

Low Body Mass Index and High Body Fat Percent in Asian Populations

Saijuddin Shaikh*

Associate, Department of Nutrition and International Health, Johns Hopkins University, Baltimore, USA

*Corresponding Author: Saijuddin Shaikh, Associate, Department of Nutrition and International Health, Johns Hopkins University, Baltimore, USA.

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Overweight and obesity are recognized as a global health problem and rapidly escalating in developing countries. Excess body fat is associated with several non-communicable diseases and increase risk of mortality [1], type 2 diabetes [2], cardiovascular diseases and cancer [3]. Obese individuals have 7 times higher risk of developing diabetes than individuals [4] of normal body mass index (BMI). It has been estimated that nearly one-third of the world population are overweight or obese by 2030 [5]. Accurate determination of obesity is very important because of major health threats posed by excess adiposity. However, BMI, calculating by weight (kg)/height (m²), an important indicator of obesity measurement in large population, since BMI over- or underestimate adiposity depending upon certain circumstances.

It is reported by WHO expert committee [6] that in an identical BMI (22.3 kg/m²), body fat percent measured by dual X-ray absorptiometry was different i.e, 9.1% and 21.2% for European and Asian Indian respectively. Lifestyle and other factors may be relevant: European man did marathon exercise whereas Indian man's main exercise was walking to hospital every day. Possibly genetic factor and intrauterine under-nutrition are also related to this difference as Indian man was low birth weight. This example remind us the limitations of BMI as a measure of adiposity across population. South Asian countries have the lowest prevalence of overweight when defined as BMI \geq 25 kg/m². WHO expert committee compiled the data and found higher levels of adiposity at lower BMI for Asian populations compared with white American and European populations and recommended cut-off points of BMI $>$ 23 kg/m² for overweight and $>$ 27.5 kg/m² for obesity in Asian population [6]. However, a more accurate obesity should be more appropriately based on total amount of body fat. The upper limits of body fat for defining obesity have been set as 25% for males and

30% for females [7]. A BMI of 30 kg/m² corresponds to 25% and 30% of body fat for males and females respectively in Caucasian [8].

A study was conducted by Dudeja, *et al.* [9] in 123 healthy men and women in Delhi, India to establish appropriate cut-off levels of the BMI for defining overweight and obesity. They measured body fat percent using skinfold thicknesses. The study reported that 15.1% males and 27.0% females were overweight and obese when a BMI of $>$ 25 kg/m² was applied as the cut-off level. However, when $>$ 25% and $>$ 30% of fat percent were used as cut-off levels for defining overweight and obese, 34.8% and 89.2% males and females were overweight and obese respectively. To determine cut-off levels of BMI, they used body fat percent as 25% for males and 30% for females as the standard and found that the BMI of 21.5 kg/m² and 19.0 kg/m² in males and females respectively. These cut-off levels of BMI were lower than WHO recommended values for Asian population.

Shaikh, *et al* [10] carried out a study in rural area of northwest Bangladesh and a total 1009 women were recruited at 3 months postpartum period. In this area, women do household chores, work in paddy field and 40% are underweight (BMI $<$ 18.5 kg/m²). Mean (SD) age (year) weight (kg) and height (cm) were 26 (5.5), 43.6 (6.2) and 149.6 (5.1) respectively. Body fat percent was measured using bioelectrical impedance analysis (BIA) and skinfold thickness methods which were developed and validated against ²H₂O dilution method (reference method) in the same population. Mean (SD) fat percent was 23.5% (4.8). The ROC curve analysis indicated that a BMI of approximately 21.0 kg/m² maximized the sensitivity and specificity of identifying the cases of 30% of body fat, by either skinfold estimates or BIA. This is substantially lower than the WHO

Health Action cut-off point ($\text{BMI} \geq 23 \text{ kg/m}^2$) and the WHO recommended standard cut-off point of 25 kg/m^2 .

Other studies reported that Asian people have higher fat percent with a lower BMI compared to White populations [11]. In White males a BMI of 25.1 kg/m^2 and fat percent was 19.3, whereas in Asian males a BMI of 23.4 kg/m^2 and fat percent was 21.4. Similarly, for White females a BMI of 23.9 kg/m^2 fat percent was 30.1, whereas, for Asian females a BMI of 22.5 kg/m^2 and fat percent was 31.6 which indicating that higher fat percent with lower BMI in Asian population. In a same BMI, fat percent is different by ethnicity is also reported by Deurenberg, *et al* [12]. Overall fat percent was 26.1 with a BMI of 22.2 kg/m^2 in Chinese, fat percent was 32.0 for a BMI of 23 kg/m^2 in Thai population, and fat percent was 29.3 for a BMI of 22.4 kg/m^2 in Indonesian.

Above mentioned evidences suggest that the relationship between percent body fat and BMI is different among different population and different ethnic groups. For public health implications the definitions of BMI cut-off levels as a diagnostic tool for obesity determination need to be population-specific instead of using WHO cut-off point of 30 kg/m^2 for obesity determination.

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