

## **BODY MASS INDEX - INDICATOR OF HEALTH**

Nicolae Nicoară<sup>\*</sup>, Gineta Holt<sup>\*</sup>, Ioana Moga<sup>\*</sup>, Dorel Tirt<sup>\*</sup>, Aida-Adela Miron<sup>\*\*</sup> Alexandra Pop<sup>\*\*</sup>

<sup>\*</sup> University of Oradea, Faculty of Medicine and Pharmacy, Department of Morphological Sciences, Oradea, Romania, e-mail: [nicduni@yahoo.com](mailto:nicduni@yahoo.com)

<sup>\*\*</sup> University of Oradea, Faculty of Medicine and Pharmacy, e-mail: [alepop95@yahoo.com](mailto:alepop95@yahoo.com)

### **Abstract**

*BMI is used to identify ideal weight limits in the general population. It uses two parameters and specifics: height and weight. Normal limits are considered between 18.5-25kg / m<sup>2</sup>. Many diseases are associated with BMI beyond normal limits. Through the studies of recent years it has been observed that BMI does not provide such a close correlation between ideal weight and health. Other parameters should be taken into account when formulating guidelines for maintaining good health. The existence of two types of fat is known: white fat, deposit and brown fat, with a role in the production of heat. The increased proportion of brown fat has a protective effect on the cardiovascular and metabolic system even in the presence of an increased body mass index. The BMI is inaccurate for athletes because the muscle mass is very well developed, with the percentage of body fat being between 10-15%.*

**Key words:** body mass index, balance, metabolic diseases

### **INTRODUCTION**

BMI's foundations were put by Adolphe Quetelet, a Belgian scientist, between 1830-1850 and named it "social physique" ( Eknoyan G ,2008).The modern BMI formula was first published in July 1972 in the Journal of Chronic Diseases by Ancel Keys. In this article, the author arguing that the BMI has a relative value in determining obesity (Blackburn H, Jacobs D, 2014,). The current interest in BMI is due to the rise in obesity

rates in Western-developed societies (Who, E.C., 2004). Some argue that other metric ear measurements could be more useful, such as waist circumference (Janssen, I. et al, 2004). The normal values are between 18.5-25 kg / m<sup>2</sup> which is considered the optimal weight; below this limit, it is considered that a person is underweight, over 25-overweight, and over 30-obesity (Flegal, K et al, 2012). Some athletes, although having a BMI outside normal limits, are due to high muscle mass in relation to body fat, which can lead to false interpretations of obesity (Frayling, T.M. 2007). The WHO believes that a BMI <18.5 may indicate malnutrition, eating disorders or other illnesses (Mei, Z., 2002). Overweight and obese are considered at risk for several diseases, including coronary artery disease, type 2 diabetes, biliary calculi, sleep apnea (Finucane, M.M. 2011). In clinical practice, there is a need for quantified terms that give indications of body health. For a body to be considered healthy, its composition must be in balance, ie the main constituents of the human body, such as: proteins, carbohydrates, lipids and water, should be in balance to allow optimal functioning of the body (Cole, T.J, 2005). The most accessible method is to measure body weight, but this method is very relative due to the difference in stature and gender of a person. Thus, the body mass index indicates more accurately the optimal parameters (Prentice, A.M. and Jebb, S.A., 2001).

#### **MATERIAL AND METHOD**

In view of the new findings, it has been observed that an optimal body mass index can lead to certain cardiac or metabolic diseases. The body mass index, we believe, is no longer a true health indicator. Visceral fat has been found to be closely correlated with cardiac diseases through unknown mechanisms (Dobbelsteyn, C.J, 2001). We believe that an assessment of body proportions in terms of muscle mass, adipose mass and bone mass is a more accurate indicator of the risks of metabolic diseases. Estimating the distribution between muscle mass and body fat is inaccurate, with the BMI focusing on body fat overestimation. A 2008 study in the US showed that obesity (BMI > 30) was present in 21% of men and 31% of women, but using a method that estimates the proportion of body fat, it was noticed that in fact, obesity is present in 50% of men and 62% of women. BMI has a high specificity in terms of obesity (95% for men and 99% for women) but low sensitivity (36% for men and 49% for women) (Romero-Corral, A, 2008). Other methods of measuring body fat include waist-hip ratio and waist circumference measurement (Lean, M.E.J., Han, T.S. and Morrison, C.E., 1995). Obesity with normal BMI is defined as a situation where

body weight is within normal limits but with a high percentage of body fat and that has the same health risks as obesity itself (Kopelman, P.G., 2000). As far as the percentage of body fat is concerned, it is not an accepted general definition of obesity. Most researchers use as a percentage of body fat > 25% for men and > 30% for women as the threshold of obesity (Frankenfield, D.C., 2001). Hydrostatic weight measurement is a method of measuring the body mass per unit volume of a living person, being a direct application of Archimedes' law in which an object replaces its own volume of water (Jackson, A.S. and Pollock, M.L., 1978).

## **RESULTS AND DISCUSSION**

The body mass index proposed by the WHO has long been considered a gold standard in terms of optimum health. However, new findings have shown that disease can occur even under optimal body mass index. Visceral fat is the most commonly criticized for this. On the other hand, the existence of two types of fat is known: white fat, deposit and brown fat, with a role in the production of heat. The increased proportion of brown fat has a protective effect on the cardiovascular and metabolic system even in the presence of an increased body mass index. The BMI is inaccurate for athletes because the muscle mass is very well developed, with the percentage of body fat being between 10-15%. A better method of estimating body composition by measuring body fat by determining skin fold and immersion in water (Archimedes method), as well as other methods such as body volume index. Taking into account the failure of epidemiological methods to prevent chronic obesity diseases such as coronary artery disease, diabetes mellitus, hypertension, etc., using BMI can be considered to be a weak indicator with reduced sensitivity in terms of predicting the condition of health. It is known that body fat plays a role in chronic diseases by disrupting the endocrine control of metabolism (secretion of its own hormones). To predict a stable future health performance in the general population, focusing on measuring body fat percentage should be the main parameter taken into account.

## **CONCLUSIONS**

1. Body indexes are routinely used in medical practice to assess the health of patients.
2. The latest findings have shown a lack of correlation between body mass indexes and health status.
3. There is a need to develop new body mass indexes that are more accurate and correlated with health.

4. According to current literature data, the percentage of body fat is the most accurate parameter of health indication.
5. The BMI is relative in terms of athletes who have an extremely developed muscle mass in relation to the percentage of body fat, although according to this parameter they may be overweight or obese.
6. Replacing routine use of BMI with other methods such as waist-to-hip ratio or hydrostatic weight is considered to be more useful in current medical practice.

## REFERENCES

1. Blackburn H, Jacobs D, 2014, "Commentary: Origins and evolution of body mass index (BMI): continuing saga" (PDF). *International Journal of Epidemiology*. 43 (3): 665–9. doi:10.1093/ije/dyu061 Freely accessible. PMID 24691955.
2. Cole, T.J., Freeman, J.V. and Preece, M.A., 1995. Body mass index reference curves for the UK, 1990. *Archives of disease in childhood*, 73(1), pp.25-29.
3. Dobbelsteyn, C.J., Joffres, M.R., MacLean, D.R. and Flowerdew, G., 2001. A comparative evaluation of waist circumference, waist-to-hip ratio and body mass index as indicators of cardiovascular risk factors. *The Canadian Heart Health Surveys. International journal of obesity*, 25(5), p.652.
4. Eknayan G ,2008, "Adolphe Quetelet (1796-1874)--the average man and indices of obesity". *Nephrology, Dialysis, Transplantation*. 23 (1): 47–51. doi:10.1093/ndt/gfm517. PMID 17890752
5. Finucane, M.M., Stevens, G.A., Cowan, M.J., Danaei, G., Lin, J.K., Paciorek, C.J., Singh, G.M., Gutierrez, H.R., Lu, Y., Bahalim, A.N. and Farzadfar, F., 2011. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9· 1 million participants. *The Lancet*, 377(9765), pp.557-567.
6. Flegal, K.M., Carroll, M.D., Kit, B.K. and Ogden, C.L., 2012. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *Jama*, 307(5), pp.491-497.
7. Frankenfield, D.C., Rowe, W.A., Cooney, R.N., Smith, J.S. and Becker, D., 2001. Limits of body mass index to detect obesity and predict body composition. *Nutrition*, 17(1), pp.26-30.
8. Frayling, T.M., Timpson, N.J., Weedon, M.N., Zeggini, E., Freathy, R.M., Lindgren, C.M., Perry, J.R., Elliott, K.S., Lango, H., Rayner, N.W. and Shields, B., 2007. A common variant in the FTO gene is associated with body mass index and predisposes to childhood and adult obesity. *Science*.
9. Jackson, A.S. and Pollock, M.L., 1978. Generalized equations for predicting body density of men. *British journal of nutrition*, 40(3), pp.497-504.
10. Janssen, I., Katzmarzyk, P.T. and Ross, R., 2004. Waist circumference and not body mass index explains obesity-related health risk. *The American journal of clinical nutrition*, 79(3), pp.379-384.
11. Kopelman, P.G., 2000. Obesity as a medical problem. *Nature*, 404(6778), p.635.

12. Lean, M.E.J., Han, T.S. and Morrison, C.E., 1995. Waist circumference as a measure for indicating need for weight management. *Bmj*, 311(6998), pp.158-161.
13. Mei, Z., Grummer-Strawn, L.M., Pietrobelli, A., Goulding, A., Goran, M.I. and Dietz, W.H., 2002. Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *The American journal of clinical nutrition*, 75(6), pp.978-985.
14. Prentice, A.M. and Jebb, S.A., 2001. Beyond body mass index. *Obesity reviews*, 2(3), pp.141-147.
15. Romero-Corral, A., Somers, V.K., Sierra-Johnson, J., Thomas, R.J., Collazo-Clavell, M.L., Korinek, J., Allison, T.G., Batsis, J.A., Sert-Kuniyoshi, F.H. and Lopez-Jimenez, F., 2008. Accuracy of body mass index in diagnosing obesity in the adult general population. *International journal of obesity*, 32(6), p.959.
16. Who, E.C., 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet (London, England)*, 363(9403), p.157.