Review article

Assessment of obesity in the Indian setting: A clinical review

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ABSTRACT

Background: Obesity is an important public health concern, one of the main lifestyle illnesses leading to chronic diseases like metabolic syndrome, diabetes, cardiovascular diseases, cancers, depression, and stroke. Hence diagnosis and management of obesity as early as possible are essential to prevent the development of these diseases. The present paper reviews some of the key indicators useful in the assessment of obesity.

Methods: We collected and reviewed different articles on obesity.

Conclusion: Obesity is a serious non-communicable disease associated with multiple risk factors leading to multiple chronic diseases. Early identification for management is essential to reduce the risk factors of the disease. Proper diet and adequate physical activity should be followed regularly to combat the condition. For diet, eating on time, eating healthy fruits and vegetables, and avoiding junk and processed foods would be healthy and Physical activity of 30 min a day is recommended for all individuals to prevent obesity in the future.

1. Introduction

Globally, obesity is increasing in prevalence and is now considered to be an epidemic. There is an association between obesity and chronic diseases such as Non-Alcoholic Fatty Liver (NAFL), cardiovascular disease, diabetes mellitus, hypertension and metabolic syndrome.⁵ (see Tables 1–3)

Obesity is defined as a condition characterized by excessive fat build-up to the point that health and well-being are at risk ³.

According to World Health Organization (WHO), it has been estimated that in 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million had obesity. In the United States of America, obesity is more common in African Americans, Hispanics, and Caucasians. The southern states of the United States have the highest prevalence, followed by the Midwest, Northeast, and West. Obesity is a growing public health concern, with the Centre for Disease Control and Prevention (CDC), reporting that one-third of persons in the United States are overweight by at least 20% over their recommended weight.

Obesity and overweight are caused by an energy imbalance between calories consumed and calories burned. Physical inactivity is increasing as a result of the increasingly sedentary character of many types of jobs, changing modes of transportation, and expanding urbanization. In addition, Environmental and societal changes linked with development frequently cause changes in food and physical activity patterns.

1.1. Body mass index (BMI)

A screening tool that is widely accepted to identify people who are overweight or have obesity is BMI. BMI can be easily correlated with other measures of adiposity.⁶ BMI is a simple index of weight for height that is commonly used to classify overweight and obesity in adults. It is calculated as a person’s weight in kilograms divided by the square of their height in meters (kg/m²).

A high BMI is a key risk factor for non-communicable diseases such as cardiovascular disease, diabetes, musculoskeletal problems, and several malignancies.

A high value, in general, implies excessive body fat and is consistently associated with greater health risks and mortality. Unusual muscular mass, such as that found in trained athletes, can raise BMI to 30, but seldom to 32. BMI classifications and cut-offs are frequently used to guide patient care.

Different people of the same BMI may have distinct body shapes,
Table 1
WHO classification of BMI for the Asian population (6).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5 kg/m²</td>
<td></td>
</tr>
<tr>
<td>Normal Weight</td>
<td>18.5-23.9 kg/m²</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>&gt;23 kg/m²</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>&gt;25 kg/m²</td>
<td></td>
</tr>
</tbody>
</table>

Table 2
Classification of Waist-Hip ratio.

<table>
<thead>
<tr>
<th>Health Risk</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.80 or lower</td>
<td>0.95 or lower</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.81-0.85</td>
<td>0.96-1.0</td>
</tr>
<tr>
<td>High</td>
<td>0.86 or high</td>
<td>1.0 or high</td>
</tr>
</tbody>
</table>

Table 3
Indian cut-offs for Indicators (7).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>INDIAN CUT-OFF</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist Circumference (WC)</td>
<td>&gt;90 cm</td>
<td>&gt;80 cm</td>
<td></td>
</tr>
<tr>
<td>Waist-Hip Ratio (WHR)</td>
<td>&gt;0.9</td>
<td>&gt;0.85</td>
<td></td>
</tr>
<tr>
<td>Wrist circumference</td>
<td>16.5 cm</td>
<td>15.7 cm</td>
<td></td>
</tr>
<tr>
<td>Neck circumference (NC)</td>
<td>35.25 cm</td>
<td>34.25 cm</td>
<td></td>
</tr>
<tr>
<td>Body Fat Percentage</td>
<td>&gt;25%</td>
<td>&gt;30%</td>
<td></td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>&gt;23 kg/m²</td>
<td>&gt;25 kg/m²</td>
<td>Obesity</td>
</tr>
</tbody>
</table>

depending on the distribution of body fat and skeletal muscle.

1.2. Waist circumference (WC)

Waist circumference is a measure of central or abdominal obesity. It can also be used to diagnose obesity. As stated by WHO, WC > 94 cm in men and >80 cm in women is associated with an increased risk of metabolic complications. This risk is significantly increased with a WC > 102 cm in men and >88 cm in women. Asian cut-off is lower with WC > 90 cm in men and >80 cm in women.

WC is simpler to measure and it avoids any consideration of the hips as they consist of bone and skeletal muscle along with fat. The technique for measuring WC is to measure with tape, halfway between the lower ribs and the iliac crest.\(^5\)

1.3. Hip circumference (HC)

Hip circumference is measured at the level of the widest circumference over the greater trochanters. This is done using a flexible narrow non-stretch tape. For measuring this circumference the subject must be measured in a standing position at the end of a gentle expiration.\(^1\)

1.3.1. Waist-hip ratio (WHR)

The WHR is obtained by dividing the WC by the HC using the same units of measurements for both.\(^7\) The WHR is a straightforward indicator of central obesity. The WHR score predicts the likelihood of acquiring numerous disorders connected with excess abdominal fat.

The WHO classifies abdominal obesity in men as having a waist-to-hip ratio of at least 0.90. For women, the ratio is 0.85 or higher. A ratio greater than 1.0 for either sex indicates a significantly increased risk of health complications.

WHR is a quick, low-cost, and accurate approach to determining adiposity of a patient. It can also indicate a patient’s risk of developing cardiometabolic disorders.\(^11\)

Some scientists believe that WHR is more accurate than BMI in predicting the risk of heart disease or possibly early mortality. For example, a 2015 study of almost 15,000 individuals discovered that participants with a “normal” BMI but an elevated WHR were at a higher risk of premature death.

Disadvantage:
- Non-nutritional factors make measurement harder to interpret.
- When used alone, it is not considered diagnostic.
- WHR is not recommended in children.

2. Wrist circumference

Wrist circumference (WrC) is an accessible tool to detect measures of skeletal frame size without being severely confounded by body fat variation.\(^1\)

WrC with a cut-off of the 97th percentile is a good technique for identifying metabolic syndrome in overweight children and adolescents.\(^1\)

WrC is thought to be a distinct fat distribution indication. A cross-sectional study conducted in Italy by Maddaloni et al. found that wrist circumference was independently linked with visceral adiposity index and metabolic syndrome in Italian overweight/persons with obesity of both genders, but not in those with a BMI of 25 kg/m².\(^14\)

In individuals of both genders, wrist circumference strongly predicts the transition from MHO healthy overweight to MUO unhealthy overweight phenotype. Only among diabetic women, increased wrist circumference reveals an independent risk for incident cardiometabolic risk factors.\(^14\)

In children and adolescents, WrC has been linked to numerous health risks.\(^15\) Metabolic syndrome and other cardiometabolic risk variables were enhanced in people with high WrCs. A recent meta-analysis of available evidence found that having a larger WrC was associated with an increased prevalence of metabolic syndrome in adults, albeit with significant between-study heterogeneity that was mostly related to gender.\(^16,17\)

3. Neck circumference (NC)

Neck circumference can be used as an initial screening technique for overweight/obesity. A neck circumference of more than 35.5 cm in men and more than 32 cm in women should be termed obesity.\(^1\)

Recent studies have revealed that NC, as an index of upper-body subcutaneous adipose tissue distribution, is a good tool to identify overweight and obesity and it is associated with cardiometabolic risks beyond that of BMI and WC.\(^1\)

3.1. Measurements

The head should be held erect (in the resting position) with the eyes facing forward. Measure around the neck in a horizontal plane at the level of the most prominent portion of the thyroid cartilage.

The NC measurement is a straightforward, practical, and low-cost screening tool for identifying overweight participants with obesity.

For example, a 2015 study of almost 15,000 individuals discovered that participants with a “normal” BMI but an elevated WHR were at a higher risk of premature death.

Disadvantage:
- Non-nutritional factors make measurement harder to interpret.
- When used alone, it is not considered diagnostic.
- WHR is not recommended in children.

Bioelectrical impedance analysis (BIA) is a more accurate method for analyzing body composition in recent years. The effectiveness of bioelectrical impedance vector analysis (BIVA) as an indicator of nutritional status and hydration has been demonstrated. According to the National Institutes of Health Technology Assessment Conference Statement on BIA in body composition measurement for estimating comparative fat mass, BIA is more accurate than BMI and may be more accurate than skinfold measurement.\(^21\)

BIA devices detect the body composition by using electrical currents depending on the distribution of body fat and skeletal muscle.
which move through the muscle easier than fat due to the increased water content of muscle.

Body impedance analysis (BIA), a relatively simple, quick, and non-invasive body composition method that is both reliable and simple to perform, is widely used to assess body composition. This method measures the conductance of a small alternating current through the body. Because conductance is primarily determined by the amount of water, which is only present in fat-free mass, BIA allows for the calculation of fat-free mass and body fat percentage. It can be applied to determine body composition in both healthy subjects and patients being monitored.

Body fat percentage of more than 25% in men and more than 30% in women are considered obese according to the endocrine society of India. 11

Tanita BC-545N is a body composition scale used to measure body fat percentage. Tanita Advanced Segmental Bio-electrical Impedance Analysis (BIA) technology is used in the BC-545N to analyse and evaluate body fat and muscle mass percentages in five body parts: arms (left and right), legs (left and right), and abdomen. Studies have shown that Tanita BC 545 N is reliable and accurate as verified by DEXA for measuring body composition in heavy smokers. 23 Studies have shown that BIA was given the best method for estimating body composition over different techniques estimated. 24

5. Imaging

CT and MRI images deposit body fat like visceral fat, and subcutaneous fat. Visceral fat correlates strongly to metabolic abnormalities. Precise and accurate measurements of regional fat mass can be estimated.

6. Dual-Energy X-ray absorptiometry (DEXA)

DEXA scanning uses low-level X-rays that pass through different types of tissues at different rates providing estimates of fat mass, fat-free mass, and bone density. This method is widely used to measure bone density and can also accurately measure fat mass. A limitation of most DEXA scanners is the capacity to image extremely obese persons. However, half-body scans have been shown to provide an accurate body compositional analysis. DEXA is relatively simple to perform, less expensive, and more accessible than magnetic resonance imaging or computed tomography. Radiation exposure is much less than computed tomography. Although subcutaneous and visceral fat cannot be clearly separated by DEXA, abdominal fat mass determined by DEXA correlates well with visceral fat as determined by other methods such as computed tomography and magnetic resonance imaging.

7. Conclusion

Obesity is a serious non-communicable disease associated with multiple risk factors leading to multiple chronic diseases. Early identification for management is essential to reduce the risk factors of the disease.

Proper diet and adequate physical activity should be followed regularly to combat the condition. For diet, eating on time, eating in a supportive and hopeful manner, may assist individuals in integrating these changes so that they become part of regular daily life and so aid in weight loss maintenance.

No single factor can accurately measure all the risk factors associated with it. It is the combined approach of an assessment of all the above factors needed to identify the risk factors and formulate measures to prevent the lifestyle problem.

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CRediT authorship contribution statement

K.G. Sruthi: Data curation, Methodology. Sushil Mathew John: Writing – original draft, Writing – review & editing. Sam Marconi David: Supervision, Writing – review & editing.

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References


