Body Composition, Body Mass Index and Relative Fat Mass

Composición corporal, índice de masa corporal y masa grasa relativa

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doi: 10.18176/archmeddeporte.00164

Ever since Sports Medicine emerged as a specific field, one of its main purposes has been to assess body size, build, proportionality and composition. A number of different goals are sought through this speciality, including the recruitment of sports talent, the optimisation of training activities, the improvement of performance in sport and the assessment of cardiovascular risk. Anthropometry was therefore adopted as a tool to lend scientific method to the taking of measurements and the interpretation of those measurements. This is often referred to as kinanthropometry and various consensuses have been reached for standardisation purposes[1].

Multiple anthropometric techniques and procedures have been developed and perfected over the years to quantify issues relating to body composition and build[2]. These include the classic Sheldon somatotype, the Phantom model for body segment proportionality, skinfold measures and the various equations for calculating fat percentage (Siri, Faulkner, Carter, Yuhasz…). Regarding the latter — the calculation of fat percentage — several dozens of equations have been published; some more generic and others for more specific populations with numerous variables, coefficients and constants that make comparisons and interrelationships between them complicated. Meanwhile, technology has steadily produced numerous procedures for determining fat mass and muscle mass with minimal intervention from the examining physician but with significant preparation by the patient, including bioelectrical impedance, magnetic resonance, tomography and densitometry. These technical and technological advancements, which could be considered a favourable result, complicate the collection of data, the interpretation of that data and comparison between different studies. The broad range of equipment, brands, models and techniques plus the existence of different benchmark values and equations based on each one means that we cannot all have everything and that each centre or researcher has their own benchmark values. Moreover, this situation has led to many studies looking to find relationships between techniques and procedures, as well as complex value conversions. Ultimately, and from a practical point of view, this means they can only be reliably compared with others of a similar nature and that the potentially precise is relegated to something approximate.

In an attempt to simplify things and to find a broad benchmark, the World Health Organisation adopted Quetelet's Index (mass/height^2) as a measurement to assess nutritional status and its links to health, calling it the Body Mass Index (BMI). The WHO classification for the BMI is mainly focused on identifying and classifying overweight tied to excess fat[3]. What some consider an advantage (the same benchmark values for men and women, regardless of age and level of physical activity) of this index is the clearest source of criticism for others. The calculation of this index has been used in the vast majority of scientific works related to public health, nutrition, and sports medicine and science. Besides the corresponding "WHO label", this is perhaps due to inertia in the traditional description of the populations used in our studies and the ease with which it can be calculated and interpreted. Regrettably, most readers of these studies have not been critical with what we are shown alongside a BMI value in a population of healthy, not obese and athletic subjects. For example, what does knowing the BMI of a population of triathletes contribute to a project? or how does knowing their BMI value help a young judoka? It is logical to expect an athlete with an acceptable muscle mass to have a high BMI (muscle has weight and the scales do not distinguish what they are weighing) but that does not mean they are overweight or obese. For that reason, BMI values and their interpretation according to the WHO classification are of no interest or usefulness in athletes.

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An inappropriate tool is being used whenever a population of athletes is described using the BMI, especially when not complemented with other data. Those data might be the fat mass percentage or the musculoskeletal mass percentage. For this percentage to be valid, it should be simple to obtain and reliable. I believe that this premise rules out anthropometric techniques with skinfold measurement as their technical complexity and inter-observer variability make them barely credible in poorly trained hands. Furthermore, the multitude of usable formulas makes it extremely difficult to compare data. The other, increasingly more popular alternative would be to rely on data obtained from bioelectrical impedance in which inter-observer variability is low. However, the differences between the data provided by the various devices make the possibility of intrinsic errors high. A third alternative has also been available for a number of years now, which is to determine relative fat mass (RFM). This is a slightly more sophisticated evolution of the classic waist-to-height ratio.

The RFM concept was described by Woolcott and Bergman in 2018 and provides distinct equations for each gender[4]. Its generic equation is: RFM = 64 – (20*height/waist) + (12*gender) [1 in women; 0 in men)]. To determine the RFM formulas, the authors considered different population groups and the correlation with dual-energy X-ray absorptiometry (DXA) as a benchmark[4]. One major advantage is that, for calculation purposes, only the waist circumference needs to be measured (as well as height). This means that measurement errors are few and far between when compared with the measurement of skinfolds. Geometric vision of what is being linked is far more logical for interpreting obesity than it is when using BMI. The RFM concept can be thought of as a cylinder, meaning that fat percentage in individuals of the same height is higher in those with a larger waist, and vice-versa; the same waist measurement indicates a larger fat component when the height measurement is smaller. Whereas the BMI is a mass divided by a surface, something that is difficult to visualise. A formula adapted to children and adolescents has also been described[5] and a growing body of benchmark data is being produced for different populations while the number of studies to validate its use is increasing[6], as is the number of those who prefer it over the BMI[7,8]. I believe it is a cheap, fast and reliable option for describing our populations, with or without the BMI, and one worthy of more attention in the field of sports medicine.

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