



## Determinants of body composition in children and adolescents

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### Histórico

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Analysis of body composition is fundamental not only to evaluate obesity, but also to know the nutritional status, the effect of diet, physical activity, and several changes associated with the nutritional status itself<sup>1</sup>. Several already known and studied factors exist that interfere in body composition, like age, weight, and height. This editorial seeks to address the importance of other possible determinants of body composition in children and adolescents.

### Body composition and its evaluation methods

Body composition is the ratio between the different bodily components and total body mass, usually expressed by the percentage of fat mass and lean mass<sup>2</sup>. Among the characteristics and functions of the parameters commonly used to evaluate the composition, the following are the most accepted: total fat mass (TFM) has both energy reserve and thermal insulation functions and is mostly located in the subcutaneous tissue (80% of TFM). Fat-free mass (FFM) is basically composed of minerals, proteins, glycogen, and water. Water represents around 55% to 65% of the body weight and 73% of the FFM, which may increase with age<sup>3</sup>.

Currently, a number of tools is available to evaluate the nutritional status and body composition. The tools most-often used to measure body composition are body mass, height, skinfolds, body perimeters, and body mass index (BMI)<sup>4</sup>. Although BMI is widely used to assess body fat, its principal disadvantage is that it does not distinguish between the types of tissues analyzed. Thus, increased BMI may result in either increased fat mass and/or increased lean mass. This may lead to a misclassification of the nutritional status<sup>5</sup>.

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Electrical bio-impedance (EBI) is another method used to study body composition, both in the clinical practice as in research<sup>6</sup>. The EBI evaluation is based on the conduction of an electrical current through the body fluids, with the results assessed from the difference of electrical conductivity of the tissues. The EBI manages to adequately define body composition, identifying individually the FFM and TFM, intra- and extra-cellular fluids, metabolic rate, and phase angle (PA). The EBI is recommended because it has less variability in its estimations than other simpler methods, like BMI<sup>7</sup>.

### **Determinants for body composition through bio-impedance in children and adolescents**

A series of differences exist between the body composition of children and adults. Body composition measurements in children are inherently challenging due to the rapid changes related to growth in height, FFM, and fat mass (FM)<sup>6</sup>. Knowing those changes is fundamental to the quality of clinical follow-up<sup>8</sup>. In body composition studies, many objective measures are already well-studied, like height, weight, age, skinfolds, and waist circumference among others and several Cartesian justifications have been presented to influence these determinants in body composition.

Upon evaluating the eco-social theory of disease distribution, we identify that most studies on the determinants for body composition did not consider an ecological, oriented, integrative, multilevel approach that considers the biological, population, and socio-economic factors of these measures<sup>9</sup>.

The nutritional status has been recognized as a measure that reflects health status differences in the population caused by the relationship among groups and not merely related to intrinsic biology. According to Krieger, a limitation we must consider in population studies is how populations and groups are defined. When we evaluate population data, we must consider that history influences health parameters in both the past and the present<sup>9</sup>, we should also consider the influence of factors denominated health protectors: practice of physical activity, adequate diet in the different age groups, and the individual socioeconomic condition<sup>10</sup>.

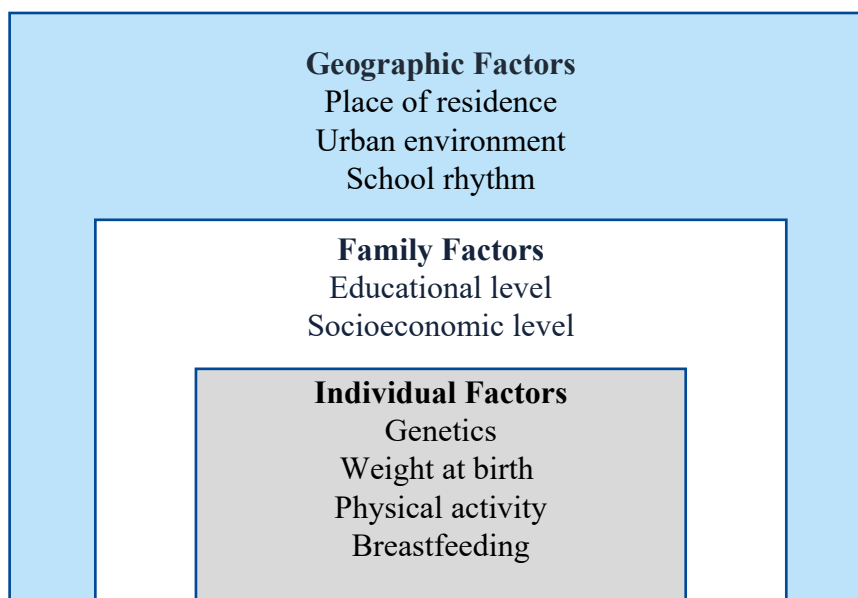
In recent years, a multifactorial etiology has been recognized, which interferes with body composition and the importance of considering an integral and socioecological understanding of the associated risk factors and the so-called protective factors<sup>11</sup>. Thus, body composition can also result from the interaction between environmental and genetic factors, race and ethnicity, and geographic and cultural differences. Determinants, such as educational level, socioeconomic “*status*”, place of residence, “*level*” of sexual maturation, weight at birth, breastfeeding, physical activity, screen time, and chronic diseases may be part of the body composition study<sup>12</sup>.

### **And how to justify the mechanisms involved with each of these determinants in body composition?**

According to Beghin *et al*<sup>13</sup>, the determinants of body composition would be divided into three levels: individual factors, family and care factors, and socioeconomic and geographic factors, as shown in [Figure 1](#). As the main players,

at the individual level the genetic mutations that influence the body composition through increased BMI (Pro12Ala that increase insulin resistance) and fat mass obesity associated gene (SNP rs9939609 gene) that also increase BMI, and the mutation related to lipid metabolism (Pro 446Leu) that increases triglycerides<sup>14</sup>. All mutations can be neutralized or reduced by breastfeeding or physical activity. Still in the first level is low birth weight that is related to increased insulin resistance and/or high abdominal adiposity and which could be reduced or canceled by breastfeeding or physical activity. In the second level, the socioeconomic status of the parents has a positive relation with the level

of physical activity of the children, but it can also be observed that encouragement by the father, regardless of socioeconomic status, increases the level of physical activity of his children. Regarding social and geographic factors, children and adolescents who spend more time in school have a higher level of physical activity and the urban environment influences physical activity. Those living in places with greater road traffic have less physical activity. On the other hand, places with bike paths, squares, parks, sidewalks, and gardens and sports events available near the homes improve the physical conditions of the residents of these places<sup>13</sup>.



**Figure 1. Different levels of factors influencing on the nutritional status of children and adolescents**

Regarding gender and its influence on body composition, considering brain structures, mental cognition, health, use of substances, personality, body composition, cardiovascular function, metabolism, and diet, differences exist between genders for the brain and body phenotypes. To

specifically exemplify the differences between the sexes, gender, and body composition, we can mention the accumulation of visceral fat associated with lower performance in the measurement of executive function; this association is present in female adolescents, but not in males.

In addition, visceral fat is associated with increased pressure levels in male adolescents, but it is not present in female adolescents. Most differences between the sexes in relation to brain and body composition probably occur during childhood or early adolescence; leading us to reflect on the impact of genetic factors and that these operate independently from the gonadal hormones and which can be influenced by environmental factors, such as individual access to education or gender stereotypes<sup>15</sup>.

In summary, considering the social inequalities and the cultural diversities of the populations, the study of different determinants for the body composition of children and adolescents can provide information to develop public policies on health and health education, as well as lifestyle changes. Future studies that evaluate, explore, and compare these and other likely determinants of body composition will be paramount importance.

**Conflict of interest:** The authors declare no conflict of interest.

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