

## DEFINITION, DIAGNOSIS, CLASSIFICATION & EVALUATION

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### ABSTRACT

Obesity is a condition of fat accumulation with adverse health outcomes. BMI and waist circumference are good measures of obesity. Asians should take measures to address weight problems at lower BMIs than Caucasians. Evaluation should be thorough, as many factors contribute to obesity, and obesity is associated with many conditions.

### DEFINITION OF OBESITY

The WHO defines obesity as “a condition of excessive fat accumulation in the body to the extent that health and well-being are adversely affected”. This definition includes a measurable trait leading to an adverse outcome.

### DIAGNOSIS

The best measure of obesity would be an assessment of the amount of body fat (Table 1). Unfortunately, the means to estimate body fat have limited reproducibility (e.g. skinfold thickness or bioelectrical impedance), are cumbersome, slow and expensive (e.g. CT, MRI, 3- or 4-compartment estimation), and are usually reserved for research settings.

Instead, anthropometric measurements, which are quick, reproducible and inexpensive, have been used as surrogate measures of obesity. *Body mass index* or *BMI* ( $\text{kg}/\text{m}^2$ ) is calculated as:  $\text{Weight in kg} / [\text{Height in m}]^2$ . BMI correlates reasonably well with the amount of body fat and is the clinical technique of choice for *defining obesity*. However, it is not applicable for children, the elderly, pregnant or lactating women, and muscular individuals. *Waist circumference* correlates to intraabdominal fat mass and is the clinical technique of choice for determining *central obesity*. It is measured at the mid-point between the lower margin of the ribs and the iliac crest in an upright individual with the abdomen relaxed, with arms at the sides and feet 12-15 cm apart. The tape should be horizontal and not compressing the skin and the measurement should be repeated until within 0.5 cm. *Body weight* was previously used to define obesity based on percent above ideal weight according to standard height-weight tables. It is useful in tracking response to interventions.

The relevance of the measures of obesity lie in the propensity to develop obesity-related adverse health outcomes, such as diabetes mellitus, hypertension, cardiovascular disease, musculoskeletal and respiratory problems.

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Table 1. Measures of Obesity

i)	<b>Anthropometric</b>
	1. Body weight
	2. Body mass index (BMI)
	3. Waist circumference
	4. Waist to hip ratio
ii)	<b>Body fat estimation</b>
	1. Skinfold thickness
	2. Bioelectrical impedance
	3. Imaging: DXA, CT, MRI
	4. Dilution techniques (deuterium oxide)
	5. Underwater weighing (densitometry)
	6. 3- or 4-compartment estimation (water, protein, mineral, fat)
iii)	<b>Disease end-points</b>
	1. Propensity to disease or risk factors e.g. coronary heart disease, diabetes mellitus and hypertension.

### CLASSIFICATIONS IN OBESITY

The WHO classified weight categories in adults using BMI in relation to body fat, and risk of adverse effects on health (Table 2A).

However the studies supporting these cut offs had been conducted among Caucasian populations. It has since been shown fairly consistently that Asians have a higher percentage of body fat, and a higher prevalence of cardiovascular risk factors, for a given BMI compared to Caucasians. The WHO convened an expert consultation in July 2002, analyzed data from various Asian countries (China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan), and proposed a set of cut-off or trigger points for public health action in Asians (Table 2B), based on the risk of comorbidities.

The panel recommendations were to retain the current WHO BMI cut-off points (Table 2A) as the international classification, but to add the trigger points for public health action in Asian populations (Table 2B) based on disease risk, that were most useful for the situation in each country. This is because increased risk is a continuum with increasing BMI, and cut-off points are merely a convenience for public health and clinical use.

In addition, where possible, in populations with a predisposition to central obesity and related increased risk of developing the metabolic syndrome, it was recommended that waist circumference be used to refine action levels on the basis of BMI.

**Table 2. The WHO classification of adults according to BMI, and the proposed BMI cut-off points for public health action in Asians**

A	
WHO classification	WHO BMI cut-off points (kg/m <sup>2</sup> )
Underweight	< 18.5
Normal range	18.5 to 24.9
Overweight	> 25.0
Pre-Obese	25.0 to 29.9
Obese class I	30.0 to 34.9
Obese class II	35.0 to 39.9
Obese class III	> 40.0

  

B	
Risk of co-morbidities	Proposed Asian BMI cut-off points for action (kg/m <sup>2</sup> )
Low*	<18.5
Average	18.5 to 22.9
Increased	23.0 to 27.4
Moderate	27.5 to 32.4
Severe	32.5 to 37.4
Very severe	> 37.5

\* but increased risk of other clinical problems

The recommended cut offs for waist circumference by the WHO are shown in Table 3. Again, recent studies in Asia have shown that these cut offs are unlikely to be appropriate for Asian populations, and different thresholds, which have been shown to correlate better with co-morbidities such as the metabolic syndrome, have been recommended.

**Table 3. The WHO and recommended Asian waist circumferences representing high-risk, gender-specific thresholds.**

Guideline	Waist circumference (cm)	
	Men	Women
WHO	> 102	> 88
Asia-Pacific Consensus	> 90	> 80

## EVALUATION

### Clinical Evaluation

The etiology of obesity is complex, with both genetic (estimated at ~70%) and environmental (~30%) influences. Of the environmental influences, a sedentary lifestyle and high intake of energy-dense micronutrient-poor foods contribute the most. Secondary causes account for < 5% of obesity in most series. Not everyone who is overweight or obese is aware of it or seeks help for it. Often, individuals who are not overweight seek help to lose weight for reasons other than health. In the context of chronic diseases such as diabetes mellitus and

hypertension, an assessment of weight category in all patients, using an easily measured parameter such as BMI, serves as an important trigger for appropriate action. Individuals needing or wanting to address weight issues should be assessed for the degree of obesity (Tables 2-3), predisposing factors, possible underlying secondary causes and potential clinical sequelae.

There are many aspects of clinical evaluation which are important in managing overweight patients successfully (Table 4). However, time is needed to discuss these issues and recommend improvements, and separate appointments may need to be planned.

**Table 4. Clinical Evaluation**

<b>a. History</b>	
o	Detailed history of obesity (e.g. changes in weight at different ages and with pregnancy) and previous weight loss attempts
o	Current motivation for and barriers to weight loss
o	Current and past medical history, including psychiatric history, evaluating for secondary causes (e.g. endocrine and genetic disorders), and co-morbid conditions (e.g. cardiovascular disease, hypertension, diabetes mellitus, hyperlipidemia, polycystic ovarian disease, osteoarthritis, cancers, sleep apnea)
o	Current and past medical therapy (e.g. steroids, antidiabetic, antipsychotic and antidepressant drugs, as well as over-the-counter and traditional medications)
o	Lifestyle factors, including details on dietary habits (e.g. the patterns, sources, amount and content of meals), exercise, smoking and alcohol intake
o	Family history of medical disease and obesity
o	Social history, including family, co-worker and financial support
<b>b. Physical examination</b>	
<b>i. Anthropometry</b>	
o	Weight and height, to calculate BMI (= weight + height <sup>2</sup> , measured in kg/m <sup>2</sup> )
o	Waist circumference
<b>ii. Physical signs</b>	
o	of secondary causes such as goitre, Cushing's syndrome, hypogonadism, dysmorphism, acanthosis nigricans
o	of co-morbid conditions such as cardiovascular disease, hypertension, diabetes mellitus, hyperlipidemia, polycystic ovarian disease, osteoarthritis, sleep apnea

### Laboratory Evaluation

Again, these are mainly to evaluate for secondary causes or co-morbid conditions, and are largely dictated by clinical suspicion. Table 5 lists some simple baseline evaluations.

**Table 5. Laboratory evaluation**

o	Fasting lipids
o	Fasting blood glucose
o	Thyroid function tests: free T4, TSH
o	For Cushing's syndrome if clinically suspected, or if there is a history of weight gain with unaccounted medication, including traditional medicines.
o	Electrocardiogram
o	Chest radiograph

### RECOMMENDED READING

MOH Clinical Practice Guidelines. Obesity. 5/2004.  
WHO expert consultation, Lancet 2004; 363:157-63

## LEARNING POINTS

- o Obesity is a condition of fat accumulation with adverse health outcomes.
  - o Surrogate measures such as BMI and waist circumference are reasonable measures of obesity and should be measured in all individuals.
  - o Appropriate action, which may be as basic as improving diet and physical activity levels, should be contemplated starting at a BMI of 23.0 kg/m<sup>2</sup>.
  - o A BMI in excess of 27.5 kg/m<sup>2</sup> and waist circumferences in excess of 90 cm in men and 80 cm in women represent moderate to high risk of co-morbid conditions, which requires attention and perhaps intervention.
  - o There are many aspects to obesity. As thorough an evaluation as possible would help identify areas where modifications could be made.
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