Commentary: Use of the body mass index to assess the risk of health outcomes: time to say goodbye?

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In this issue of the journal, Yun et al. report on the association of changes in body mass index (BMI; the weight in kilograms divided by the square of the height in metres) with risk of cause-specific mortality in a cohort of 473,358 Korean men aged 30–64 years at baseline. When controlled for BMI at baseline, those persons whose BMI increased moderately (between 5.0 and 9.9%) over the subsequent 6 years compared with persons with stable BMI (BMI changes between −5.0 and 4.9%) had a slightly (albeit non-significantly) reduced risk of subsequent death from cardiovascular diseases (CVD), non-CVD and overall mortality; whereas those persons whose BMI increased severely (by ≥10%) had a significantly higher risk of all three outcomes. In analyses stratified by BMI at baseline, the risk reductions for non-CVD and overall mortality associated with a moderate BMI increase were strongest in persons who started with a low BMI; whereas the enlarged risk associated with severe BMI increase was strongest among persons who started with higher BMI levels.

These results suggest that a severe gain in BMI during adulthood is associated with increased mortality, whereas modest gain in BMI may not increase the risk of premature death, and it may even be beneficial, particularly among persons who start with a low BMI. However, the interpretation of these results is limited because BMI reflects different body compartments, and it is not clear whether the changes observed by Yun et al. reflect changes in fat mass or fat-free mass. Further, it is not clear to what extent these changes were associated with changes in body fat distribution. Current guidelines classify states of obesity primarily based on the BMI; however, we now have good evidence that measurement of BMI alone does not accurately reflect the risk of disease and mortality that is associated with adiposity, and this may also be true for changes in BMI.

Obesity is conceptually defined as a condition of abnormal or excessive body fat accumulation to the extent that health may be impaired. It is interesting to note that although BMI is, to some extent, correlated with the amount of fat, it is neither a specific marker of body fat nor a marker for abnormal fat accumulation. For example, visceral adipose tissue is metabolically more active and it secretes more cytokines and hormones that may be relevant for disease risk compared with subcutaneous adipose tissue, yet BMI is only a crude measure of visceral fat mass. To acknowledge the latter facts to some extent, current obesity guidelines recommend to measure waist circumference as a marker of regional body fat.
distribution in Caucasian persons with a BMI between 25.0 and 34.9, and they propose cut-off points for waist circumference of 102 cm in men and 88 cm in women to define abdominal obesity and to identify persons at risk for disease.\(^2\)\(^3\)

Waist circumference or waist–hip ratio show much closer correlations with the amount of visceral fat, which may explain why they are more strongly associated with risk of metabolic diseases than BMI. In fact, in the large European Prospective Investigation into Cancer and Nutrition (EPIC study), waist circumference was strongly and directly associated with the risk of death, once BMI was adjusted for.\(^4\) This association tended to be stronger among participants with a lower BMI than among those with a higher BMI. When participants in the middle third of BMI and the lowest quintile of waist circumference were used as the reference category, those persons in the lowest third of BMI and the highest quintile of waist circumference had the highest relative risk of death.\(^4\) These results suggest that the high risk of death among persons with high BMI is likely due to increased adiposity, whereas the increased risk of death among participants with a low BMI could be the result of low muscle mass, since even at a low BMI, waist circumference was positively related to the risk of death. One may speculate whether the increased risk of mortality among persons with severe increase in BMI, observed by Yun et al.\(^1\), was due to an increase in visceral fat mass (i.e. increase in waist circumference), whereas the reduced risk of mortality among persons who start very low and have a moderate increase in BMI was due to an increase in non-fat (muscle) mass (i.e. less increase in waist circumference). Unfortunately, waist circumference was not measured in the study by Yun et al., and the study thus illustrates that no simple conclusions can be drawn if we rely solely on the measurement of BMI to assess the risk of mortality. Clearly, we need studies that look prospectively at how changes in waist circumference relate to mortality beyond BMI.

What can we learn from these findings? Should we substitute BMI with parameters of abdominal adiposity, as some authors have suggested?\(^7\) The answer is: no, we should not say goodbye to BMI, but we should welcome the use of waist circumference in addition to BMI. The results from the EPIC study have shown that we need both markers to accurately assess the risk of mortality.\(^4\) The measurement of waist circumference in addition to BMI should therefore be mandatory to assess the risk for health outcomes, and this is particularly true for persons with a low BMI. Further, we need more research on markers that can be used to more precisely quantify the risk of health outcomes associated with patterns of body composition and metabolism. While most of this research is currently focused on markers of obesity, surprisingly very little is known about markers of low muscle mass, although low muscle mass may be an important predictor of mortality, particularly among the elderly.

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**References**