Broca Index: A Simple Tool to Measure Ideal Body Weight

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Abstract

Proper measure of ideal body weight (IBW) is necessary in medical science. According to physicians, IBW is related to the lowest morbidity and mortality. Broca Index (BI) is a simple and effective tool to measure IBW; and general physicians, nutritionists, and Life Insurance Companies can use it confidently. In this mini review aspects of Broca Index (BI) are discussed for the calculation of ideal body weight (IBW) of health conscious people.

Keywords: Broca Index, ideal body weight, BMI

1. Introduction

In the 21st century, obesity becomes a global health problem for both developed and developing countries (WHO, 2020). It is considered as one of the most fatal health issues worldwide (Mohajan & Mohajan, 2023c). To measure obesity various anthropometric measurement indices are available. But most of them require more time, a lot of money, tedious methodology, etc. (Bhurosy & Jeewon, 2013). At present also there are many formulas to calculate ideal body weight (IBW), but most of them are very complicated to common people. Only an expert can determine the actual IBW value, and also require charts or calculators to find out it (Alejandro et al., 2018; Mohajan & Mohajan, 2023d). For example, Body Mass Index (BMI) is a popular and reliable anthropometric tool to measure obesity, but it is not a simple method for common people (Henriques et al., 2019).

Broca Index (BI) is an estimation of IBW, where only height in centimeter is used for the measurement. It is the easiest method to calculate the ideal body weight for height. It is developed in 1871 by a French army physician, anatomist, and anthropologist, Pierre Paul Broca (1824-1880). For BI estimation only a single measurement of height in centimeter (cm) is necessary (Laurent et al., 2020). Although Broca Index (BI) is very simple in measurement, it is now considered as outdated, and physicians and clinicians preferred Body Mass Index (BMI) to use in their treatment (Alejandro et al., 2018).

2. Literature Review

The literature review is an introductory division of any research that displays the works of previous researchers in the same field (Polit & Hungler, 2013). It often behaves with a secondary research source and does not study about future research work (Gibbs, 2008). Weber-Sanchez Alejandro and his coauthors have tried to verify validity of BI compared with Hammond and Robinson formulas, and with IBW that has calculated from ideal body mass index (BMI) (Alejandro et al., 2018). Lipscombe Clare Bernadette and Lipscombe Trevor have established a series of mathematical formulae of IBW to compare the BMI and IBW formulas by means of the ANSURII database (Bernadette & Trevor, 2021).

Jenyz M. Mundodan and his coworkers aim to identify 'normal range' for Broca Index, which resembles to the

normal range for BMI. They have advised that the weight of a person should ideally be within 81% to 95% of Broca Index (Mundodan et al., 2018). Ramirez López Erik and his coworkers compare the perceived ideal body weight (PIBW) with the calculated IBW by formulas and the BMI of 22. They have obtained that the IBW formulas and BMI of 22 does not necessarily represent a desirable or aesthetic weight (Erik et al., 2018).

3. Research Methodology of the Study

The academicians always take the research as an essential and influential work to lead in academic world (Pandey & Pandey, 2015). Methodology is a guideline to complete a familiar research that helps the researchers to grow the trust of a reader in the research findings (Kothari, 2008). Combining both concepts above, we have realized that the research methodology is a way to the researchers for organizing, planning, designing, and conducting a good research (Legesse, 2014). We have briefly described the Body Mass Index (BMI) and obesity, and then we have briefly discussed Broca Index (BI) to determine ideal body weight (IBW). Finally, we have highlighted on the drawbacks of BI. We have used Broca Index (BI) related secondary data sources to prepare this mini review research paper (Mohajan, 2018a,b, 2020).

4. Objective of the Study

Main objective of this study is to discuss Broca Index (BI). It is a very simple in measurement and works only with one standard measurement, height. Other trivial objectives of the study are as follows:

- to highlight on BMI and obesity, and
- to show the limitations of BI.

5. Body Mass Index (BMI)

Belgian Flemish astronomer, mathematician, statistician, and sociologist, Lambert Adolphe Jacque Quetelet (1796-1874), has developed Body Mass Index (BMI) (Mardolkar, 2017). The BMI is a measure of human body fat based on height and weight, where height is measured in meters, and mass in kilograms (Taylor et al., 1998). At present BMI is one of the best available and highly used anthropometric estimates of body fatness for public health purposes (Bhurosy & Jeewon, 2013). The metric formula of BMI is as follows (WHO, 2004):

$$BMI = \frac{mass_{kg}}{height_m^2},\tag{1}$$

where unit is kg/m^2. Four categories of BMI were established by World Health Organization (WHO) as: underweight, normal, overweight, and obese (WHO, 1995). An individual is considered underweight if his/her BMI is under 18.5, normal weight if it is within 18.5 to 24.9, overweight if it is within 25 to 29.9, and obese if it is 30 or more (Di Angelantonio & Bhupathiraju, 2016).

6. Obesity

Obesity is defined as an individual having a BMI of 30 and above (WHO, 2020). It is a multifactorial chronic disease that is developed in human body when series of excess food taking happens such a way that energy intake exceeds consumption, i.e., the excess amount of calories is taken in and less is burnt (Chooi et al., 2019). It is growing among industrial, developed and developing and transition economies around the world (Shetty & Schmidhuber, 2011). It has spread worldwide due to the popularity of junk food, changing lifestyles, increasing incomes, urbanization, and aggressive marketing (Lee et al., 2022). Obesity is a consequence of many non-communicable diseases (NCDs), such as hypertension, cardiovascular diseases, Alzheimer disease, asthma, metabolic syndrome, liver steatosis, gallbladder disease, osteoarthritis, obstructive sleep apnea, certain types of cancer, hypercholesterolemia, metabolic syndrome, musculoskeletal disorders, and type 2 diabetes (Mohajan &, Mohajan 2023a, b).

7. BI Formula

At present accurate assessment of obesity becomes a public health concern. BI can be expressed as a simple equation as (Rössner, 2007),

$$\text{Standard weight (kg)} = \text{height (cm)} - 100.\tag{2}$$

When Dr. Broca had developed the Broca Index (BI), it was used to find only normal weight, but later it was expanded to ideal body weight (IBW) (Laurent et al., 2020). For example, a male of 163 cm tall will have a standard weight of 63 kg. For females, the standard weight is 10% less than that of male. For example, a female of 163 cm tall will have a standard weight of 63 × 0.9 = 56.7 kg (Erik et al., 2018). Obesity occurs when the weight is 20% in excess of BI value that gives a normal Broca weight within the BMI range of 20 to 25 (James

et al., 1998).

The IBW is boon for the human and is related to the lowest mortality. An insurance company considers IBW as a standard measure to identify healthy population (Shah et al., 2006). Broca Index (BI) and BMI cut-offs have a correlation; consequently Broca index can be used for body fat measurement (Alejandro et al., 2018). BI is developed more than 150 years ago in France, but still it is a valid and effective method to determine IBW. For its simplicity it is commonly used in some countries of the world, such as in India, Japan, the Czech Republic, etc. (Shah et al., 2006). BI could be a useful tool for nonprofessionals who face difficulty to calculate their BMI (Laurent et al., 2020).

8. Limitations of Broca Index

Broca Index works only with one standard measurement, i.e., height. One major fault of it is that it is not specific for height outliers, and also it does not provide correct value for infants. Broca index do not make the difference among muscle mass, large frames, and body fat mass (Godescu, 2020). Some people who are well developed physically, such as athletes, strong workers, muscular persons, gymnasts, acrobats, etc.; they are considered as obese by Broca Index due to their larger muscles and body frames than the average (Rahman & Adjeroh, 2015). Hence, Broca Index does not offer a correct diagnostic in these situations, and does not make the difference among muscles mass, large frames and body fat mass (Krakauer & Krakauer, 2012).

9. Conclusions

In the study we have observed that BI offers the same accuracy formula as other more complex formulas that provide to measure overweight and obesity. But at present it is rarely used in healthcare and nutrition science. Since BI has validity and utility in clinical practice, and also for its simplicity we, the common people can use it for the measurement of our IBW as an alternative tool. In the crowded areas where outpatients are numerous and patients are not critically ill; general physicians can take Broca Index (BI) as their measurement for treatment in. Also nutritionists can assess the general nutritional status through the use of BI. To maintain an aesthetic figure, health conscious people can use Broca Index (BI) confidently. Life Insurance Companies can also use Broca Index (BI) to open account for the healthy beneficiaries.

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