



## السِّمَنَةُ المركزية بُناءً على مؤشِّراتٍ مُحيطُ الحِصْرِ ونسبةُ الحِصْرِ إلى الطول لدى طُلَّابِ جامعةِ طيبة

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## المستخلص:

تستهدفُ الدراسةُ تحديدَ السِّمَنَةِ المركزية المقاسة بمحيطِ الحِصْرِ (WC) ونسبة الحِصْرِ إلى الطول (WHtR) لدى طُلَّابِ جامعةِ طيبة الذكور في المدينة المنورة، المملكة العربية السُّعُودِيَّة. في المجموع، شارك (74) طالِبًا جامعِيًّا في الدراسة (متوسِّطُ العمر  $\pm$  انحراف معياري =  $22.6 \pm 1.2$  سنة). تمَّ قياسُ الطول باستخدام مقياس الطول المتنقِّل (Seca) وتمَّ َّ قياسُ محيطِ الحِصْرِ (WC) باستخدام شريط قياس. تمَّ حسابُ نسبة الحِصْرِ إلى الطول (WHtR) مقسومًا على الطول (سم). وتمَّ استخدامُ الإحصاء الوصفي (قيم المتوسِّط الحسابي، والانحراف المعياري، والنسب المئوية (%)) وأظهرت نتائج الدراسة أنَّ قيمَ المتوسِّط الحسابي والانحراف المعياري لمحيط الحِصْرِ ونسبة الحِصْرِ إلى الطول قد بلغت ( $76.5 \pm 7.9$  سم.  $0.44 \pm 0.04$ ) على التوالي. وكان مُعدَّلُ انتشار السِّمَنَةِ المركزية المقاسة بواسطة محيط الحِصْرِ ونسبة الحِصْرِ إلى الطول ( $5.4\%$ ) و ( $14.9\%$ ) على التوالي. وخلصت الدراسةُ الحاليَّةُ إلى أنَّ انتشارَ السِّمَنَةِ المركزية لدى طُلَّابِ جامعةِ طيبة كان أعلى باستخدام نسبة الحِصْرِ إلى الطول، مقارنةً بمحيط الحِصْرِ. الكلمات المفتاحية: الصِّحَّة، التَّربية البدنية، زيادة الوزن/السِّمَنَةُ.



## Central Obesity Based on Waist Circumference and Waist-to-Height Ratio Indicators among Male Students at Taibah University

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### Abstract:

The aim of the study was to determine the central obesity measured by waist circumference (WC) and waist-to-height ratio (WHtR) among male university students at Taibah University in Madinah, Saudi Arabia. In total, 74 male university students participated in the study (mean  $\pm$ SD age = 22.6  $\pm$  1.2 year). The height was measured by using a portable stadiometer (Seca) and WC was measured using measuring tape. WHtR was calculated as WC (cm) divided by height (cm). Descriptive statistics were used as mean values, standard deviation (SD), and proportions (%). The results of the study showed that the mean values and  $\pm$ SD of WC and WHtR were 76.5  $\pm$  7.9 cm; 0.44  $\pm$  0.04, respectively. The prevalence of central obesity measured by WC and WHtR was 5.4% and 14.9%, respectively. It is concluded that the prevalence of central obesity among male students Taibah University was higher using WHtR, compared to WC.

**Keywords:** Health, Physical Education, Overweight/Obesity.



## Introduction

It is well known that obesity is a growing epidemic health problem worldwide. Obesity is recognized as a significant risk factor of non-communicable diseases such as type 2 diabetes, cardiovascular disease, nonalcoholic fatty liver disease, and elevated cancer death risk (Bendor, Bardugo, Pinhas-Hamiel, Afek, & Twig, 2020; Piché, Tchernof, & Després, 2020; Powell-Wiley et al., 2021). According to the World Health Organization (WHO), adult obesity rates in the world were 13% (male: 11%; female: 15%). In Saudi Arabia, a recent study showed that the current prevalence of obesity was 24.7% based on the body mass index (BMI) category status (Althumiri et al., 2021).

This specifies the BMI of  $\geq 30$  as obese, recommending the need to have an action to focus more on obesity in Saudi Arabia. Although BMI has been a useful proxy for obesity for many years, it does not distinguish between those who are muscular and those who are overweight (Nuttall, 2015). However, there is a far more significant issue with BMI. It is just a substitute for total body fat and does not discriminate between people with various patterns of fat distribution, even among the overweight (Ashwell & Gibson, 2014).

Anthropometry is an alternative measurement and has been widely used in large-scale epidemiology studies and clinical settings. This is of course due to its low cost, favorable safety profile, and ease of use (Fang, Berg, Cheng, & Shen, 2018; Kuriyan, 2018; Mony, Swaminathan, Gajendran, & Vaz, 2016). Anthropometric measures of abdominal obesity include waist circumference (WC) and waist-to-height ratio (WHtR) which have also been used as proxies for central obesity (Ashwell & Gibson, 2016; Roriz et al., 2014; Sahakyan et al., 2015). WC is a simple, inexpensive method to measure abdominal obesity (Cornier et al., 2011). The most common site for WC measured is at the narrowest part of the trunk, and it can be measured at the midpoint, umbilicus, or iliac crest level (Cornier et al., 2011).

WC was found to be the best predictor for metabolic syndrome in the Saudi population (Al-Rubean et al., 2017). In the Saudi population, 92 cm for males and 87 cm for women represented the ideal WC cutoff value for detecting two or more risk factors of metabolic syndrome (Al-Rubean et al., 2017). In addition to WC, the adoption of WHtR might make the worldwide public health message simpler since it serves as a quick and accurate global indication of the health hazards of obesity (Shen et al., 2017).

Research has demonstrated that WHtR cutoff value of  $\geq 0.5$  has been regarded as a risk assessment tool and has become widely used. Consequently, this translates into the simple screening message 'Keep your waist to less than half your height' (Ashwell & Gibson, 2014).

## Research problem

Abdominal obesity assessments including WC and WHtR have been recommended and used worldwide (Ashwell & Gibson, 2016; Roriz et al., 2014; Sahakyan et al., 2015). However, the information published by investigators in Saudi Arabia using WC and WHtR has been relatively limited. To the best of the author's knowledge, there is only one cross-sectional study conducted on the Saudi population. This study showed that WHtR was superior to BMI and WC for determining the elevated risk of diabetes, hypertension, dyslipidemia, and coronary artery disease (Alshamiri et al., 2020). Therefore, it is important to conduct a research on a sample of Saudi population aiming to use abdominal obesity assessments including WC and WHtR. Accordingly, it was important to conduct a study targeting central obesity among Saudi male students recruited from



the Sport Sciences and Physical Activities program at the Department of Physical Education and Sport Sciences, College of Education at Taibah University.

### **The aim of the study**

The aim of the current study was to determine the central obesity measured as WC and WHtR among male students at Taibah University in Madinah, Saudi Arabia.

### **The importance of the study**

The importance of the study includes the following:

- 1- Using abdominal obesity assessments including WC and WHtR could reveal new information regarding obesity status among university students.
- 2- The results of the current study could promote healthy lifestyles for the those in the current study who were recognized as overweight and obese based on WC and WHtR criteria, including physical activity and a healthy diet.

### **The scope and delimitation of the study**

The study was delimited to male university students who have been enrolled in the Department of Physical Education and Sport Sciences at Taibah University (First semester, 2020 - 2021) and living in Madinah, Saudi Arabia.

### **The terminology of the study**

1. Central obesity is a medical problem with high abdominal fat distribution and has been associated with higher risk of mortality
2. Waist circumference serves as a readily available means to estimate central obesity. It is also the measurement taken around the abdomen at the narrowest part of the trunk.
3. The waist-to-height ratio is defined as the waist circumference divided by height. It has recently gained attention as an anthropometric index for central obesity.

### **Methods**

In total, 74 university students ( $BMI = 22.5 \pm 3.8 \text{ kg/m}^2$ ;  $\text{age} = 22.6 \pm 1.2 \text{ years}$ ) participated in this study. Body weight was measured by using a Seca digital scale to the nearest 0.1 kg. Height was measured by using a portable stadiometer (Seca) to the nearest 0.5 cm with the head in horizontal Frankfurt plane. BMI was defined as weight in kilograms divided by height in meters squared.

During the first semester of the 2020 - 2021 academic year, Saudi male students were randomly selected from Taibah University in Madinah. All male participants were enrolled in the Sport Sciences and Physical Activities program at the Department of Physical Education and Sport Sciences, College of Education at Taibah University. All procedures and protocols in the study were made to conform to the ethical guidelines, and an informed consent form was signed by all participants.

### **WC and WHtR:**

WC was measured to the nearest centimeter at the narrowest part of the trunk with both arms hanging freely at the end of gentle expiration. WC was measured using a standard tape measure to the nearest 0.1 cm. WHtR was calculated as WC (cm) divided by height (cm).



### Classification of WC, WHtR:

Boundary values for WC were based on the following values: low risk <94 cm and high risk: 94–102 cm.

WHtR classifications were based on the following boundary values: ‘no increased risk’ (WHtR= <0.5), ‘increased risk’ (WHtR= ≥0.5 )

A single well trained anthropometrist with great experience of anthropometry (International Society for the Advancement of Kinanthropometry (ISAK) accreditation) took all measurements for all students in the same room. All students were asked to wear minimal underwear, and all anthropometric measurements were measured in private.

### Statistics

The data were analyzed using the statistical software package SPSS, version 21. Descriptive statistics are presented as mean values, standard deviation (SD), and proportions.

### Results

In the current study, 74 university students were included in the data. Descriptive information and mean (SD) of different anthropometric measurements of the university students are given in Table 1. The 74 male students were recruited from Taibah University in Madinah, Saudi Arabia. All participants had complete data and participants who had missing and incomplete data were eliminated from the analyses (16 participants). Lack of interest in the study was the main barrier to participation.

**Table 1**

*Mean (±SD) of different anthropometric measurements*

Variables	Mean ± SD
Age (years)	22.6 ± 1.2
Height (cm)	172.7 ± 5.4
Weight (kg)	76.5 ± 7.7
BMI (kg/m <sup>2</sup> )	22.5 ± 3.8
WC (cm)	76.5 ± 7.9
WHtR	0.44 ± 0.04

BMI= body mass index; WC: Waist circumference; WHtR: waist-to-height ratio

**Table 2**

*Prevalence of central obesity measured by WC and WHtR.*

WC (cm)		WHtR	
Low risk <94 cm	High risk ≥ 94	WHtR <0.5	WHtR ≥0.5
94.6%	5.4%	85.1%	14.9%

WC: Waist circumference; WHtR: waist-to-height ratio

Table 2 showed the prevalence of central obesity measured by WC and WHtR. High WC was observed among 5.4% of male university participants. However, male university participants had a greater prevalence of central obesity using WHtR (14.9%) compared to WC.



## Discussions

In this study, we used anthropometric methods for estimation of the central obesity among Saudi male university students. To our knowledge, this is the first study to report the prevalence of central obesity measured by WC and WHtR among a sample of university students in Madinah, Saudi Arabia.

This study presents new information regarding the determinants of overweight/obesity among a sample of Saudi male university students. We found a considerably low prevalence of overweight/obesity among participants based on WC (5.4%) and WHtR (14.9%).

In the current study, the mean values of WC ( $76.5 \pm 7.9$  cm) and WHtR ( $0.44 \pm 0.04$ ) were lower compared to a similar study conducted in male Bangladeshi university students (aged  $21.99 \pm 1.63$  years), showing that mean WC was  $81.25 \pm 4.85$  cm and WHtR was  $0.48 \pm 0.03$  (Zamsad, Banik, & Ghosh, 2019). This might be due to the fact that our participants were more physically fit as they were recruited from Sport Science Program, which, of course, is regarded as one of the limitations of the current study. More importantly, for the those in the current study who were recognized as overweight and obese based on WC and WHtR criteria, promoting healthy lifestyles for them is a public health priority as the WHO recommends at least sixty minutes of moderate-to-vigorous physical activity every day, and a healthy dietary intake including five servings of fruit and vegetables per day.

Due to its low cost, good safety record, and simplicity of use, anthropometry, an alternative measurement method, has been frequently employed in clinical settings and large-scale epidemiological research (Fang et al., 2018; Kuriyan, 2018; Mony et al., 2016). WC and WHtR, which have also been employed as substitutes for central obesity, are anthropometric measurements of abdominal obesity (Ashwell & Gibson, 2016; Roriz et al., 2014; Sahakyan et al., 2015). Our study showed that the prevalence of central obesity using WC and WHtR was 5.4% and 14.9%, respectively. Our findings are consistent with a recent study which showed that the proportion of abdominal obesity by WC and WHtR among South African adolescents (aged 13-20 years) was 2% and 19%, respectively (Debeila, Modjadji, & Madiba, 2021).

In fact, few studies have reported abdominal obesity measured by WC and WHtR amongst adolescents in Saudi Arabia. Our study included students from 18 to 22 years of age while the earlier studies presented the prevalence data for 13-20 age grouped. For example, the prevalence of central obesity among Saudi male adolescents males was 35.9% (aged 14 to 19 years) when using cutoffs based on WHtR of 50% (Al-Hazzaa et al., 2014). Another study conducted in Saudi participants showed that higher WC values for males ( $>90$  cm) were observed in the 30–39 age group, compared to a younger group (Azzeh et al., 2017).

It is important to note that that the prevalence of central obesity among Saudi male university students was higher using WHtR, compared to WC. This is not an unexpected finding, because WHtR, as novel measure, has recently gained prominence and is frequently used for assessing the risk of cardiometabolic illnesses (Yang, Xin, Feng, & Yang, 2017). A systematic review and meta-analysis of studies demonstrate that WHtR is more effective in identifying cardiometabolic risk factors in both sexes than WC and BMI (Ashwell, Gunn, & Gibson, 2012). A more recent study found that WHtR was a more accurate indicator of frequent cardiac events than BMI, Waist-Hip-Ratio, and WC

(Pasdar et al., 2020). Therefore, it has been recommended that WHtR should be taken into account as a screening technique.

The current study has some limitations. Firstly, the study participants were relatively fit students, and thus, WHtR among other groups with different fitness levels in Saudi Arabia remains unknown. Secondly, the sample size of the current study was relatively small. Therefore, large studies are needed to be conducted especially in females, since the current study failed to reveal data in age differences between male and female university students.

### Conclusion

It was concluded that although the prevalence of central obesity among Saudi male students at Taibah University was relatively low, the prevalence of central obesity using WHtR, compared to WC, was higher.



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