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IS WAIST HIP RATIO A SIGNIFICANT HEALTH RISK FACTOR?A CROSS SECTIONAL STUDY AMONGST UNDER GRADUATE MEDICAL STUDENTS

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ABSTRACT

Background: The waist-hip ratio (WHR) is a widely recognized anthropometric measurement that provides critical insights into an individual's fat distribution and overall health risk. Unlike Body Mass Index (BMI), which merely accounts for total body mass, WHR specifically addresses the proportion of waist circumference to hip circumference, thereby offering a more precise indicator of central obesity and associated health risks.

Aim and Objective: To study the waist-hip ratio as a significant health risk factor.

Methodology: This was a cross-sectional study performed on 362 MBBS students of Rama Medical College Kanpur by purposive sampling using pretested and validated questionnaire to assess their demography, lifestyle factors, and anthropometric measurements.

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Results: Waist-hip ratio was significantly associated with physical exercise, and junk food consumption and positively correlated to waist circumference, weight, height, and BMI. Out of the total student population, 16 individuals (4.4%) had a waist-hip ratio that falls within therisk category.

Keywords: waist-hip ratio, medical students, obesity, health, BMI

INTRODUCTION

The waist-hip ratio (WHR) is a crucial anthropometric measurement used to assess the distribution of body fat and predict health risks associated with central obesity. Unlike other metrics such as Body Mass Index (BMI), WHR specifically examines the ratio of the circumference of the waist to that of the hips, providing a more precise indicator of abdominal fat accumulation.

Body mass index (BMI), waist-to-hip ratio (WHR), fat distribution, skinfold thickness, densitometry, and bioimpedance are some of the methods available to measure obesity and body fat (Chan et al., 2003; Hu, 2008). BMI and waist-to-hip ratio are among the most popular methods to measure obesity due to their simplicity, ease of execution, and low cost(1)

Recent studies have indicated the presence of a trend in overweight and obesity in children and adolescents of developing countries, but there is very little work done to evaluate the relationship between the prevalence of obesity among young adults and various modifiable risk factors such as hypertension(2), less than 20% of US adults who were trying to lose or maintain weight, were following recommendations to eat fewer calories and increase physical activity to at least 150 minutes per week (3). Overweight and obesity is a state when there is an abnormal or excessive fat accumulation in the body which poses a risk to an individual health. Around 2.8 million people are dying each year because of being overweight and obese. Obesity was once more prevalent among high-income countries but is now a prevalent problem in low-and middle-income countries.

The National Institutes of Health (NIH) and the North American Association for the Study of Obesity (NAASO) have developed and published guidelines for the assessment and treatment of obesity. These guidelines are evidence-based, decision-oriented, and tailored for clinical

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use.(4) WHR has been found to have a stronger association with multiple CVD risk factors in several studies conducted in China, Korea, Japan, and other ethnic groups(5).

Medical students, who represent the future of the healthcare profession, are an essential group for studying WHR. The rigorous academic demands, high levels of stress, irregular sleep patterns, and often suboptimal lifestyle choices associated with medical training can significantly impact their health. Understanding the prevalence and implications of WHR in this population can help identify those at risk of developing metabolic and cardiovascular conditions early on, and promote healthier habits that can be sustained throughout their careers.

Aim And Objectives:

1. To study the lifestyle factors associated with waist-hip ratio.

2. To study the correlation between waist-hip ratio and common anthropometric measurements.

MATERIAL AND METHODS

Study type: Cross-sectional analytical study

Study population: MBBS Students of Rama Medical College, Kanpur

Study area: The study was conducted in Rama Medical College, Kanpur

Study duration: from January 2024 to May 2024

Sample Size: 362 students selected by purposive sampling.

Inclusion Criteria: All undergraduate MBBS students who gave consent for participation.

Exclusion Criteria: Non-cooperative and unwilling students.

Data collection: The study used a pretested structured questionnaire which was distributed to students in their practical classes 15 minutes prior starting the practical. The students were explained about the entire procedure before starting the study. Demographic information, and lifestyle related factors information were obtained by using the interview technique (Step 1). Anthropometric measurements, height, weight, waist circumference, and hip circumference

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were measured as per the guidelines given by the WHO STEPS instrument (Step 2), immediately after Step 1.

Ethical approval: Ethical approval was duly obtained from the ethics committee of Rama Medical College before commencing the study. Informed written consent was obtained from all participants before their inclusion in the study, ensuring their voluntary participation and confidentiality of responses (RMCHRC/Ethics/2023/3185-A)

Consent: Informed written consent was obtained from all participants before their inclusion in the study.

Data Analysis: The collected data was analyzed by using Jamovi Software. Descriptive analysis was done by mean and standard deviation for quantitative variables while frequency and proportion for categorical variables. statistical significance tested using Chi-square test and correlation matrix. A p-value of less than 0.05 was considered to be statistically significant.

RESULTS

In the present study a total of 362 students were included in the final analysis. Among the study population 54(14.9%) participants were aged less than 20 years, 284(78.5%)were aged 20-23 years, and 24(6.6%) were aged more than equal to 24 years. There is a slightly higher proportion of female students 199 (55%) compared to male students163 (45%), indicating a balanced gender distribution with a slight female predominance. The majority of the students are Hindu 327(90.3%), followed by a smaller proportion of Muslim students 28(7.7%) and a very small percentage of students from other religions 7 (1.9%). This indicates a predominantly Hindu population among the students. Most students come from nuclear families258 (71.3%), while a smaller proportion comes from joint families 104(28.7%). This reflects a higher prevalence of nuclear family structures among the students. A majority of the students belong to the upper socioeconomic status 244(67.4%), while the remaining 118(32.6%) belong to the upper middle socioeconomic status. This indicates that most students come from relatively affluent backgrounds. (Table1) The vast majority of students 346(95.6%) do not engage in alcohol abuse, with only a small proportion 16(4.4%) reporting alcohol abuse. A significant majority of students 330(91.2%) do not smoke, while32(8.8%)of students were smokers. Most students 284 (78.5%) engage in daily physical exercise, indicating a high level of physical activity among the student population. However,78(21.5%)do not engage in daily physical exercise. A majority of students 214 (59.1%) follow a vegetarian diet, while a significant

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minority 148 (40.9%) follow a non-vegetarian diet. About 110(30.4%) students consume junk food, whereas the majority 252(69.6%) do not consume junk food.

A notable proportion of students 214(59.1%) skip meals, while148(40.9%) do not skip meals. This indicates a relatively high prevalence of meal skipping among the students. A significant majority of students 262(72.4%) sleep less than 8 hours per night, whereas only 100(27.6%) of students get more than 8 hours of sleep. This suggests that most students may be experiencing insufficient sleep (Table 2) .The table 3 presents the mean, standard deviation, minimum, and maximum values for various anthropometric measurements of medical students. Table 4 includes chi-square test results, p-values, and Cramér's V statistics to assess the strength and significance between WHR categories (Normal and Risk) and various lifestyle variables among the study participants.

There is a statistically significant association between junk food consumption and WHR category ($p = 0.021$) suggesting that those who consume junk food are more likely to be in the risk category for WHR. There is a statistically significant association between physical exercise and WHR category ($p < 0.001$). The Cramér's V value (0.378) indicates a moderate association, suggesting that those who do not engage in physical exercise are much more likely to be in the risk category for WHR .There is no statistically significant association between gender and WHR category ($p = 0.536$),between age group and WHR category ($p = 0.510$), between alcohol abuse and WHR category ($p = 0.379$) and no statistically significant association between smoking and WHR category ($p = 0.153$).

Waist Circumference is strongly positively correlated with WHR ($r = 0.636$, $p < 0.001$). This indicates that waist circumference is a significant determinant of WHR. Height is Moderately positively correlated with WHR ($r = 0.297$, $p < 0.001$), suggesting that taller individuals may have a higher WHR. Weight is Moderately positively correlated with WHR ($r = 0.236$, $p < 0.001$), indicating that heavier individuals may have a higher WHR.BMI is Weakly positively correlated with WHR ($r = 0.106$, $p = 0.045$), showing a slight relationship between BMI and WHR.Hip Circumference has a very weak and non-significant correlation with WHR ($r = 0.072$, $p = 0.170$), indicating that hip circumference does not significantly impact WHR.

TABLE1: DEMOGRAPHICCHARACTERISTICS OF STUDY PARTICIPANTS(N=362)

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VARIABLE	CATEGORY	NUMBER	PERCENTAGE
AGE GROUP	LESS THAN 20 YEARS	54	14.9
	20-23YEARS	284	78.5
	MORE THAN EQUAL TO 24 YEARS	24	6.6
GENDER	MALE	163	45
	FEMALE	199	55
RELIGION	HINDU	327	90.3
	MUSLIM	28	7.7
	OTHER	7	1.9
FAMILY TYPE	NUCLEAR	258	71.3
	JOINT	104	28.7
SOCIO ECONOMIC STATUS	UPPER	244	67.4
	UPPER MIDDLE	118	32.6

TABLE 2: DISTRIBUTION OF LIFE STYLE FACTORS IN STUDY PARTICIPANTS (N=362)

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VARIABLE	CATEGORY	NUMBER	PERCENTAGE
ALCOHOL ABUSE	YES	16	4.4
	NO	346	95.6
SMOKING	YES	32	8.8
	NO	330	91.2
PHYSICAL EXERCISE/DAY	YES	284	78.5
	NO	78	21.5
PRIMARY DIET	VEGETARIAN	214	59.1
	NON VEGETERIAN	148	40.9
JUNK FOOD	YES	110	30.4
	NO	252	69.6
SKIP MEALS	YES	214	59.1
	NO	148	40.9
SLEEP	<8HOURS	262	72.4
	>8HOURS	100	27.6
WAIST HIP RATIO			
	NORMAL	346	95.6
	RISK	16	4.4

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TABLE 3:ANTHROPOMETRIC MEASUREMENTS IN STUDY PARTICIPANTS(N=362)

VARIABLE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
WEIGHT(Kgs)	61.4	9.15	41	95
HEIGHT(cms)	165	8.34	150	185
WAIST CIRCUMFERENCE (cms)	81.4	8.98	54.0	118
HIP CIRCUMFERENCE (cms)	96.5	8.19	73	120
WAIST HIP RATIO(WHR)	0.843	0.0669	0.620	1.13
BMI(Kg/m^2)	22.8	2.80	17	33

BMI=Body Mass Index

TABLE 4:ASSOCIATION OF WAIST HIP RATIO WITHLIFE STYLE VARIABLES IN STUDY PARTICIPANTS(N=362):

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VARIABLE	**WHR CATEGORY**					
	NORMAL	RISK	TOTAL	CHI SQUARE	P VALUE	CRAMER V
ALCOHOL ABUSE					0.379	0.0462
YES	16(100.0%)	0(0.0%)	16	0.774		
NO	330(95.4%)	16(4.6%)	346			
SMOKING					0.153	0.0751
YES	29(90.6%)	3(9.4%)	32	2.04		
NO	317(96.1%)	13(3.9%)	330			
JUNK FOOD					*0.021	0.121
YES	101(91.8%)	9(8.2%)	110	5.29		
NO	245(97.2%)	7(2.8%)	252			
GENDER					0.536	0.0325
MALE	157(96.3%)	6(3.7%)	163			
FEMALE	189(95.0%)	10(5.0)	199	0.383		
AGE GROUP						
LESS THAN 20 YEARS	50(92.6%)	4(7.4%)	54	1.35	0.510	0.0610
20 -23 YEARS	273(96.1%)	11(3.9%)	284			
MORE THAN	23(95.8%)	1(4.2%)	24			

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EQUAL TO 24 YEARS						
PHYSICAL EXERCISE						
YES	283(99.6%)	1(0.4%)	284	51.6	*<0.001	0.378
NO	63(80.8%)	15(19.2%)	78			

*P value<0.05 is statistically significant

Cramer V:</=0.2-weak association

0.2to 0.6=moderate association

>0.6=strong association

TABLE5: CORRELATION OF WAIST HIP RATIO WITH ANTHROPOMETRIC MEASUREMENTS(N=362)

MEASUREMENT	**PEARSON CORRELATION VALUE(r)**	**P VALUE**
WAIST CIRCUMFERENCE	0.636	<0.001
HIP CIRCUMFERENCE	0.072	0.170
HEIGHT	0.297	<0.001
WEIGHT	0.236	<0.001
BMI	0.106	0.045

*P value<0.05 is statistically significant

rvalue (0.9to 1.0)=very highly correlated

(0.7 to 0.9)=highly correlated

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(0.5 to 0.7)=moderately correlated

(0.3 to 0.5)=low correlation

DISCUSSION

The present study investigates the significance of WHR among medical students at Rama Medical College, Kanpur, to understand its association and correlation with lifestyle variables and anthropometric measurements. The findings reveal that WHR was significantly correlated with several anthropometric measurements such as waist circumference, height, and weight. A strong positive correlation with waist circumference ($r = 0.636$, $p < 0.001$) underscores the critical role of abdominal fat in determining WHR. This suggests that students with larger waist circumferences are more likely to have higher WHR, indicating greater central obesity. The moderate correlations with height ($r = 0.297$, $p < 0.001$) and weight ($r = 0.236$, $p < 0.001$) further highlight the relevance of overall body size and weight in influencing WHR. According to a study by Devendra Singh WHR was a stable measure with high within-person reliability and was significantly correlated ($r = .61$) with direct measures of the intraabdominal-subcutaneous fat ratio (Ashwell, Cole, & Dixon, 1985) as well as with deep abdominal fat ($r = 0.76$) (Despres, Prudhomme, Pouliot, Tremblay, & Bouchard, 1991), using computed tomography scanning.(6) Abdominal obesity, assessed by WHR or waist circumference, has been found to be a better predictor of total, CHD, and CVD mortality than BMI in some population groups,but the prospective data of the effects of abdominal obesity on the CVD incidence are still scant. (7) ,our study indicates a lack of physical exercise was strongly associated with being in the higher risk category for WHR ($\chi^2 = 51.6$, $p < 0.001$, Cramér's $V = 0.378$). This significant association emphasizes the importance of regular physical activity in maintaining a healthy WHR and, by extension, reducing the risk of obesity-related health conditions. Aerobic exercise have resulted in significant changes in body fat measures like BMI and WHR among young Taiwanese adults who were obese.(8), in the current study the consumption of junk food shows a significant association with higher WHR ($\chi^2 = 5.29$, $p = 0.021$, Cramér's $V = 0.121$), suggesting that dietary habits play a crucial role in influencing central obesity among students. Physical activity is more important for our health than ever. It is a lever for physical fitness, working efficiency, immune system resilience, and maintenance of psychophysical balance.(9)

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According to study done by A. Mohammad beige WHR was significantly different between subjects who used and not used fast food while the difference in BMI was not significant. Therefore, fast food consumption was related to WHR, but was not related to BMI,these results are quite similar to our study.(10) Interestingly, the study finds no significant associations between WHR and other factors such as alcohol abuse, smoking, gender, and agegroup.The matrix of WC and WHR with BMI highlighted about 14.5% of normal and underweight students being at substantially increased risk of metabolic complications given thesex-specific cutoff for WHR. NFHS-5 has reported WHR, as a measure of central obesity, withalmost double the proportion of males (40.9% vs. 22.1) and females (43.7% vs. 20.1) aged 15–
49 years in Gujarat (11).

Unhealthy habits picked up at early stage of college life generally persist in adult life. During college students usually not able to adopt healthy practices due to studies, lack of time and other commitments. Stress of studies, rigorous training, pressure of constant examinations, stay away from home and lack of access, time and will to engage in physical activity makes the medical students becoming overweight and obese.

Regular physical activity leads to increased physical fitness, improved ability to cope with stress, and higher self-esteem (12,13).

CONCLUSION

The Waist-Hip Ratio (WHR) is a vital anthropometric measurement that provides significant insights into the distribution of body fat and the associated health risks among medical students at Rama Medical College, Kanpur. This study highlights that a higher WHR is strongly correlated with larger waist circumferences, indicating central obesity, which is a known risk factor for various metabolic and cardiovascular diseases. Furthermore, the study reveals that lifestyle factors such as lack of physical exercise and consumption of junk food are significantly associated with higher WHR, emphasizing the importance of regular physical activity and healthy dietary habits in maintaining optimal health. These findings underscore the need for targeted health interventions to promote healthier lifestyles among medical students, ensuring their well-being and preparing them to better advocate for health in their future medical practices.

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Recommendations:

Promote Regular Physical Activity

Implement Nutritional Education

Conduct Regular Health Screenings

Stress Management Programs

Promote Adequate Sleep

Limitations:

The study's cross-sectional nature limited the ability to establish causality.

Acknowledgment: We acknowledge and thank all the MBBS students who gave their valuable time for this study.

Declarations:

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: We have taken consent to participate.

Consent for publication: We have consent for the publication of this paper.

Authors' contributions: Dr.LS:Development of concept and study design,literature search,data collection,data analysis and statistical analysis,manuscript preparation.

Dr.AG:Manuscript editing

Dr.RJ:Manuscipt review,Dr.CRC:Data collection,Dr.ND:Data Collection

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