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A Practical Estimation of Body Fat Percentage Among Morbidly Obese Patients

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Dear editor,

In Iran, prevalence of obesity doubled between 2005 and 2014, rising sharply from 12.6 to 25.9% (1). Worldwide prevalence of overweightness and obesity has doubled since 1980, with one-third of the world's population now classified as overweight or obese (2). Conservative treatment options for obesity, such as behavioral and physical interventions, have failed to stop the increasing prevalence rates (3). A popular but invasive treatment option for obesity is bariatric surgery which has seen an annual rise in procedures performed (4). Bariatric surgery is one of the most effective treatments for combating obesity and its related disorders of type 2 diabetes and hypertension (4). Current guidelines recommend bariatric surgery as a treatment option in patients with a body mass index (body mass index (BMI); [weight (kg)/height^2 (meters)]) > 40 or > 35 with serious co-morbidities (4, 5).

The "gold standard" method for assessment of body composition in clinical practice is dual-energy x-ray absorptiometry (DXA) which provides a rapid and non-invasive assessment of fat and fat-free mass (6). High associated costs and the requirement for specialist support are disadvantages of DXA, meaning it is not feasible to use routinely in clinical practice (7). Lower-cost alternatives include bioelectrical impedance analysis (BIA), which is a simple, non-invasive, low-cost device that estimates total body water, fat, and fat-free mass (FFM) (7). BIA has a major limitation when used with the morbidly obese due to the variability of body water distribution (7). A comparison of body composition assessment by DXA and BIA, according to BMI, has been previously reported (7). Fat mass estimation between DXA and BIA was similar in patients with BMI $\geq$ 40, whereas fat-free mass was overestimated by a mean of ~5.9 kg using the BIA method (7). An alternative method to assess body composition and hence fat mass is using equations based on anthropometrics that has been proposed as alternatives to BMI in previous studies (8). Previously published equations require more than 10 different anthropometric measurements or even require up to four different skinfold measurements and hence are relatively complex equations to be used in clinics (8, 9).

Herein, we have introduced a simple anthropometric linear equation that is more accurate than the BMI to estimate whole-body fat percentage among adult individuals. It has previously been validated by the National Health and Nutrition Examination Survey (NHANES) (9). Using this equation, relative fat mass (RFM) can be calculated by the following equation: 76 - (20 $\times$ (height (m) /waist (m)) for women; 64 - (20 $\times$ (height (m)/waist (m))) for men. Alternatively, 64 - (20 $\times$ (height (m)/waist (m)) + (12 $\times$ sex) for both men and women (male = 0; female = 1) (9). For identifying individuals with obesity, RFM $\geq$ 33.9 for women and $\geq$ 22.8 for men showed a high level of sensitivity (9). We hypothesized that RFM could be an accurate and suitable index for surgeons and clinicians to estimate and monitor body fat percentage before bariatric surgery and during post-operative follow up. Since DXA is an expensive and inaccessible method for many, BIA is used routinely by surgeons and clinicians as a more cost-effective substitute, although it may not be available in all healthcare centers. The RFM equation allows physicians to estimate body fat percentage cheaply and quickly without the need for any

equipment. However, further empirical work is required to test its efficacy in obese populations who are being considered for bariatric surgery.

Footnotes

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