New International Measuring Stick for Defining Obesity in Non-Europeans

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Body mass index (BMI) is a useful way of classifying the degree of excess weight in an individual. Defining BMI cut points at which adverse cardiovascular outcomes, diabetes mellitus, and other comorbidities are more likely to occur affords clinically relevant guidelines for patient care. Expert panels from both the National Institutes of Health and the World Health Organization have developed such cut points, which define overweight as a BMI (weight [in kilograms]/height [in meters squared]) of 25.0 to 29.9 kg/m², mild or grade I obesity as a BMI of 30 to 34.9 kg/m², grade II or more severe obesity as a BMI of 35 to 39.9 kg/m², and extreme or grade III obesity as a BMI ≥40 kg/m². Epidemiological studies focusing on persons of European descent have verified that these cut points are, indeed, associated with incremental risk for cardiovascular events and all-cause death. An awareness that appropriate BMI cut points for Asians may differ from those of Europeans has been largely based on observations that cardiovascular and metabolic risk in Asians occur at a lower BMI than in Europeans. For example, there is increasing evidence of a high prevalence of type 2 diabetes mellitus and elevated cardiovascular risk in Asian countries, despite an average BMI in these countries that is <25 kg/m². Even for Asian-Americans, the prevalence of diabetes mellitus after adjustment for BMI is 60% higher than in their European counterparts.

The definition of clinically useful BMI cut points in Asian populations has been difficult, at least in part because of the limitations of previously used methodologies. Two general methodological approaches have been taken in the past to derive these BMI cut points in Asians: (1) recalculation of BMI cut points based on the measurement of percent body fat, which is typically higher in Asians, and (2) use of population-specific health surveys to associate the prevalence of risk factors with specific BMI cut points, typically through the use of multivariable logistic regression analyses. Two previous studies in Taiwanese and Singaporeans that used 1 or both of these approaches were unable to conclusively identify appropriate specific BMI cut points for these populations.

The recalibration of BMI cut points based solely on differences in percent body fat assumes a linear relationship between percent body fat and cardiometabolic risk. This is not likely to be the case, because there are other contributing factors that would have an impact on risk at specific BMI levels, including genetic factors, nutritional factors, other environmental factors, and body fat distribution. The approach of incorporating specific health surveys into multivariable logistic regression analyses is limited by the need to consider one outcome at a time, which necessarily involves a degree of bias in how these outcomes are considered. Furthermore, there is a significant degree of overlap between outcomes that is difficult to take into account with these models.

The study by Razak et al in the present issue of Circulation takes an innovative and clinically meaningful approach to developing BMI cut points for obesity in 3 non-European populations residing in Canada (Chinese, Southeast Asians, and Aboriginals). The investigators identified 3 general metabolic categories that best described cardiometabolic risk: glucose metabolism, lipid metabolism, and blood pressure. For these 3 categories, the study identified the BMI cut points at which the degree of abnormality in these measures approximated that found in Europeans with a BMI of 30 kg/m². The underlying variables that defined these categories were physiologically meaningful, and some could serve as surrogate markers for clinical outcomes, including future development of diabetes mellitus, atherosclerotic events, stroke, heart failure, and arrhythmia.

One of the challenges with taking this approach is the need to consider a large number of overlapping metabolic variables in an unbiased fashion. To address these challenges, the investigators used principal components analysis (a technique for reducing multidimensional data to lower dimensions to simplify analysis). Using this approach, the investigators identified a surprisingly low BMI cut point for obesity based on glucose metabolism in all 3 groups: a BMI of 20.6 kg/m² for Chinese, 21.0 kg/m² for Southeast Asians, and 21.8 kg/m² for Aboriginal people, relative to a BMI of 30 kg/m² in Europeans. Similarly, the BMI cut points for lipid metabolism were lower in all 3 groups: 25.9 kg/m² for Chinese, 22.5 kg/m² for Southeast Asians, and 26.1 kg/m² for Aboriginals, again relative to a 30-kg/m² cut point in Europeans. Thus, this approach identified different types of predisposed risk between ethnic populations, with all 3 groups demonstrating abnormal glucose metabolism at a much lower BMI than in Europeans. Southeast Asians were particularly likely to have abnormal lipid metabolism at a lower BMI than that in Chinese or Aboriginals and at a substantially lower BMI than in Europeans.

The study by Razak et al deals with some of the limitations of the previously used approaches. Because the
study directly measured the degree of metabolic perturbation at various BMIs in non-European groups relative to the degree of metabolic perturbation at a BMI of 30 kg/m² in Europeans, there are no assumptions of a linear relationship between percent body fat and cardiometabolic risk. Another advantage of this approach is the more unbiased consideration of metabolic variables through the use of principle components analysis. Overall, the approach provided conclusive findings with the enrollment of a relatively small number of patients.

The inclusion of Aboriginal people together with Asians in the Razak et al study is instructive. Aboriginals in Canada are indigenous peoples who include Indians (First Nations), Métis, and Inuit. There are >900,000 Aboriginal people in Canada, which is 3.3% of the country’s total population. Although many Aboriginals in Canada hold a belief that they originated in North America, there are supportable theories that they actually originated in Asia and migrated to North America across the Beringia land bridge approximately 20,000 years ago. Given the substantial difference in culture and diet between the Aboriginals and the Asians in Canada but the similar BMI cut points for glucose and lipid metabolism, which are distinct from those in Europeans, one could postulate an underlying genetic factor that may explain the similarity.

There are some important limitations to the study by Razak et al, many of which have been acknowledged by the authors. The study only included subjects who lived in Canada, and so the validity of extrapolating these specific cut points to other Asian populations would need to be verified separately. There would be competing environmental factors inherent to living in Canada that could have affected the BMI determinations in the study. In addition, there is some concern that despite the fact that the authors cast a wide net of considered metabolic variables and used a sophisticated statistical approach, the 3 derived factors only explained 56% of the total variation of the 14 variables entered into the model. Before we can consider setting new BMI cut points for these ethnic groups, it will be important to replicate the findings from this study in other Asian populations. It will also be critical to show that these specific BMI cut points have relevance in terms of actual clinical outcomes.

In the last World Health Organization Expert Consultation addressing the issue of setting different cut points for BMI in Asian populations, the committee agreed that overweight or obesity originated in Asia and migrated to North America across the Beringia land bridge approximately 20,000 years ago. Given the substantial difference in culture and diet between the Aboriginals and the Asians in Canada but the similar BMI cut points for glucose and lipid metabolism, which are distinct from those in Europeans, one could postulate an underlying genetic factor that may explain the similarity.

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