International Journal of Medical and Health Research
ISSN: 2454-9142
www.medicalsjournals.com
Volume 2; Issue 3; March 2016; Page No. 64-67

BMI for health and fitness

[1] Anita Pharswan, [2] Pankaj Singh, [3] Virendra Singh

[1] Asst. Professor in Physical Education (Guest Faculty), HNBGU, Srinagar, Uttarakhand, India.

[2] Physical Education Teacher, Kendriya Vidyalaya, New Cantt, Allahabad, India.

[3] Research Scholar, Dept. of Physical Education and Sports, AMU, Aligarh, Uttar Pradesh, India.

Abstract
The purpose of the study was to spread awareness among the people about the present scenario of Health and fitness related challenges, especially obesity by calculating Body Mass Index. BMI is generally used as a means of correlation between groups related by general mass and can serve as a vague means of estimating adiposity.
The duality of the BMI is that, while it is easy to use as a general calculation, it is limited as to how accurate and pertinent the data obtained from it can be. Generally, the index is suitable for recognizing trends within sedentary or overweight individuals because there is a smaller margin of error.
The accumulation of too much fat in the body, leads to serious health risks, including death in severe cases of obesity, especially morbid obesity. Therefore, irrespective of the causes of obesity, it is essential for obese people to take suitable steps for losing as much weight as is necessary to bring it to the level of normal BMI.

Keywords: BMI, Health and fitness, Body Mass Index, overweight

Introduction
Studies predict that India will be the global diabetes capital by 2050 if the abdominal and lower limb obesity and metabolic syndrome are not arrested. Alarmed by reports, the Health Ministry has reduced the cut-off for body mass index (BMI) to 23 kg/m^2 to fight the battle against obesity. If your BMI is over 23 kg/m^2, then you are considered obese. The global standard for BMI is 25 kg/m^2. So, someone considered not obese by most international standards, might be obese in India [1].

The guidelines were released jointly by the Health Ministry, the Diabetes Foundation of India, the All-India Institute of Medical Science (AIIMS), Indian Council of Medical Research, the National Institute of Nutrition and 20 other health organisations - Those with BMI of 25 kg/m^2 will be clinically termed obese (as opposed to 30 kg/m^2 at the international level) and those with BMI of 32.5 kg/m^2 will require bariatric surgery to eliminate excess flab. "The Indian body composition puts them in high risk for diabetes and hypertension [2].

Meaning
BMI is "Body Mass Index". It tells you whether your body weight is appropriate for your height.

Definition
Body Mass Index (BMI) is a measure of body fat based on height and weight that applies to both adult men and women.

Formula
Body Mass Index (BMI) is weight (kg) divided by height (cm) squared.
BMI = Weight in kilograms / (Height in meters) ^{2}

Metric
Weight (kg) / [Height (m)]^2

English
(Weight (lb) / [Height (in)]^2) x 703
Now a day's BMI calculator is easily available on various sites.

BMI is a gross estimate for the amount of fat in your body. It tells you whether you need to lose weight or not. Not all adults who have a BMI in the range labeled "healthy" are at their most healthy weight. They may have lots of fat but very little muscle. Similarly, if you are an athlete or exercise a lot, then you may have lots of muscle and less fat and if your BMI is more than the normal range, then it may still be healthy. The BMI normal range is not applicable to pregnant and breast feeding mothers.
Normal BMI value range is 18.5-23. In Indians it is advisable that the BMI be not more than 22.9*

Interestingly, many successful athletes seem to have their BMI around 21:

- Haile Gebrselassie (the current marathon world record holder): 21.1.
- Scott Jurek (world's no.1 vegan ultrarunner): 21.2.
- Chrissie Wellington (Ironman Hawaii winner 2007 & 2008): 20.8.
- Craig Alexander (Ironman Hawaii winner 2008): 21.0.

The body mass index (BMI), or Quetelet index, is a statistical measurement which compares a person's weight and height. Though it does not actually measure the percentage of body fat, it is used to estimate a healthy body weight based on how tall a person is. Due to its ease of measurement and calculation, it is the most widely used diagnostic tool to identify weight problems within a population, usually whether individuals are underweight, overweight or obese. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics" [3].

While the formula for BMI dates to the 19th century, the term "body mass index" for the ratio and its popularity date to a 1972 paper by Ancel Keys, which found the BMI to be the best proxy for body fat percentage among ratios of weight and height [2]., the interest in measuring body fat being due to obesity becoming a discernible issue in prosperous Western societies. BMI was explicitly cited by Keys as being appropriate for population studies, and inappropriate for individual diagnosis. Nevertheless, due to its simplicity, it came to be widely used for individual diagnosis, despite its inappropriateness.

BMI provided a simple numeric measure of a person's "fatness" or "thinness", allowing health professionals to discuss over- and under-weight problems more objectively with their patients. However, BMI has become controversial because many people, including physicians, have come to rely on its apparent numerical authority for medical diagnosis, but that was never the BMI's purpose; it is meant to be used as a simple means of classifying sedentary (physically inactive) individuals with an average body composition. For these individuals, the current value settings are as follows: a BMI of 18.5 to 25 may indicate optimal weight; a BMI lower than 18.5 suggests the person is underweight while a number above 25 may indicate the person is overweight; a BMI below 17.5 may indicate the person has anorexia nervosa or a related disorder; a number above 30 suggests the person is obese (over 40, morbidly obese).

For a given height, BMI is proportional to weight. However, for a given weight, BMI is inversely proportional to the square of the height. So, if all body dimensions double, and weight scales naturally with the cube of the height, then BMI doubles instead of remaining the same. This result in taller people having a reported BMI that is uncharacteristically high compared to their actual body fat levels. This anomaly is partially offset by the fact that many taller people are not just "scaled up" short people, but tend to have narrower frames in proportion to their height. It has been suggested that instead of squaring the body height (as the BMI does) or cubing the body height (as the Ponderal index does), it would be more appropriate to use an exponent of between 2.3 to 2.7. The WHO regard a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese. These ranges of BMI values are valid only as statistical categories when applied to adults, and do not predict health [5].

Category	BMI range – kg/m^2	BMI Prime	Mass (weight) of a 1.8 metres (5 ft 11 in) person with this BMI
Severely underweight	less than 16.5	less than 0.66	under 53.5 kilograms (8.42 st; 118 lb)
Underweight	from 16.5 to 18.4	from 0.66 to 0.73	between 53.5 and 60 kilograms (8.42 and 9.45 st; 118 and 132 lb)
Normal	from 18.5 to 24.9	from 0.74 to 0.99	between 60 and 81 kilograms (9.4 and 13 st; 130 and 180 lb)
Overweight	from 25 to 30	from 1.0 to 1.2	between 81 and 97 kilograms (12.8 and 15.3 st; 180 and 210 lb)
Obese Class I	from 30.1 to 34.9	from 1.21 to 1.4	between 97 and 113 kilograms (15.3 and 17.8 st; 210 and 250 lb)
Obese Class II	from 35 to 40	from 1.41 to 1.6	between 113 and 130 kilograms (17.8 and 20.5 st; 250 and 290 lb)
Obese Class III	over 40	over 1.6	over 130 kilograms (20 st; 290 lb)

These recommended distinctions along the linear scale may vary from time to time and country to country, making global, longitudinal surveys problematic. In 1998, the U.S. National Institutes of Health brought U.S. definitions into line with World Health Organization guidelines, lowering the normal/overweight cut-off from BMI 27.8 to BMI 25. This had the effect of redefining approximately 25 million Americans, previously "healthy" to "overweight". It also recommends lowering the normal/overweight threshold for South East Asian body types to around BMI 23, and expects further revisions to emerge from clinical studies of different body types.

In Singapore, the BMI cut-off figures were revised in 2005 with an emphasis on health risks instead of weight. Adults whose BMI is between 18.5 and 22.9 have a low risk of developing heart disease and other health problems such as diabetes. Those with a BMI between 23 and 27.4 are at moderate risk while those with a BMI of 27.5 and above are at high risk of heart disease and other health problems.

Category	BMI range – kg/m^2
Emaciation	less than 14.9
Underweight	from 15 to 18.4
Normal	from 18.5 to 22.9
Overweight	from 23 to 27.5
Obese	from 27.6 to 40
Morbidly Obese	greater than 40

Limitations and shortcomings

Some argue that the error in the BMI is significant and so pervasive that it is not generally useful in evaluation of health. University of Chicago political science professor Eric Oliver says BMI is a convenient but inaccurate measure of weight, forced onto the populace, and should be revised [6].

The medical establishment has generally acknowledged some shortcomings of BMI. Because the BMI is dependent only

upon weight and height, it makes simplistic assumptions about distribution of muscle and bone mass, and thus may overestimate adiposity on those with more lean body mass (e.g. athletes) while underestimating adiposity on those with less lean body mass (e.g. the elderly).

A 2005 study in America showed that overweight people actually had a lower death rate than normal weight people as defined by BMI.

In an analysis of 40 studies involving 250,000 people, patients with coronary artery disease with normal BMIs were at higher risk of death from cardiovascular disease than people whose BMIs put them in the "overweight" range (BMI 25-29.9). In the intermediate range of BMI (25-29.9), BMI failed to discriminate between body fat percentage and lean mass. The study concluded that "the accuracy of BMI in diagnosing obesity is limited, particularly for individuals in the intermediate BMI ranges, in men and in the elderly. These results may help to explain the unexpected better survival in overweight/mild obese patients. Patients who were underweight (BMI <20) or severely obese (BMI ≥35) did, however, show an increased risk of death from cardiovascular disease.

Body composition for athletes is often better calculated using measures of body fat, as determined by such techniques as skinfold measurements or underwater weighing and the limitations of manual measurement have also led to new, alternative methods to measure obesity, such as the body volume index. However, recent studies of American football linemen who undergo intensive weight training to increase their muscle mass show that they frequently suffer many of the same problems as people ordinarily considered obese, notably sleep apnea.

A further limitation relates to loss of height through aging. In this situation, BMI will increase without any corresponding increase in weight.

A study by Romero-Corral et al., using data representing non-institutionalized civilians in the United States, found that BMI-defined obesity was present in 19.1% of men and 24.7% of women, but that obesity as measured by bodyfat percentage was present in 43.9% of men and 52.3% of women.

The exponent of 2 in the denominator of the formula for BMI is arbitrary. It is meant to reduce variability in the BMI associated only with a difference in size, rather than with differences in weight relative to one's ideal weight. If taller people were simply scaled-up versions of shorter people, the appropriate exponent would be 3, as weight would increase with the cube of height. However, on average, taller people have a slimmer build relative to their height than do shorter people, and the exponent who matches the variation best is between 2 and 3. An analysis based on data gathered in the USA suggested an exponent of 2.6 would yield the best fit for children aged 2 to 19 years old. The exponent 2 is used instead by convention and for simplicity.

As a possible alternative to BMI, the concepts fat-free mass index (FFMI) and fat mass index (FMI) were introduced in the early 1990s [7].

The advantages of the present chart are the following: (i) it is very simple to use and demonstrate. The weight and height can be plotted in the same chart and BMI can be directly read from the right margin of the chart. It avoids the tedious calculation of BMI; (ii) The same chart can be used for both sexes; (iii) In addition to incorporating weight, height and BMI in the same chart, it also depicts the various curves denoting normal range, underweight or CED, overweight (tendency for obesity) and obesity; (iv) It can diagnose both underweight and obesity and also shows the desirable weight range for the stature of an individual. This information may help to curtail future obesity as well as purposeful dieting and slimming especially in adolescent girls, who consider themselves obese, even though they are in the normal range; (v) the purposeful omission of a curve below BMI 15, for example, at BMI 13, will avoid false satisfaction among underweight adolescents that they are also above a curve. This is important because adolescence is the last and the final chance for them to grow and maintain normal body proportions; and (iv) This health path can also be used by adults to maintain optimum body proportions and thus remain fit and keep away from many of the lifestyle diseases [8].

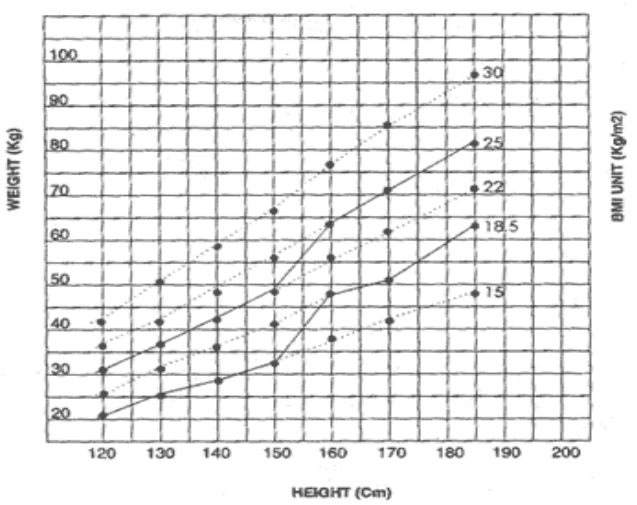

Fig. 1. The chart is applicable to both sexes. Plot the height on the X axis and the weight on the Y axis and then directly read the BMI from the right margin. For example, if the height is 160 cm and weight is 55 kg, BMI is 22 and if the height is 160 cm and weight id 60 kg, BMI is between 22 and 25. Readings between the bold lines is ideal. For those in the growing age group or up to a height of 150 cm, readings of BMI <15 indicates underweight or chronic energy deficiency (CED) and readings >22 indicate overweight and >25 indicates obesity. For those who have completed growth or above a height of 150 cm, readings of BMI <18.5[8] indicate underweight or chronic energy deficiency (CED) and readings >25 indicate overweight and >30 indicate obesity.

Applications

Public Health

The BMI is generally used as a means of correlation between groups related by general mass and can serve as a vague means of estimating adiposity. The duality of the BMI is that, while it is easy to use as a general calculation, it is limited as to how accurate and pertinent the data obtained from it can be. Generally, the index is suitable for recognizing trends within sedentary or overweight individuals because there is a smaller margin of error. The BMI has been used by the WHO as the standard for recording obesity statistics since the early 1980s.

This general correlation is particularly useful for consensus data regarding obesity or various other conditions because it

can be used to build a semi-accurate representation from which a solution can be stipulated, or the RDA for a group can be calculated. Similarly, this is becoming more and more pertinent to the growth of children, due to the fact that the majority of children are sedentary [9].

Clinical Practice

BMI categories are generally regarded as a satisfactory tool for measuring whether sedentary individuals are underweight, overweight or obese with various exceptions, such as: athletes, children, the elderly, and the infirm. Also, the growth of a child is documented against a BMI-measured growth chart. Obesity trends can then be calculated from the difference between the child's BMI and the BMI on the chart. In the United States, BMI is also used as a measure of underweight, owing to advocacy on behalf of those with eating disorders, such as anorexia nervosa and bulimia nervosa.

Legislation

In France, Israel, Italy and Spain, legislation has been introduced banning usage of fashion show models having a BMI below 18[10]. In Israel, a BMI below 18.5 is banned[11]. This is done in order to fight anorexia among models and people interested in fashion.

Conclusion

The accumulation of too much fat in the body, leads to serious health risks, including death in severe cases of obesity, especially morbid obesity. Therefore, irrespective of the causes of obesity, it is essential for obese people to take suitable steps for losing as much weight as is necessary to bring it to the level of normal BMI.

References:

1. http://fitho.in/2009/05/16/you-might-be-obese-check-new-indian-guidelines-here/
2. http://www.thaindian.com/newsportal/uncategorized/india-reworks-obesity-guidelines-makes-fitness-norms-tighter_10012347
3. http://www.dossier.net/utilities/bmi1/english2.html
4. http://preventdisease.com/news/12/061812_How-Flawed-And-Outdated-Is-The-Body-Mass-Index-BMI-Measurement.shtml
5. http://: (Edge Sports Performance, 2010)
6. http://en.wikipedia.org/wiki/Body_mass_index
7. http://www.bariatricmedicine.co.za/what-is-body-mass-index.asp
8. http://www.liquisearch.com/body_mass_index/limitations_and_shortcomings
9. Elizabeth KE. Consultant Pediatrician and Nutritionist, Department of Pediatrics,
10. S.A.T. Hospital, Medical College, Thiruvananthapuram, India.
11. Barasi ME. Human Nutrition- a health perspective. ISBN 0-340-81025-4, 2004.
12. Laura Stampler. France Just Banned Ultra-Thin Models. TIME.com.
13. ABC News. Israeli Law Bans Skinny, BMI-Challenged Models. ABC News.