

## Prevalence of obesity and the correlation between different indices of obesity among healthy Sri Lankans

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### Abstract

*With the rising prevalence of Non Communicable Diseases (NCD) in the developing world, obesity becomes an important component in risk stratification. Different indicators of obesity include body mass index (BMI), waist circumference (WC), waist hip ratio (WHR) and triceps skin fold thickness (TSFT). A study was undertaken to determine the prevalence of global and central obesity among healthy Sri Lankan cohort and to assess the correlation of body mass index with other indices of obesity. Anthropometric measurements including body mass index, waist circumference, waist hip ratio and triceps skin-fold thickness were obtained from 48 healthy volunteers. Prevalence of global obesity was defined as BMI more than 23 kg/m<sup>2</sup> and central obesity as WC more than 90 cm for male and more than 80 for female, WHR more than 0.9 for male and more than 0.8 for female. Correlation of BMI with other parameters of obesity was calculated using Pearson correlation. The prevalence of global obesity was significantly high in females (60%) when compared to males (28%). Central obesity according to WC was 16% in males and 43.4% in females. The prevalence of central obesity according to WHR was 12% in males and 73% in females. There was a strong association between BMI with WC ( $r = 0.71, p = 0.001$ ) and TSFT ( $r = 0.76, p = 0.001$ ) but the association with WHR was poor ( $r = 0.33, p = 0.21$ ). Out of the three anthropometric measurements assessed, WC and TSFT were found to be good indicators of global obesity. Although, WHR had higher sensitivity of detecting central obesity in females, it was not a reliable indicator of global obesity.*

**Key words:** Global obesity, Central obesity, body mass index, waist circumference, waist hip ratio and triceps skin-fold thickness

### Introduction

Obesity is associated with increased morbidity and mortality. The common major illnesses that have shown strong associations with obesity include hypertension, diabetes mellitus, abnormalities of serum lipid metabolism (dyslipidaemia), osteoarthritis of the weight bearing joints, and certain malignancies such as colonic cancer. Epidemiological data from different parts of the world show that rise in the incidence of the major non communicable disease (NCD) such as diabetes, hypertension and dyslipidaemia often precede an epidemic of obesity in the population concerned. Estimation of the prevalence of obesity in the population is based primarily on the index and the cut off point of obesity used in the assessment. The most commonly used index in the assessment of obesity is the body mass index (BMI): defined as the weight in kilograms of an individual divided by square of the individual's height in meters (World Health Organization. 1997). The World Health Organization (WHO) and the International Obesity Task Force recommend the BMI cutoff point of 30 kg/m<sup>2</sup> for obesity (Deurenberg, *et al.*, 1998). This cutoff point was derived largely from mortality statistics from European and American populations. Several studies carried out mainly among Asian populations have challenged the notion that one BMI cutoff point fits all populations. They have separately established that the BMI cutoff point for obesity for Asian populations is pegged between 23 and 27 kg/m<sup>2</sup> (Stevens & Nowicki. 2003). Furthermore, studies have shown that Asian populations have high risks of type 2 diabetes, cardiovascular disease, and mortality from other causes at relatively lower BMI, which they postulated to be largely attributable to the higher proportion of body fat in Asian populations (Norgan, 1994). Therefore, it has been suggested that lower BMI cutoff points for obesity are appropriate for Asian populations and the new cutoff point considered for overweight is 23 kg/m<sup>2</sup> and for obesity, 27.5 kg/m<sup>2</sup> is considered to be significant (WHO Expert Consultation, 2004).

Although overweight ness or global obesity is associated with a number of illnesses both in the western and people in our region, a special type of obesity recognized as central obesity has gained much attention in the recent past due to its stronger association with major non communicable diseases including diabetes, high blood pressure and dyslipidaemia (Sjostrom *et al.*, 1999). Central obesity is due to the deposition of fat around the waist region of the body and

is called visceral obesity due to its predilection of fat deposition inside the abdominal organ called omentum. Some studies have shown that the recent rise of non-communicable diseases in the Asian population is primarily due to the rise in the incidence of central obesity among the people living in this region.

There are several ways of measurement of central obesity. Waist circumference measured in centimeters around the mid point between xipisternum and the iliac crests in the standing position is the most widely used index of central obesity. Some studies have used the waist hip ratio as a reliable index of central obesity. The waist-hip ratio (W/H) was defined as the waist circumference divided by the hip circumference. The hip circumference is measured around the widest part of the buttocks with soft clothes.

In defining the cut off points for central obesity too, the accepted figures for western population have been found to be too high for the Asian region. Therefore the waist circumference over 80 cm in a female and 90 cm in a male is considered abnormal (centrally obese), as opposed to 88 cm and 102 cm in the western population respectively. The other anthropometric measurement used for estimation of fat content of the body is the skin fold thickness measured with a special caliper in millimeters in the region of the upper arm. This measurement is called triceps Skin fold thickness and is often used in the assessment of the nutritional status of the children (Deurenberg *et al.*, 1991). The value of each of these measurements in the assessment of obesity depends on factors such as their practical utility in the field surveys and reproducibility. Some times, taking multiple measurements in a single individual may be time consuming and require privacy, sensitive equipments etc. Therefore, selection of a valid and practical index to estimate obesity is important especially in the in field surveys on obesity.

Present study was undertaken to determine the prevalence of global and central obesity among healthy Sri Lankan cohort and to assess the correlation between the Body mass index (BMI), waist circumference (WC), waist hip ratio (WHR) and the Triceps Skin fold Thickness (TSFT).

### Materials and Methods

Fifty apparently healthy individuals were invited to take part in the study. Forty eight of them fulfilled selection criteria and two were found to have diabetes with elevated blood glucose. A complete medical history and physical examination including standard measurement of blood pressure was carried out to exclude any major medical illness. The body weight was measured without shoes using a standard measuring scale, and height to the nearest centimeter was taken. All volunteers underwent biochemical screening to exclude diabetes mellitus and with a fasting blood glucose and a lipid profile to exclude any major lipid abnormality. Anthropometric measurements including body mass index, waist circumference, waist hip ratio and triceps skin-fold thickness were obtained from 48 health volunteers. Prevalence of global obesity was defined as BMI more than 23 kg/m<sup>2</sup> and central obesity as WC more than 90 cm for male and more than 80 for female, WHR more than 0.9 for male and more than 0.8 for female.

Statistical analyses were performed using SPSS for Windows version 11. We looked at basic descriptive statistics and also Pearson correlation analyses where appropriate.

### Results

Overall, there was no significant difference in age between men (32.2 years) and women (32.5). The mean BMI of the men was 21.54 ± 2.1 and in women it was 23.94 ± 3.07. The mean waist circumference was 75.5 ± 4.8 cm in men and 76.4 ± 5.7 cm in women. According to BMI, the prevalence of global obesity was 43.7% (21/48) in our study cohort and it was significantly high in females (60%) when compared to males (28%). In contrast to this, the overall prevalence of central obesity according to WC was 29% (14/48). However, the prevalence of central obesity according to WC was significantly high in women (43.4%) compared to men (16%). The prevalence of central obesity according to WHR was 12% (3/25) in males and 73% (16/23) in females.

Table 1: Prevalence of obesity according to BMI and other anthropometric measurements.

Anthropometric measurements	BMI	WC	WHR
Prevalence of obesity (%)	43.7%	29%	12%

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According to our study, there was a strong association between BMI with WC ( $r = 0.71$ ,  $p = 0.001$ ) and TSFT ( $r = 0.76$ ,  $p = 0.001$ ). However, the association between BMI and WHR was poor ( $r = 0.33$ ,  $p = 0.21$ ).

### Discussion

Obesity is a subset of being overweight. Not everyone who is overweight is obese. This is clearly shown in body builders, who have high BMI but low central obesity. Therefore, it is worth remembering that BMI is a measure of body weight and not of obesity.

In our study, the overall sensitivity of BMI in detecting the central obesity was 85 % (12/14). However, the specificity of BMI was comparatively low (71%) as an indicator of central obesity. This was clearly seen in females in whom the specificity of BMI in detecting central obesity was as low as 61%. This indicates that BMI has a much improved sensitivity but are still plagued by high false-positive rates, especially for women. Low specificity of BMI could be due to the new low BMI cutoff points adopted for Asian people. Therefore, locally established BMI cutoff points are better indices for screening of obesity. This will assist in efforts to combat the scourge of the increasing incidence of obesity, more precise indices for obesity need to be established.

### Conclusion

In general, BMI has a good sensitivity, but comparative low specificity, in detecting central obesity. As oppose to this, out of the three anthropometric measurements of central obesity, WC and TSFT were found to be good indicators of global obesity. Although, WHR had higher sensitivity of detecting central obesity in females, it was not a good indicator of global obesity.

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