AATCC Review

10 November 2022: Received
14 March 2023: Revised
22 May 2023: Accepted
28 June 2023: Available Online

www.aatcc.peerjournals.net

Research Article Open Access

Anthropometric Measures as Indicators of Health Risks among Female College Students

V. Vijaya Lakshmi and E. Shirin Hima Bindu*

Department of Resource Management and Consumer Sciences, College of Community Science, PJTSAU, Saifabad, Hyderabad, India

ABSTRACT

The present study investigated the relationships between anthropometric measurements of female college students. The study was conducted on a relatively small sample size of female college students. The sample consisted of 15 respondents with an age range from 16 to 23 years. The anthropometric measurements included age, height, weight, BMI, waist circumference, hip circumference, Waist-Hip Ratio(WHR) and Waist circumference - Height Ratio (WHtR). The results of the study showed that there were significant correlations between age and each of the other variables. The strength of the correlations varied from moderate to strong, with the strongest correlation being between age and Body mass index(BMI). Additionally, the results of the regression analysis showed that BMI was a significant predictor of waist circumference. These findings suggest that there are important relationships between anthropometric measurements of female college students. These relationships can be used to better understand the risk factors for obesity and other health conditions.

The study also has some limitations. First, the sample size was relatively small, which may limit the generalization of the findings. Second, the study was a cross-sectional design which restricts the ability to establish causal relationships between variables. Despite these limitations, the study provides valuable insights into the relationships between anthropometric measurements of female college students. These findings can be used for health interventions and emphasize the importance of monitoring body composition changes and addressing associated health risks in this population. The study suggests that there are significant correlations between age and various body composition variables.

Keywords: *Anthropometric measurements; Waist-hip ratio (WHR); Waist circumference-height ratio (WHtR); BMI; Body composition; Female students; Health risks; Obesity*

INTRODUCTION

Obesity is a significant public health concern, with rising prevalence rates among young adults. College students, in particular, face increased vulnerability to obesity due to lifestyle changes associated with the transition to college life, changing dietary habits, and physical activity patterns. The prevalence of obesity among college students has been steadily increasing, reaching 32.3% in 2019, compared to 24.1% in 2011.

Abdominal obesity, specifically visceral fat accumulation, has been identified as a crucial risk factor for chronic diseases like heart disease, type 2 diabetes, and stroke. Waist-hip ratio (WHR) has emerged as a more specific measure of abdominal obesity, providing insights into health risks associated with body fat distribution.WHR is a measure of body fat distribution, particularly the proportion of fat around the waist relative to the hips. Waist circumference-height ratio (WHtR) is another measure of body fat distribution that takes into account waist circumference relative to height. Body mass index (BMI) is a widely used measure to classify individuals into weight categories and assess their health risks. However, BMI has limitations as it fails to consider variations in body fat distribution and cannot differentiate between muscle and fat mass.

The present study aims to compare BMI, WHR, and WHtR as indicators of health risks among female college students. This demographic is particularly susceptible to changes in body composition, lifestyle habits, and psychosocial factors that contribute to weight gain and the potential onset of chronic diseases. By focusing on this population, the study intends to provide valuable insights into the effectiveness of BMI, WHR, and WHtR in predicting health risks and guiding interventions among female college students.

The hypothesis underlying this research hypothesizes that WHR, as a measure of abdominal obesity, will serve as a superior predictor of health risks compared to BMI in this population. This hypothesis is driven by accumulating evidence highlighting the adverse health effects of abdominal obesity, independent of overall body weight. By examining this hypothesis, the study seeks to find out suitable indicators for assessing health risks in female college students.

The study examines various anthropometric measurements

**Corresponding Author: : E. Shirin Hima Bindu*
Email Address: shirincalla@gmail.com

DOI: https://doi.org/10.58321/AATCCReview.2023.11.03.261

among female college students viz., age, height, weight, BMI, waist circumference, hip circumference, WHR, and WHtR. These variables collectively provide comprehensive insights into body composition and its associated health risks. Age is included to examine any age-related correlations, while height, weight, and BMI offer overall body size and weight status information. Waist circumference, hip circumference, WHR, and WHtR focus on body fat distribution and abdominal obesity, which are key indicators of health risks.

Understanding the relationships and associations between these variables can help identify potential risk factors for related health conditions in female college students. The findings will contribute to formulating interventions to improve health status and emphasizing the importance of monitoring body composition changes and addressing associated health risks in this vulnerable population.

METHODS

This research study employed an exploratory research design to compare BMI, WHR, and WHtR as indicators of health risks in a sample of 15 female college students. Anthropometric measurements, including height, weight, waist circumference, and hip circumference were collected using standardized protocols.

Height was measured using a stadiometer and weight with a digital weighing machine. The waist circumference was measured by measuring tape at the center of the superior iliac crest and the lower edge of the last palpable rib at the midaxis. Hip circumference was measured parallel to the floor, at the largest circumference of the buttocks. BMI was calculated using the standard formula, while WHR was obtained by dividing waist circumference by hip circumference and WHtR was obtained by dividing waist circumference by height.

Different variables were compared using descriptive statistics, correlation and regression models. The data was analyzed using SPSS software.

RESULTS AND DISCUSSION

The descriptive statistics (Table 1) provided for the variables in the sample of female college students offer insights into the distribution and variability of age, height, weight, BMI, waist circumference, hip circumference, WHR, and WHtRcan be further analyzed to explore associations, patterns, and potential health implications.

The sample consisted of individuals aged 16 to 23 years, with an average age of 21.4 years and a relatively narrow age distribution. The students' heights ranged from 149 cm to 166 cm, with an average height of 156.13 cm. Their weights varied from 36 kg to 53 kg, with an average weight of 43.533 kg. The BMI values in the sample ranged from 15.2 to 20.3, with an average BMI of 17.853.

Table 1:Details of the study participants

Variables	Min	Max	Mean	Std. Dev
Age	16	23	21.4	1.993
Height(cm)	149	166	156.13	4.704
Weight(kg)	36	53	43.5333	4.42181
BMI	15.2	20.3	17.85333	1.534306
Waist circumference (cm)	63	94	75.86	9.024237
Hip circumference (cm)	68	109	86.67	10.95712
Waist Hip Ratio (WHR)	0.814	0.926	0.871067	0.037393
Waist circumference Height Ratio (WHtR)	0.406	0.579	0.485267	0.054384

The waist circumference of the female college students in the sample ranged from 63 cm to 94 cm, with an average waist circumference of 75.86 cm and a standard deviation of 9.024. Similarly, the hip circumference ranged from 68 cm to 109 cm, with an average hip circumference of 86.67 cm and a standard deviation of 10.95. WHR values in the sample ranged from 0.814 to 0.926, with an average WHR of 0.871067 and a standard deviation of 0.037.

Research studies have highlighted the significance of WHR as an indicator of health risks, particularly its association with cardiovascular diseases and metabolic disorders. The WHtR values in the sample ranged from 0.406 to 0.579, with a mean WHtR of 0.485 and a standard deviation of 0.054.

It has been proposed as a better predictor of health risks compared to BMI or WHR alone. Studies have shown that WHtR is strongly associated with cardiometabolic risk factors and can serve as a simple and practical screening tool for identifying individuals at higher risk for chronic diseases.

Table 2: Categorization of subjects on the basis of body mass index

Category	Body mass index	Number (N) of respondents (%)
Underweight	<18.5	4 (26.6%)
Normal Weight	18.5-24.9	11 (73.0%)

The findings from Table 2 indicate that a significant proportion of female college students in the sample have a normal weight status based on BMI. This aligns with the established understanding that a healthy weight range lies within the normal BMI range of 18.5 to 24.9. It is important to note that BMI alone may not provide a comprehensive assessment of an individual's health, as it does not account for variations in body composition. Additional factors, such as waist circumference, body fat percentage, and muscle mass, should be considered for

a more comprehensive evaluation of health risks associated with weight status among female college students.
A study analyzed data from the National Health and Nutrition Examination Survey (NHANES) conducted between 1994 and 2004 in the United States showed that among the adult population, including college-aged individuals, a significant proportion fell within the normal-weight category based on BMI [2].

Table 3: Categorization of subjects on the basis of WHR and WHtRThresholds

	Wait Hip Ratio		Waist Height Ratio (WHtR)	
Health Risk	**WHR Threshold**	**Number (N) of respondents (%)**	**WHtR Threshold**	**Number (N) of respondents (%)**
Moderate	0.81 to 0.85	4 (26.6%)	<0.50	9 (60.0%)
High	0.85+	11 (73.0%)	>0.50	6 (40.0%)

The findings from Table 3 indicate that a significant proportion of female college students in the sample have a moderate and high health risk, based on both WHR and WHtR measurements. This suggests an increased risk of developing health complications associated with abdominal obesity. However, there is a significant minority of students who are at a lower risk. The actual risk of chronic diseases for an individual will depend on a number of factors, including their overall health, lifestyle and family history.

Table 4:Correlation of age with variables

Variable 1	Variable 2	Correlation Coefficient (r)
Age	WHR	-0.59276*
	WHtR	0.43854*
	Height	0.31585*
	Weight	0.606318*
	Waist Circumference	0.495046*
	Hip Circumference	0.633559*
	BMI Kg/m^2	0.499453*

** -Significance Level at 0.05*

Table 4 revealed the correlations between dependant variables i.e., WHR, WHtRHeight, Weight, Waist Circumference, Hip Circumference and BMI Kg/m2 and independent variables i.e. age

1. Age and WHR: The negative correlation coefficient (Table 4) suggests that as age increases, WHR tends to decrease in female college students. This means that as women get older, they may experience a redistribution of body fat from the waist to the hips. This finding is supported by a study that WHR tends to decrease with age in women, indicating a shift towards a more gynoid (pear-shaped) body fat distribution [5].

2. Age and WHtR: The positive correlation coefficient (Table 4) suggests that as age increases, WHtR tends to increase in female college students. This means that as women age, they may experience an increase in abdominal obesity relative to their height. This finding is consistent with the study who demonstrated that WHtR increases with age in both sexes, and highlighted the utility of this measure as an indicator of central obesity [1].

3. Age and Waist-Hip Circumference: The positive correlation coefficients (Table 4) suggest that as age increases, waist and hip circumference tends to increase among female college students this finding supports the hypothesis that as women age, abdominal fat mass increases in adulthood, and women accumulate more fat in the waist and hips, which is associated with greater health risks This finding is consistent with the study who found a positive association between age and waist circumference in a sample of Portuguese women, who found a positive association between age and waist circumference in a sample of Dutch women [3], [4].

4. Age and BMI: The positive correlation coefficient (Table 4) suggests that as age increases, BMI tends to increase among female college students. This finding supports the general trend of weight gain and potential changes in body composition as individuals progress through adulthood. It is important to note that BMI does not differentiate between fat and muscle mass, so the increase in BMI could be due to changes in either or both components.

Overall, the research findings in this study are in line with existing literature and support the understanding of the relationship between age and various body composition variables among female college students. These correlations emphasize the importance of monitoring body composition changes and addressing associated health risks in this population.The strength of the correlations varies from moderate to strong, with the strongest correlation being between age and BMI.

Table 5:Coefficients for a regression model with the dependent variable 'waist circumference' and the predictor variable 'BMI'

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-14.223	15.104		-.942	.364
	BMI	5.046	.843	.857	5.985	<.001
a. Dependent Variable: waistcircumference						

The BMI coefficient (Table 5) represents the change in the dependent variable (waist circumference) associated with a one-unit increase in the predictor variable (BMI). The coefficient value is 5.046, indicating that, on average, for every one-unit increase in BMI, waist circumference increases by 5.046 units. This coefficient is statistically significant ($p < 0.001$). The result of the BMI coefficient aligns with the well-established understanding that BMI is positively associated with waist circumference, which is an indicator of abdominal obesity. Numerous studies have investigated the relationship between BMI and waist circumference as a marker of health risks.

A research study investigated the relationship between BMI, waist circumference, and metabolic syndrome in an Australian Indigenous community [6]. The study found a significant positive association between BMI and waist circumference, indicating that as BMI increases, so does waist circumference. This supports the understanding that higher BMI is associated with increased weight circumference or abdominal obesity.

CONCLUSION

In conclusion, the findings in this paper suggest that there are some important relationships between anthropometric measurements in female college students. The relationship between body composition and health is well-established. In recent years, there has been growing interest in the use of anthropometric measures, such as waist circumference and waist-to-hip ratio, as predictors of health risks.

The results suggest that there are significant correlations between age and each of the other variables, with the strongest correlation being between age and BMI with older students tending to have a higher BMI. This is likely due to a combination of factors, including changes in metabolism, activity level, and dietary habits. Another significant correlation was found between BMI and waist circumference, with higher BMI being associated with larger waist circumferences.

Additionally, the regression analysis findings also show that BMI is a major predictor of waist circumference. This is due to the significant danger that abdominal fat poses for chronic illnesses like type 2 diabetes, heart disease, and stroke in later life.

As women grow older, they may experience an increase in body fat levels, which could lead to an increase in health risks. Therefore, it is important for female college students to be aware of their body composition and to make healthy lifestyle choices to maintain a healthy weight. Hence it is recommended to

- Maintain a healthy weight by monitoring their BMI and waist circumference.
- Maintain a nutritious diet low in processed foods, sweetened beverages, and trans fats.
- Engage in regular physical activity, such as strength training and aerobic exercise.

Future scope of the study

A study can be taken up to investigate the relationship between body composition and health outcomes in female college students. This would help to determine whether changes in body composition are associated with an increased risk of chronic diseases. A research on the impact of body composition on academic performance can be taken up.

Conflict of interest

All the authors declare that they have no conflicts of interest.

Acknowledgment

The authors would like to thank College of Community Science, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, India for providing an opportunity to carry out this research work.

REFERENCES

1. Ashwell, M., Gunn, P., & Gibson, S. (2012). Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: systematic review and meta-analysis. Obesity Reviews, 13(3), 275-286.

2. Ogden C L,Carrol M D, and Curtin L R (2006). Prevalence of overweight and obesity in the United States 1994-2004. Journal of the American Medical Association, Apr 5;295(13):1549-55. doi: 10.1001/jama.295.13.1549.

3. Padez, C., Fernandes, T., Mourão, I., Moreira, P., & Rosado, V. (2003). Prevalence of overweight and obesity in 7-9-year-old Portuguese children: Trends in body mass index from 1970–2002. American Journal of Human Biology, 16(6), 670-678.

4. Snijder, M. B., Visser, M., Dekker, J. M., Goodpaster, B. H., Harris, T. B., Kritchevsky, S. B., &Seidell, J. C. (2003). Low subcutaneous thigh fat is a risk factor for unfavourable glucose and lipid levels, independently of high abdominal fat: The Health ABC Study. Diabetologia, 46(7), 1011-1018.

5. Visscher, T. L., Seidell, J. C., &Molarius, A. (2001). Variation in waist-hip ratio and its relationship with BMI in 50-year-old women. European Journal of Clinical Nutrition, 55(5), 426-431.

6. Wang, Z., Hoy, W. E., & Wang, Z. (2020). Obesity as measured by BMI and waist circumference and its association with metabolic syndrome in an Australian Indigenous community. Obesity Research & Clinical Practice, 14(2), 136-144.