The Body Mass Index

Advantages, Limitations, and Alternatives

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Abstract – A brief introduction to the Body Mass Index (BMI). Read about its advantages, limitations, and alternatives.

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Disclaimer: This is a complementary article for the [Body Mass Index Calculator](#) available at Minerazzi.com. The content of the article was adapted from the resources listed in its References section.

The Body Mass Index Defined

The Body Mass Index (BMI), also known as Quetelet's Index after Adolphe Quetelet (1796-1874), categorizes people's weight.

A BMI is the weight of a body divided by the square of its height, $BMI = M/H^2$, and reported in kg/m^2. If pounds and inches are used, the result is multiplied by 703 $(kg/m^2)/(lb/in^2)$.

The following table lists BMI categories and cutoff values. In the table, $BMI_{prime} = BMI /25$ where 25 is the upper optimal limit and overweight lower limit.

BMI for adults 20 years old and older regardless of age, sex, or gender.

Category	BMI (kg/m^2)	BMI$_{prime}$
Underweight	< 18.5	< 0.74
Normal (healthy) weight	18.5 – 24.9	0.74 < 0.99
Overweight	25.0 – 29.9	1.00 – 1.19
Obese Class I (Moderately obese)	30.0 – 34.9	1.20 – 1.39
Obese Class II (Severely obese)	35.0 – 39.9	1.40 – 1.59
Obese Class III (Very severely obese)	≥ 40.0	≥ 1.60

Advantages

BMI allows doctors to discuss weight problems more objectively with their patients; it is helpful as a global index of nutrition and as a screening tool.

BMI$_{prime}$ is useful clinically because it shows by what ratio a person deviates from the maximum optimal BMI. For instance, individuals with a BMI of 34 kg/m^2 have a BMI Prime of 34/25 = 1.36, and are 36% over their upper mass limit.

BMI is age and sex-specific for children and teens (2 to 19 years old) because the amount of body fat changes with age and between girls and boys. In this case, BMI is reported as a percentile ranking using reference populations from same age and same sex individuals.

Limitations

A BMI does not diagnose disease or illness, ignores variations in frames, physical characteristics, and populations, and does not distinguish between body fat and lean body mass. In general, at the same BMI:

- Women tend to have more body fat than men.
- The amount of body fat may be higher or lower depending on the racial/ethnic group.
- Older people, on average, tend to have more body fat than younger adults.
- Athletes have less body fat than non-athletes.

The index can be misleading for highly active people like athletes with a high muscle-to-fat ratio.

In general, a BMI is not helpful for assessing body composition because it does not discriminate between the following types of mass in a body:

- Body fat = essential fat mass + stored fat mass

- Lean body mass = muscle mass + bone mass + fluids mass

- Muscle mass = skeletal muscle mass + smooth muscle mass + cardiac muscle mass

Essential fat is found in bones, liver, kidneys, intestines, and muscles and is required for a body to function normally. Stored fat mass is found in adipose tissue and is used as energy and to insulate and cushion the body. Stored fat mass surrounds organs and is under the skin.

Excess of stored fat mass must be kept under close watch. This is the type of fat that leads to chronic diseases and conditions like obesity, heart failure, diabetes, and fatigue. Individuals with excessive fat stored in the abdominal area (abdominal fat) have a greater risk of heart disease and cancer than individuals with similar BMIs who store their fat in other areas.

Alternatives

Due to its limitations, the following BMI alternatives have been proposed:

- New Body Mass Index (BMI$_{new}$)

- Surface-based Body Shape Index (SBSI)

- As Body Shape Index (ABSI)

- Corpulence Index (CI)

- Modified Body Mass Index (mBMI)

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