CONTINUING MEDICAL EDUCATION

What is Obesity?

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Introduction

Obesity is a complex multifactorial chronic disease that develops from an interaction of genotype and the environment. Our understanding of how and why obesity develops is incomplete, but involves the integration of social, behavioral, cultural, physiological, metabolic and genetic factors.

In recent years there has been a dramatic increase in the prevalence of obesity in Asia as well as in other regions of the world. Coincident with the high rates of obesity, the prevalence of other chronic diseases like type 2 diabetes mellitus, hypertension, and coronary heart disease is also escalating, and this increase is expected to continue.

Measurement of total body fat

A number of weight-for-height indices have been developed for measurement of body fat content of which the body mass index (BMI) (defined as weight/height^2 [kg/m^2]) is the most widely used. BMI generally correlates highly with adiposity, although it can sometimes misclassify total body fat content. For example, athletes who are muscular have a high BMI, due to muscle weighing more than fat, and will have BMI within the overweight range, even though they are not obese. The shortest and tallest subjects also tend to be misclassified as obese [1]. It is possible to measure adipose tissue mass by various means, but most of these require sophisticated apparatus and techniques beyond the scope of most clinical practices. Although bio-electrical impedance (BIA) is easily applied, this technique requires further evaluation for its reproducibility in clinical and epidemiological population-based studies. Therefore BMI, which is easy to calculate, has been recommended as the measure of obesity for adults to be used in all studies.

Most studies that examine the risk of adverse health associated with obesity in Asian countries have been based on data from Europe or the United States. However, the increased health risks associated with obesity occur in people with lower BMI in the Asia-Pacific region when the standard criteria are used[2]. Body fat in certain Asian ethnic groups was under-predicted by BMI when an equation derived from a Caucasian population was used. BMI / % body fat (% BF) ratios were also different among the Asian ethnic sub-groups[3]. It has been recognized that the current WHO criteria to classify overweight and obesity in adult Europids using the BMI or waist circumference, may not be appropriate in Asian or Pacific Island populations. There are many indications that in Asians the risk of diabetes and other chronic diseases starts to increase rapidly when BMI or waist circumference are well within the accepted range for Europeans; therefore cutoff points recommended for white European populations will not help to identify Asian individuals at high risk [4].

The World Health Organization consultation on obesity proposed a system of classification based on BMI (Table I), similar to classifications used in a number of past studies on Europids[5]. In these studies the ranges for BMI (underweight, normal, overweight, obese) have been based on mortality outcomes where the confounding influences of cigarette smoking and co-existing chronic disease have been minimized. An individual with a BMI of 30 or more is considered obese. This applies to both men and women. For comparison, this would relate to a direct measure of approximately 25% body fat in men and 30% body fat in women.

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New proposal

The steering committee of the Asia-Pacific perspective for redefining obesity, co-sponsored by the World Health Organization Regional Office for the Western Pacific (WPRO), the International Association for the Study of Obesity and the International Obesity Task Force has recommended different ranges for the Asia-Pacific region based on risk factors and morbidities (Table II). In Asians, the cut-offs for overweight (23.0 kg/m^2) and obesity (25.0 kg/m^2) are lower than the WHO criteria [6].

These are provisional recommendations which need to be revised in the light of further validation of studies and clinical experience. Some support for these cut-offs has come from data on Chinese living in Hong Kong [7] where the morbidity risk increases with a BMI > 23 kg/m^2. Similar data have been published from the Chinese in Singapore[8]. Hong Kong Chinese populations have a higher % BF for a given BMI which would partly explain why the health risks associated with obesity occur at a lower BMI[9]. These results support the recommendations of using lower BMI cut-offs to define obesity in the Asia Region.

In a study of North Indian population too, it was found that the conventional cut-off level of the BMI underestimates overweight and obesity when % BF is used as the standard to define overweight [10].

Distribution of body fat

In a study of the subjects with a BMI below 30 (not obese according to conventional BMI), about one-third of the men and almost one-half of the women were obese according to their measured levels of body fat. Some individuals who were found to be obese judging by % BF had a BMI as low as 20. The conclusion is that BMI assessment produces significant numbers of false negatives - seemingly non-obese individuals by BMI who nevertheless qualify as obese by % BF [11].

It is not just the amount of fat but also its distribution that determines the risk associated with obesity. Abdominal or visceral fat is associated with the cardiovascular risk factors of the metabolic syndrome. The presence of excess fat in the abdomen out of proportion to total body fat is an independent predictor of risk factors and morbidity. In a study of Dutch men and women the following waist measurements of > 102 cm in men or > 88 cm in women were found to be associated with a substantially increased risk of metabolic complications [12]. Although the recent WHO report [5] suggests that 94 cm in men and 80 cm in women should be the appropriate measures in Europids, these cut-offs are also not suitable for Asian populations as it has been observed that South Asians have high levels of abdominal obesity, although they may not be considered obese by conventional BMI criteria [13].

New proposal

However, the steering committee of the Asia-Pacific perspective for redefining obesity has suggested different levels for defining abdominal obesity in Asians and proposed interpretation of waist circumference in the light of BMI also. (Table III)

When using circumference measurements it is important that standard anatomical locations are used. The WHO [14] recommended methods are as follows. For waist or abdominal circumference, the subject stands with feet 25-30 cm apart, weight evenly distributed. Measurement is taken midway between the inferior margin of the last rib and the crest of the ilium in a horizontal plane. The measurer sits by the side of the subject and fits the tape snugly but not compressing soft tissues. Circumference is measured to nearest 0.1 cm. For hip circumference the measure is taken around the pelvis at the point of maximal protrusion of the buttocks.

What is Obesity?

Thus far we have been following the European conventional measurements of anthropometry to classify obese individuals. In our clinical experience too, we have observed that BMI severely underestimates the prevalence of obesity as defined by waist circumference and waist-hip ratio. So we were not certain about the prevalence of obesity in our population as well as in an individual patient. We compiled anthropometric data including BMI waist-hip ratio and waist circumference of 776 patients in our diabetes clinic. While only 28% patients were overweight (pre-obese) and 5.2% were obese by BMI, 69% were obese by waist circumference criteria when the conventional European values were used (Table IV). This had an abundance of subjects with increased waist circumference but 'normal' BMI and we were not clear in our mind whether to classify them as obese or not.

However, when we applied the proposed criteria, we found that about one-third of those patients who had abnormal waist circumference but normal BMI were 'appropriately' classified as either pre-obese/at-risk or obese. Though this illustrates that the proposed classification is suitable for our population, this has to be validated by studies in normal population with measurements of anthropometry including % body fat measures.

We believe that exclusive Asian anthropometric data and a classification based on that and validated by sophisticated anthropometric measurements will be very useful in identifying the subjects at risk for type 2 diabetes mellitus and cardiovascular diseases. This is especially relevant in view of the worsening 'epidemic' of non-communicable diseases in Asian countries which is resulting in significant morbidity, and mortality apart from a great financial burden on these nations.

Table I: Classification of weight by BMI in adult Europids

Classification	BMI	Risk of co-morbidities
Underweight	<18.5	Low
Normal Range	18.5-24.9	Average
Overweight >25.0		
Pre-obese/At Risk	25.0-29.9	Increased
Obese I	30.0-34.9	Moderate
Obese II	35.0-39.9	Severe
Obese III	>40.0	Very severe

Table II: Proposed classification of weight by BMI in adult Asians

Classification	BMI	Risk of co-morbidities
Underweight	<18.5	Low
Normal Range	18.5-22.9	Average
Overweight ≥23.0		
Pre-obese/At Risk	23.0-24.9	Increased
Obese I	25.0-29.9	Moderate
Obese II	≥30.0	Severe

Table III: Co-morbidities risk associated with different levels of BMI and suggested waist circumference in adult Asians

Classification	BMI	Risk of co-morbidities	
		Waist circumference	
		<90 cm (men)	≥90 cm (men)
		<80 cm (women)	≥80 cm (women)
Underweight	<18.5	Low	Average
Normal range	18.5-22.9	Average	Increased
Overweight	≥23.0		
At risk	23.0-24.9	Increased	Moderate
Obese I	25.0-29.9	Moderate	Severe
Obese II	≥30.0	Severe	Very severe

Table IV: Classification of our diabetic population by conventional and proposed anthropometric criteria

Classification	n = 776 (type 2 diabetes mellitus patients)			
	Conventional European criteria		*Proposed Asian criteria*	
Pre-obese / At-risk by BMI	218	28%	161	20.7%
Obese by BMI	41	5.2%	259	33.3%
Abnormal waist circumference	535	69%	598	77%

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What is Obesity?
CME Multiple Choice Questions:

1. In routine clinical practice, the most appropriate tool for estimating total body fat is
a) Weight
b) Height
c) Waist circumference
d) Waist/ Hip ratio
e) BMI

2. The following statements regarding Waist / Hip ratio and Waist circumference are **(True or False)**
a) Waist circumference is measured at umbilicus
b) Gives an appropriate index of visceral fat
c) BMI correlates well with Waist / Hip ratio
d) Proposed normal waist circumference for females is < 80 cm
e) Proposed normal waist circumference for males is < 90 cm

3. Old proposals had to be changed because **(True or False)**
a) In Asian patients with cardiovascular disease the BMI was normal
b) BMI did not correlate with obesity as defined by Waist / Hip ratio
c) Asians are small built as compared to western people
d) BMI correlated well with visceral fat
e) BMI showed false positives in estimating body fat

4. Regarding BMI as an index of obesity the following statements are **(True or False)**
a) It mis-classifies very tall and short persons
b) The parameters are different across ethnic races
c) It is calculated by Height / Weight^2
d) It gives a good index of visceral fat
e) It is the best index of obesity to estimate cardiovascular risk

5. The best among the investigations that correlate with visceral fat content is:
a) BMI
b) Waist / Hip ratio
c) Waist circumference
d) CT scan for visceral fat
e) Bioelectrical impedance