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PERSPECTIVE

Ethnic-Specific Criteria for Classification of Body Mass Index: A Perspective for Asian Indians and American Diabetes Association Position Statement

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Abstract

Definitions for overweight and obesity are universally applied using body mass index (BMI), based on morbidity and mortality data derived from white populations. However, several studies have shown higher body fat, excess metabolic perturbations, and cardiovascular risk factors at lower value of BMI in Asian versus white populations. Definitive guidelines have been published to classify a BMI of $\geq 23\,kg/m^2$ and $\geq 25\,kg/m^2$ as overweight and obese, respectively, by the Indian Consensus Group (for Asian Indians residing in India) and a BMI of $\geq 23\,kg/m^2$ for screening for diabetes by the National Institute of Health and Care Excellence of the United Kingdom (for migrant south Asians) and, in an encouraging initiative recently (2015), by the American Diabetes Association (for all Asian ethnic groups in the United States). Overall, multiple studies, and now several guidelines, emphasize early intervention with diet and physical activity in Asian ethnic groups for prevention and management of obesity-related noncommunicable diseases. By application of these guidelines, an additional 10–15% of the population in India would be labeled as overweight/obese, and more South Asians/Asians will be diagnosed with diabetes in the United Kingdom and the United States. Additional health resources need to be allocated to deal with increasing numbers of Asians with obesity-related noncommunicable diseases, and research is needed to evolve cost-effective interventions. Finally, consensus based on data is needed so that the World Health Organization and other international agencies could take definitive steps for revision of classification of BMI for Asian populations globally.

> Classifying an individual as lean, when in fact the individual is truly obese, may put this individual at risk for diseases associated with obesity and potentially delay possible beneficial therapy.[1]

New Year's Eve of the year 1995, while standing in a market in New Delhi, India, I was approached by a sick-looking young man, who said, ''You have treated my mother with diabetes; could you please treat me?'' I was somewhat surprised and sought information from him; he was 30 years of age, had a weight of nearly 65 kg, body mass index (BMI) of $22.4\,kg/m^2$, and fasting blood glucose of 225 mg/dL and had type 2 diabetes mellitus (T2DM)—not the usual middle age obesity-diabetes situation that I see in clinics. By this time, increasing research had shown that Asian Indians (and many other Asian ethnic groups) are developing T2DM at a BMI considered ''normal'' by international definition. The question that remained in my mind was ''Is this definition of BMI for Asian Indians correct?'' Subsequently, I was curious to know more about this ''anomalous phenotype'' of Asian Indians and accordingly formulated my search and research to answer this question.

The aim of the article is to discuss the rationale and evidence regarding upper cut-points of BMI for South Asians, in light of the recent position of the American Diabetes Association (ADA) to revise BMI cut-points for all Asians in the United States for screening of diabetes. Furthermore, it is hoped that collated data and arguments presented in this article should initiate discussion in other national and international agencies to revise the BMI cut-points for South Asians as well.

The literature search was conducted in the electronic databases Pubmed, Embase, and Google Scholar, using the following search terms: ''South Asians,'' ''Asians,'' ''Asian

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Indians,'' ''BMI,'' ''obesity,'' and ''diabetes.'' Terms to define ethnic groups have been done according to guidelines published by Bhopal.[2] Specifically, people with European ancestral origins have been defined as ''whites'' or ''white populations.'' At many places, terminology used by original authors has been retained.

Obesity, Adiposity, and BMI

Let us take a step back and recapitulate some background data and definitions. BMI (ratio of height and weight, expressed as kg/m^2) is commonly used to define overweight and obesity based on the morbidity and mortality statistics from the white populations. The lowest risk of mortality was between BMI values of $18.5\,kg/m^2$ and $25\,kg/m^2$ in 78,612 Dutch men over 32 years of age.[3] Furthermore, based on these data, a person with a BMI of $\geq 25\,kg/m^2$ or $\geq 30\,kg/m^2$ is defined as overweight or obese, respectively.[4] Since then these cutoffs for diagnosing overweight and obesity have been universally recommended.

Ideally, BMI should capture adiposity. It is interesting that a constant BMI cutoff for defining obesity (in the true sense, ''adiposity'') could be applied to all ethnic groups if the composition of body compartments (water, muscle, bone) remained constant in all individuals while body fat alone varied. The relationship of BMI with body fat will be linear and consistent in such a case. Clearly, such a scenario is not possible, and BMI changes in line with the changes in the proportion of any of the body compartments. This is particularly apparent in those with heavier muscle mass (e.g., professional wrestlers) as they would be defined as obese based on BMI, although their body fat may not be excessive. On the other hand, the BMI value would not change appreciably if there is a proportional decrease in the muscle mass and increase in body fat. Excess fat mass of such an individual, who otherwise is considered to be nonobese, may enhance the metabolic and cardiovascular risks and also may increase mortality.

Ethnicity and BMI: Contentious Issues

There is considerable variation in body fat and fat-free mass among various ethnic groups. Misclassification of 12% of black women as obese according to BMI criteria of obesity has been reported due to their greater muscle mass.[5] Many studies have suggested that Asian populations have more body fat relative to weight (but not in absolute terms) than white populations. The observations by Deurenberg-Yap et al.[6] of high body fat in Asian Indians in Singapore at low BMI values have been supported by studies on Asian Indians residing in India[7] and immigrant Asian Indians in the United States.[8] In 123 healthy Asian Indians, receiver operating characteristic curve analysis showed a low sensitivity and negative predictive value of the conventional cutoff of BMI ($25\,kg/m^2$) in identifications of overweight compared with a cutoff value based on percentage body fat, and this BMI cutoff resulted in substantial misclassification (approximately 25% of men and approximately 70% of women).[9]

Data show that comorbid diseases, including T2DM, occur at lower BMI levels in Asian Indians and other Asian populations than in the white population. In a sample of 1,513 Hong Kong Chinese (910 men and 603 women), a normogram was developed to show to show the predictive values of different indexes for the cardiovascular risk factors using likelihood ratio analysis. Higher levels of BMI, waist–hip ratio, waist circumference, and the waist-to-height ratio were associated with risk of having diabetes mellitus or hypertension in Chinese as in Caucasians; however, the cutoff values of each were lower in Chinese subjects than in Caucasians.[10] In a study in north India, nonobese Asian Indians (BMI of $\leq 25\,kg/m^2$) were divided into four quartiles of body fat and waist circumference. Those men and women in upper quartiles of body fat (quartile 3, 30.1–36% fat; quartile 4, >36% fat) showed significantly higher odds ratios for hypertension, diabetes, and hypertriglyceridemia compared with those having lower quartiles for body fat.[11]

The observations of higher body fat and higher morbidities at a relatively lower BMI, as seen in Asians and in elderly people with ''sarcopenic obesity,'' are conceptually supported by studies done by Ruderman et al.[12] more than three decades ago. Neil Ruderman coined the term ''metabolically obese normal weight (MONW),'' for those ''nonobese'' people having predisposition for T2DM, dyslipidemia, and premature atherosclerosis. It is likely that these ''MONW'' subjects have high total body fat at a ''normal'' value of BMI; hence, they have excess adiposity. Seventeen years later, Ruderman et al.[13] opined that many of these people were ''mildly obese'' and had BMI values in the upper range of normal, or had higher fat mass.

Metabolic perturbations in such MONW people could also be due to an increase in adipose tissue in other regional fat depots (abdomen, liver, or muscle) that may not increase overall adiposity.[14–17] Young Asian Indians having BMI in the ''nonobese'' range ($23 \pm 2\,kg/m^2$) had higher total abdominal and visceral fat and lower rate of glucose disposal compared with those Caucasians with comparable BMI values.[18] Although the average waist circumference in South Asians appears to be lower, abdominal adiposity is significantly more than in Caucasians.[8,18]

Fat deposition in other tissues also may affect insulin sensitivity. Deposition of fat in liver (nonalcoholic fatty liver disease) has been shown to cause insulin resistance in white populations,[14,19] but more so in Asian Indians.[20] It is often debated why South Asians are susceptible to develop truncal and abdominal obesity and consequent metabolic disorders. One hypothesis is that as obesity develops, South Asians exhaust storage capacity of subcutaneous adipose tissue compartments before whites do, resulting in metabolic complications at lower absolute masses of adipose tissue than for whites.[21]

To summarize, most obese people would have insulin resistance and the metabolic syndrome. However, ''nonobese'' subjects, classified according to BMI, may be insulin resistant and have an adverse metabolic profile. Many of them have excess body fat, increased abdominal fat, and nonalcoholic fatty liver disease. Such a characteristic phenotype is frequently seen in South Asians.[15,17,22,23]

Dithering, Hesitations, More Data, and Then More Definitive Steps

Since the initial studies as described above, the BMI and ethnicity issue has been continuously debated in international conferences and written about in international journals during the past two decades.[7,24,25]

Prompted by data from several studies, in 2000 a World Health Organization (WHO) Expert Group, specifically dealing with the obesity issue of people residing in the Asia–Pacific region, suggested redefining the criteria for obesity, acknowledging the ''need for different standards that are culturally specific.'' In a monograph of this WHO consultation,[26] the proposed BMI criterion for overweight was 23–24.9 kg/m^2, and that for obesity was ≥25 kg/m^2. The cutoff values for waist circumference were also lowered for people residing in the Asia–Pacific region. However, these ''suggested'' lower BMI cut-points by this committee were not accepted by WHO, and ≥25 kg/m^2 for overweight and ≥30 kg/m^2 for obesity were continued as universal definitions.

In a subsequent publication in 2004, another WHO consultation concluded, ''the available data do not necessarily indicate one clear BMI cut-off for all Asian Indians for overweight and obesity.''[27] No attempt was made, therefore, to redefine cutoff points for each population separately. The consultation identified further potential public health action points (23.0, 27.5, 32.5, and 37.5 kg/m^2) along the continuum of BMI and proposed methods by which countries could make decisions about the definitions of increased risk for their populations.[27] At this time, it is interesting that new concept of ''duality'' of cutoff points for defining overweight and obesity—one for ''universal'' use and another for ''individual country use''—was introduced. Another way of looking at these ''dual'' BMI definitions was that one cutoff was according to morbidity and mortality statistics, and another was to define the risk of diabetes. It is interesting that misclassification of diagnosis of diabetes at BMI ≥25 kg/m^2 for Asian Indians was reported by us 12 years ago.[28] Clearly encouraged by this WHO Consultation and increasing research data from India, the Indian Consensus Group in 2009 studied all available evidence and defined 23–24.9 kg/m^2 for overweight and ≥25 kg/m^2 for obesity.[29] Since then these values have been widely used by physicians in India.

Subsequently, this issue continued to be debated and researched for other South Asians and other Asian races, including migrant Asians. Razak et al.[30] studied 289 South Asians and compared them with other ethnic groups in Canada. These authors showed that for a given level of BMI, elevated levels of glucose and lipid-related factors were more likely to be present in South Asians and that cut-points of BMI based on these factors were 6 kg/m^2 lower compared with Europeans.[30] Subsequently, a study in the United Kingdom showed that for South Asian males, derived BMI obesity cutoff points equivalent to 30.0 kg/m^2 in white Europeans were 22.6 kg/m^2 (95% confidence interval, 20.7, 24.5 kg/m^2) for the glycemia factor.[31] Tillin et al.[32] looked at incidence rates of diabetes equivalent to those at a BMI of 30 kg/m^2 in European men and women; age- and sex-adjusted cut-points for other ethnic groups were as follows: South Asians, 25.2 (23.4, 26.6) kg/m^2; African Caribbeans, 27.2 (25.2, 28.6) kg/m^2.

Recently, cross-sectional data from 40–75-year-old participants (4,672 whites and 1,348 migrant South Asians from the ADDITION-Leicester [United Kingdom] and 985 indigenous South Asians from the Jaipur Heart Watch/New Delhi [India] studies) were examined. Cut-points for obesity of >25 kg/m^2 were derived for South Asians using fractional polynomial models with fasting and 2-h glucose as outcomes and ethnicity, objectively measured BMI/waist circumference, their interaction, and age as covariates.[33] Based on lower BMI cutoffs for South Asians shown in this study, the authors stated that ''health interventions are required at a lower BMI and waist circumference for South Asian individuals.''[33]

In 2012, the National Institute of Health and Care Excellence (now known as NICE) guidelines in the United Kingdom, for the first time, included BMI cut-points similar to the India Consensus Guidelines for all south Asians residing in the United Kingdom.[34]

ADA (2015) Position Statement on BMI Cutoff for Asians, and Yet the Cup Is Only Half Full

Although BMI cutoffs in Asian Indians and South Asians living in the United Kingdom show differences from British white populations, the situation may be different for migrant Asians in the United States with respect to diet, physical activity, and exposure to vastly different conditions than their homeland and resultant stress. Although lower cut-points of BMI for defining overweight/obesity have been used ''unofficially'' by some hospital/diabetes centers in the United States for some time now, a review of recent studies conducted on Asian Americans by Hsu et al.[35] showed occurrence of T2DM at a relatively lower BMI cut-points. These investigators clearly mentioned that for screening for T2DM, a BMI cut-point of 23 kg/m^2 is appropriate for Asian populations residing in the United States, and the same has been stated in the position statement for 2015 by the ADA.[36] Clearly, this is a major and much-needed health initiative for Asian populations.

Making Guidelines for Public Health Only After Acquisition of "Perfect" Data?

At the same time the ADA has defined BMI cutoffs for screening for diabetes for Asian Americans, as well as India and other Asian countries (Japan, China)[37,38] have lowered BMI cut-points to define overweight and obesity based on available data, many would still argue that BMI should only be defined according to overall mortality, particularly when some studies in South Asians have not shown inordinately high mortality at BMI cut-points ≥23 kg/m^2.[39,40] Time and again, validity of ''health guidelines'' have been questioned because of lack of robust data, particularly in the context of mortality. Could ''less than perfect'' data be enough to make guidelines for improving public health? The Indian Consensus Group also deliberated in 2009 if data were enough to make recommendations for lower cut-points of BMI, but strong concern for rising obesity and diabetes led all of us to believe that the right decisions were made. Even Hsu et al.[35] stated there is a need to tailor health interventions in specific ethnic groups in a ''personalized'' manner and that ''there is urgent need to act now, even in absence of perfect data.'' So, although ADA has opened a fresh chapter in making new definitions of BMI vis-à-vis diabetes, a morbid disease, more research is needed to define the precise relationship of BMI, incidence of diabetes, and mortality in various ethnic groups in different countries and in migrants.

It has been estimated that by application of these guidelines, an additional 10–15% of the population in India would be labeled as overweight/obese and would require

appropriate management.[29] Similarly, in the United States more persons will be diagnosed with diabetes in the year 2015. Additional health resources need to be allocated to deal with the increasing numbers of patients with diabetes, and this will put an excess burden on health budgets, a particularly difficult proposition for many resource-constrained developing countries in Asia, including India. However, the Indian Consensus Group strongly emphasized that application of revised guidelines on a countrywide basis is also likely to have a deceleration effect on the escalating problem of T2DM and cardiovascular disease in India; thus, such a step may be economically beneficial in the long run. Additionally, despite recognition of the health challenges in ethnic health in developed countries (e.g., the United Kingdom), there is a lack of guidance on how best to promote lifestyle changes in ethnic minority populations,[41] and research is needed to evolve cost-effective interventions.

Finally, although India, other Asian countries, the United Kingdom, and the United States have already taken definitive steps, consensus based on data is needed for WHO and other international agencies so that definitive steps for revision of classification of BMI for Asian populations could be taken.

Author Disclosure Statement

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