for effective analysis. The study employed ANOVA test and Bivariate correlation analysis for determining the significance between Waist Height Ratio (WHtR) with several parameters pertaining to obesity and cardiovascular functions. The descriptive parameters have been expressed as mean±standard deviation. The level of significance was considered as $\alpha = 0.05$.

Results

The study has considered 100 patients whose basic characteristics have been shown (Table 1).

Table 1: Baseline characteristics of the study participants

Characteristic	Value
Age (years)	23.6±3.36
Pulse Rate	85.09±11.25

Systolic Blood Pressure (mmHg)	123.42±60.17
Diastolic Blood Pressure (mmHg)	76.61±7.77
Waist/Hip Ratio	0.868±0.064
Waist/Height Ratio	0.491±0.066
Body Fat Percentage (%)	25.247±9.926
BMR (calories/day)	1322.15±234.08
BMI	22.11±3.55

Several factors have been investigated in the study. It shows that 51% of the study population is male while 49% of the study population is female. The study also found that 36% of the study population are based on vegetaranian diet while 64% are based on non-vegetaranian diet. The study also noted that 87% of the sample do not smoke and 88% of the study sample do not consume alcohol. The study also found that there is no diabetes and hypertension in the study sample. Figure 1 shows the distribution of gender, diet, smoking history and alcohol history.

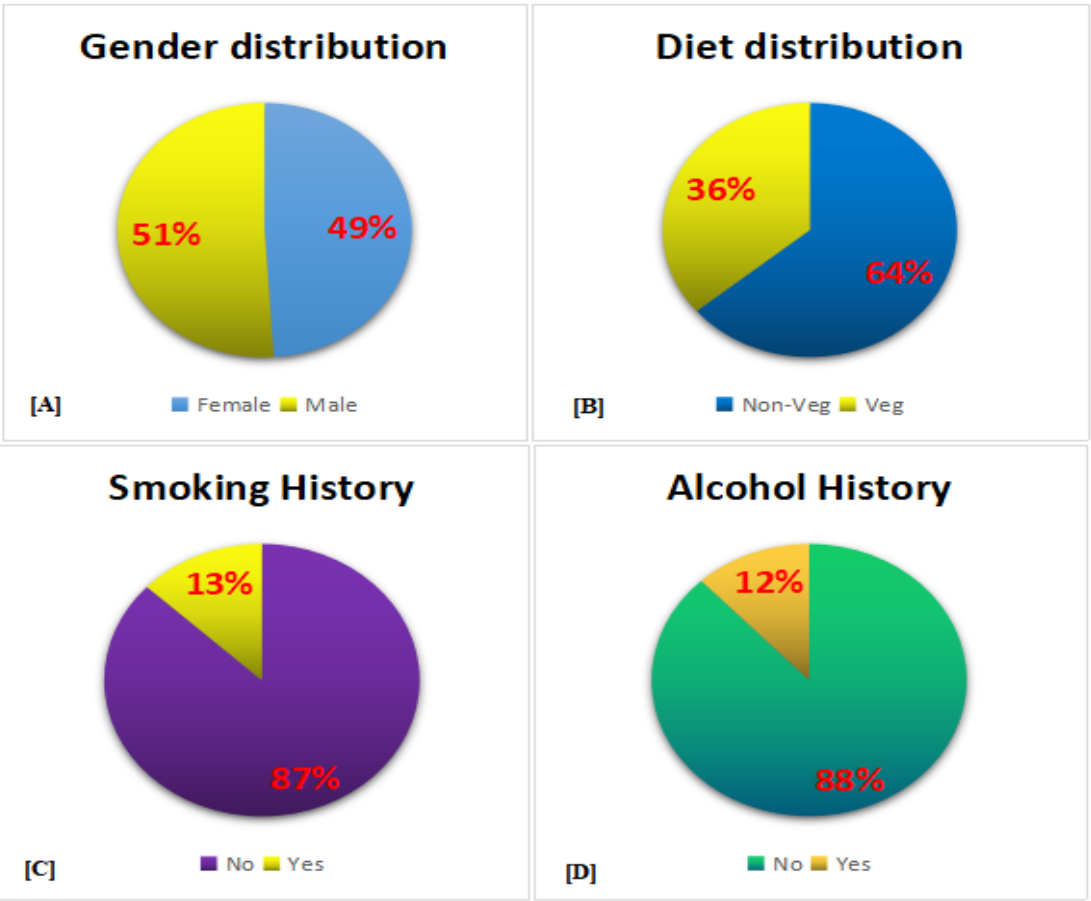

Figure 1: [A] Gender distribution in the study sample. [B] Percentage of vegetarian and Non-vegetarian diet in the study sample. [C] Percentage of smokers in the study sample. [D] Percentage of alcholics in the study sample.

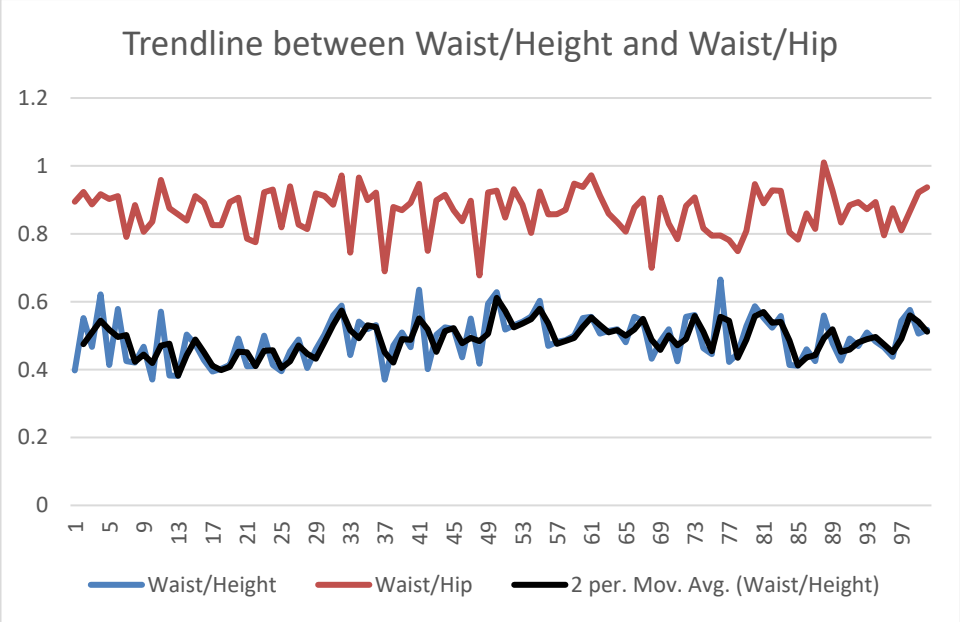

Figure 2: The correlation and trendline between Waist-Height ratio to that of Waist-Hip ratio

The study found that WHtR between male and female is 0.4792±0.06 and 0.5024±0.07, respectively. It was also found that WHtR between Veg diet and Non-veg diet is 0.4935±0.06 and 0.4874±0.07, respectively.

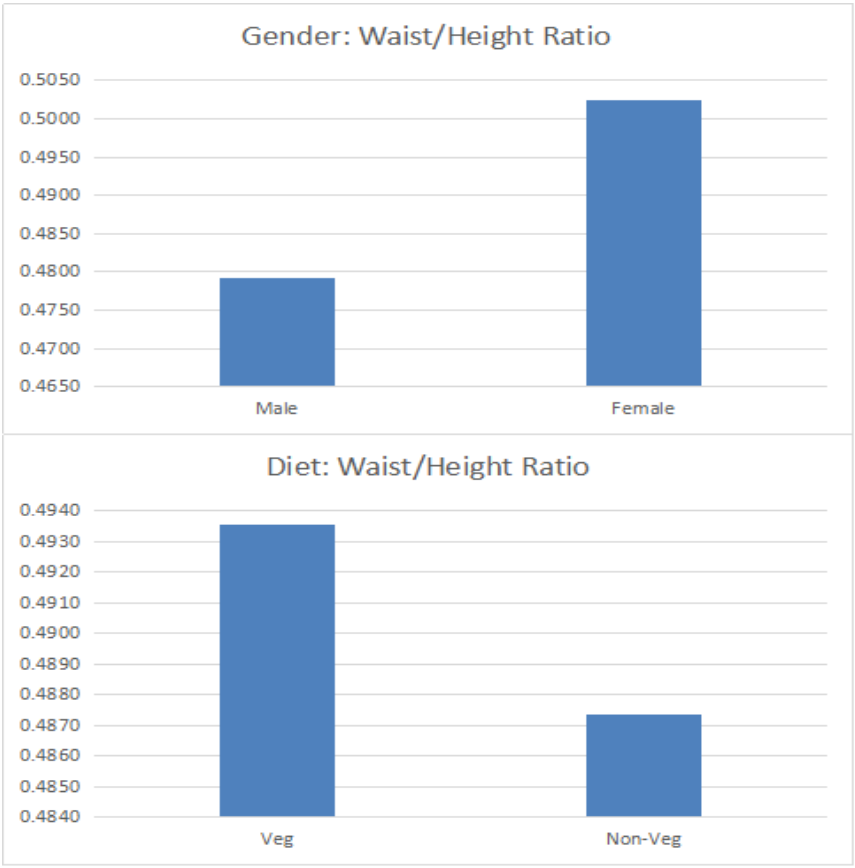

Figure 3: Comparison between mean value of Waist-Height ratio with respect to gender and diet

The study found that the WHtR is a statistically significant predictor of both obesity and cardiovascular parameters, like percentage of body fat and systolic blood pressure (p<0.05). For parameters like BMI, DBP, pulse rate, WHtR was not found to have correlation (Table 2).

Table 2: Significance and result of ANOVA test

Parameter	F value	*p*-value
Percentage of body fat	23.661	.000
BMI	2.392	.111
SBP	77.269	.000
DBP	1.704	.235
Pulse	.722	.779

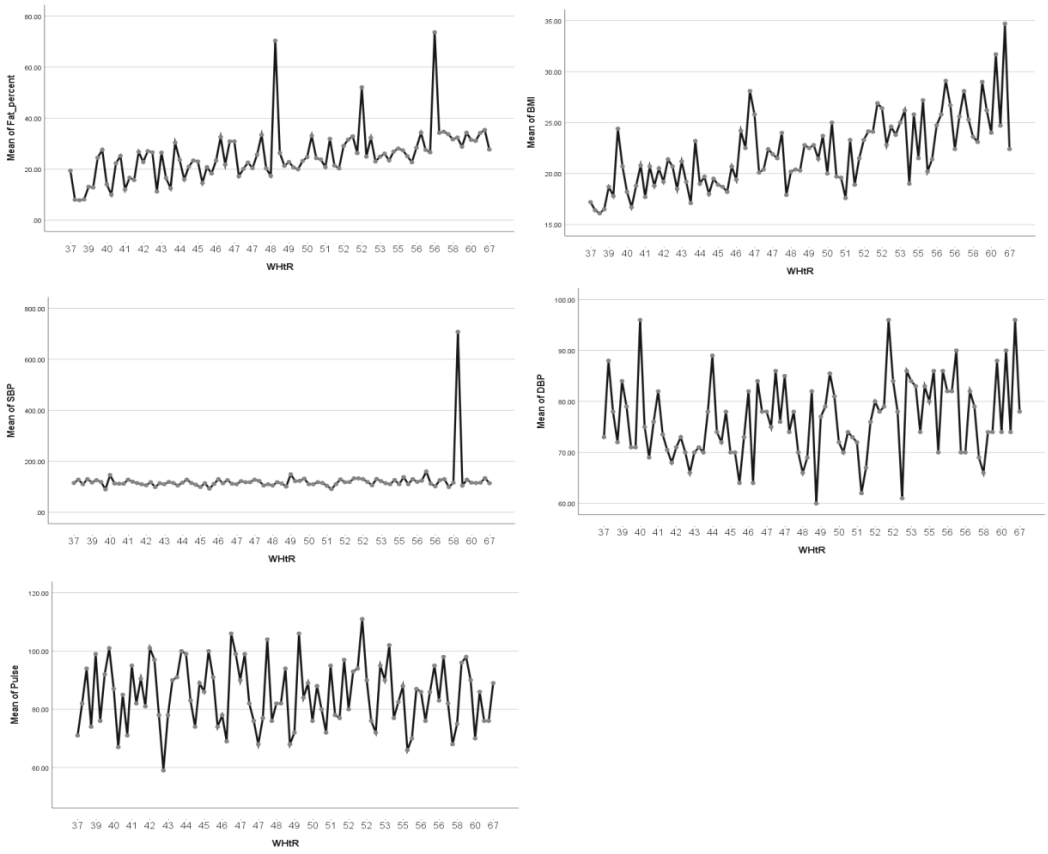

Figure 4: Correlation graph between different parameter with WHtR

Discussion

According to the study that was reported, 42 obese and 23 overweight youngsters were examined. Higher WC (PR=1.879) and WHtR (PR=8.352) values in children were associated with a greater occurrence of having greater BMI position (obese). When by means of multivariate analysis, WHtR was found to be supplementary significant than WC in determining BMI status [13, 14].

The WC P90 and obesity in children were significantly correlated in the study (95%CI: 1.343 to 2.630; P 0.001). Associated toward teenagers through WC P90, those with WC P90 had a 1.879 times higher probability of presence obese (by BMI). An earlier investigation conducted in Norway discovered a substantial correlation between WC and BMI [14].

Obesity causes an excess of fat to accumulate on the body, which will eventually cover any gaps between the

visceral organs or under the skin. Fat can be divided into visceral/central and subcutaneous/peripheral types depending on where it is found. When there is an excess of calories consumed (high-calorie diet) relative to the amount of energy expended, subcutaneous fat accumulates (physical inactivity). Fat starts to build up outside of the subcutaneous tissue, usually in the visceral areas, when the subcutaneous tissue's capacity for storing fat is reached before when its capability towards produce novel adipocytes is compromised. The measurement of waist circumference can be used to estimate visceral fat and calculate fat mass. In an Australian study, WC was found to be a important forecaster of both retroperitoneal adipose tissue mass (RPATM) as well as intrperitoneal abdominal adipose tissue mass (IPATM). As a result, subjects with higher levels of obesity often had significant visceral fat as evaluated by WC [15, 16].

Due to the fact that most obese (88%) and overweight (82.6%) people were of average height, our research demonstrated that greater fat deposition is not associated with increased height. If a youngster consumes more calories than necessary for direct development, the extra calories would be deposited as subcutaneous and visceral fat. Correspondingly, a prior Indonesian study found that a rise in BMI did not coincide with a rise in height. Amongst individuals who were obese and those who were normal weight, there were no appreciable differences in average height. Therefore, subjects with higher levels of obesity may have higher levels of visceral fat as evaluated by the WHtR. Age and ethnicity have no bearing on this assessment, which may permit the identical borderline values aimed at both children and adults. Because there were substantial correlations between both measures and BMI status, we ran a multivariate analysis. WHtR was the more predominate characteristic linked to BMI status in comparison to WC. Our research demonstrates a substantial relationship between WC and WHtR and BMI status in kids amongst the ages of 10 plus 12 years. WHtR is a more reliable indicator of obesity than WC. For the purpose of identifying kids and teenagers who have elevated cardiometabolic risk due to central adiposity, the WHtR index is dependable, simple to apply, and less age-dependent [16-18].

The widespread consensus is that a WHtR cutoff of 0.5 serves as a standard threshold for abdominal adiposity in both adults and kids younger than 6 years old. The WHtR hasn't been tested on infants or young children, though. Gender as well as civilization specific WHtR cutoffs can increase the selectivity then responsiveness of detecting individuals at increased metabolic risk, even in older teenagers. Screening people with higher cardiometabolic risk may also benefit from the inclusion of WHtR to BMI or WC. The WHtR is currently a commonly used, validated indicator of central adiposity that is included in the majority of contemporary research [18].

Adult Meta-analyses and controlled trials have shown that the WHtR is superior than BMI and on par with, or slightly better than, WC in terms of predicting increased cardiometabolic risk. BMI with WC are comparable to WHtR for determining people through elevated cardiometabolic risk, according to studies in children and adolescents. To verify the effectiveness of WHtR for anticipating obesity-related more extensive predictive research on comorbidity in kids and teens are needed [15, 19].

A cross-sectional study with 26701 Chinese males in their middle years was found to have been conducted. Body mass index (BMI), overall cholesterol (TC), blood pressure (BP), as well as fasting blood glucose (FBG) was discovered towards rise through an increase in the mean WC and WHtR, among the seven optimal cardiovascular health metrics. In comparison to participants with poor or

intermediate cardiovascular health, individual using advanced or excellent cardiovascular health had considerably reduced mean WC and WHtR values. The mean WC and WHtR dropped after age adjustment via 1.486 cm as well as 0.009 each 1-point rise in the cardiac healthiness mark, respectively, and by 2.242 cm in addition to 0.013 per 1-point rise in the number of optimal cardiac health indicators [19, 20].

Both the WC and WHtR showed a strikingly declining trend in the current study, which coincided the optimal cardiac health rating has increased. Once age was taken into account, a 1-point increase in the cardiovascular health score was linked to a 1.486 cm decrease in the mean WC and a 0.009 decrease in the mean WHtR, while a 1-point greater availability of the best heart health indicators was linked to a 2.242 cm decrease in the mean WC and a 0.013 decrease in the mean WHtR. Researcher and colleagues discovered that people through good or else excellent cardiac wellbeing had a markedly decreased threat of stroke than people in underprivileged wellbeing [15, 18-20].

Increased levels of risk factors aimed at heart illnesses, like hyperinsulinemia, insulin resistance, hypertension, and abnormalities in blood lipids, can be brought on by excessive body fat buildup. The extrapolative efficacy of the WC versus WHtR is still debatable, despite the fact that the WC as well as WHtR is useful measures aimed at evaluating abdominal obesity and forecasting the threat aimed at cardiac illnesses. According to numerous reports, the WHtR is more accurate at forecasting the threat aimed at cardiac illnesses than the WC and BMI [20].

In conclusion, the findings of this investigation demonstrate a negative correlation between the cardiovascular health score and the WC and WHtR and that this correlation is stronger with the WHtR than the WC. The WHtR is also very useful for forecasting the risk of cardiovascular illnesses and screening people that are at high risk for abdominal obesity and cardiovascular disorders. [21]

Conclusion

The study has concluded that WHtR is a statistically significant predictor that can be used to predict the outcome of obesity and cardiovascular function. Although, it cannot be said that WHtR is one of most reliable, as few parameters are statistically correlated with WHtR, however, the latter can be used to provide a clinically significant prediction about the status of obesity and cardiovascular function. The study inferred that systolic blood pressure and percentage of body fat are the two parameters which are highly significant with respect to the variation in WHtR in predicting the status of obesity and cardiovascular function, respectively.

However, the author also suggests to conduct more researches with larger and varied population. Finally, this current study has brought forward a clinically significant finding which can contribute in clinical prediction of obesity and cardiovascular status of an individual.

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