FACTORS INFLUENCING BODY MASS INDEX, ADVANTAGES AND ITS LIMITATIONS

BY

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Abstract

This paper investigated the factors affecting Body Mass Index, Advantages and the limitations of Body Mass Index. The work describes the meaning of Body Mass Index, the factors affecting Body Mass Index, and the limitation of Body Mass Index. It is not expensive and it is easy to use. Body Mass Index investigate nutritional status of an individuals as a way of preventing chronic disease that can occur due to overweight or underweight, the higher BMI, the higher the risk of developing a range of health conditions associated with excess weight such as liver disease, arthritis, diabetes, cancers, hypertension and high cholesterol, Body Mass Index has been found the most appropriate, non- invasive and less expensive for determining nutritional status, BMI is calculated as weight in kilogram divided by height squared The result obtained is compared against BMI chart. This help to categorized the result obtained as underweight, normalweight, overweight and obese.There are different factors that influences BMI, such as physical exercise, socioeconomic status, Birth weight, Television factor, Natural condition, Environmental factor, Age and Sex. Despite the advantages of BMI, the following are some of the limitations, such as BMI calculation depend on the net weight and height of an individual and does not consider the distribution of muscles and bone mass, it does not differentiate between body fat and muscle mass, BMI cannot be used during pregnancy, there is a potential risk of over estimating fatness in individuals with high muscle mass such as athletics. This paper concluded that BMI is an acceptable tool for nutritional assessment. The studyrecommended among others that an individual should take the responsibility to know their nutritional status, by knowing their BMI, pregnant women, athletics should considered other methods due to their special body composition.

Key Words: Body Mass Index, Non Communicable Diseases, Nutritional Status.

Introduction

Body Mass Index is calculated as weight in Kilograms divided by height in meters squared (kg/m^2). The purpose of BMI is to identify within each population, the proportion health state that warrants a public health or clinical intervention. (WHO, 2004). One of the greatest public health challenges today is preventing the epidemics of overweight and obesity. Overweight and obesity result from energy imbalance between calories consumed from foods or beverages and calories expended in normal body functions or daily activities, with increased intake of energy dense foods and sugar- rich beverages and physical in activities (http://www.chp.gov.ht 2018). The world obesity federation estimated that over one billion adults were overweight and 425 million were obese globally obesity and its associated health

effects are becoming serious health concerns. Over weight and obesity are associated with increased risk of non-communicable diseases. (Little 2016).

BMI does not require special training. The results are easy to understand and achieved within short moments. The higher BMI, the higher the risk of developing a range of health conditions associated with excess weight such as liver disease, arthritis, diabetes, cancers, hypertension and high cholesterol, health Harvard edu/blog/how-useful-is-the-body-mass-index-bmi-20163309339-. It is generally accepted worldwide that BMI is highly sensitive to under-nutrition. BMI has been used in many contexts related to nutritional status. The basic intention according to world Health Organization (WHO) of nutritional assessment is to improve human health. Body Mass Index has been found the most appropriate, non- invasive and less expensive for determining nutritional status (Das, 2009).

According to Trustwell (2007), the two main types of methods used today for nutritional assessment are measuring weights and height and other body measurements, are biochemical tests, usually on blood, sometimes on urine. The BMI calculator divides weight in kilograms by height in meters squared. The resulting number is compared against the BMI chart. This help to categorize the result obtained as underweight, a healthy weight, overweight or obese, (gymnation.com / blogs/the- benefits- of calculating-bmi/).

The healthy range for most people is a BMI of 18.5 to 24.9, those with greater muscle mass may have a healthy weight range at a higher figure. Body mass index is an estimate of body fat based on height and weight. A high BMI can be a sign of too much fat on the body, while a low BMI can be a sign of too little fat on the body. The higher a person's BMI the greater their chances of developing certain serious conditions, such as high blood pressure, heart disease and diabetes. A very low BMI can result to health problems, such as osteoporosis, low immune function and anemia. People gain weight as a result of an energy imbalance. Healthy weight can be achieved by physical exercising and consumption of healthy diets. (Erica, 2016)

Overweight is defined as a body mass index of 25 to 29.9 while body mass index of 30 or higher obesity. The BMI cut points in adults are the same for men and women weight gain usually means adding more body fat, not adding more muscle. Weight gain in adulthood increases diseases risk. It is normal for children to have different amounts of body fat at different ages, also for boys and girls to have different amounts of body fats. The healthy range for BMI varies based on age and gender. The

healthy weight range for adults of BMI20to25 is not suitable measure for children and adolescent due to the amount of body fat different between boys and girls, also, the amount of body fat changes with age. BMI number is plotted on the BMI for-age growth charts for either boys or girls to obtained a percentile ranking, Thereafter, BMI is calculated for teens and children and classified as normal weight, overweight, underweight. And obese. The BMI for-age percentile is used to interpret the BMI number because it includes both sex and age specifics for teens and children, These criteria are not the same used to interpret BMIfor adults, which do not take sex or age into consideration (Kuczmarski,2001, Maruf, 2011)BMI is very easy to measure and calculate and is therefore the most commonly used tool to correlate risk of health problems with the weight at population level. BMI was developed as a risk indicator of disease. (www.who /int /en /health-topics/disease-prevention/nutrition/ a- healthy – lifestyle/ body- mass-index-bmi) The following are the factors influences BMI, advantages and the limitation of BMI,

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a. Physical exercise is very important for maintaining a healthy weight, maintenance and building of healthy of bone density including muscle strength, physical exercise has an influence on the human physique. Frequent physical activities can reduce the level of body fat and increased muscle mass. These factors therefore have influence on the basic Body Mass Index values of weight and height (Hung & Erang 2013). Physical active is usually encouraged as a health – promoting behavior, exercising compulsively and excessively is a common purging strategy used to compensate for caloric intake or to change one's body weight, The negative associations between weight, body image, and physical activity are unfortunate given that the positive effects of engaging in physical activity on body image, with and without changes in body composition, are consistently demonstrated in the literature. (Monteiro, Amara; Oliveira & Borges, 2011). Many people are concern about their weight, yet they avoid physical activities, pathogenic weight control behaviours, they experiences weight – related bias and stigma which sometimes result to emotional problem (Lindwall; Lindgren, 2005). The relative percentage of body fat at different BMIs clearly varies within population. It depends on environmental factors. Such as the amount of physical activity, as well as physiological factors. A healthy person should have muscle mass and less fat, increase muscle mass reduces the risk of visceral fat. Visceral fat

lies deep in the intra abdominal cavity and around the organs of the body which is more dangerousthan subcutaneous fat, visceral fat is associated with cardiovascular diseases, obesityand diabetes. Cardio exercise can reduce visceral fat. (WHO, 2004)

b. Socioeconomic status (SES) Adesina, Peterside, Anochie & Akani (2012) revealed that, socioeconomic status influences affordable and appropriate food, thus influencing the quantity and quality of diet. This is different from one person to another. The prevalence of underweight in his study was higher in the lower SES as compared to the upper SES. Overweight and obesity was found to be higher in the upper SES. Mahgoub, Nnyepi & Bendele (2006) stated that malnutrition affect physical growth, morbidity, mortality, cognitive development, reproduction, physical work capacity and it is consequently impacts on human performances, health and survival. Sawaya (2006) also reviewed that malnutrition is one of the most important social problems. There is sufficiently good evidence to prove that smaller size and poor growth is associated with impaired development, complex environment, cultural and economic factors, inadequate of food. The poor food habit influences physical growth. Food insecurity and changes in life style lead to an increased incidence of obesity and the consequent risk of chronic non communicable diseases such diabetes mellitus, cardiovascular disease and cancer.

c. Birth weight. Goldani, Haeffner, Agranonik, Barbieri, Berrio, and Silva (2007) postulated that birth weight can partially mediate body size. They stated that higher BMI among individuals born with a high birth weight has been related to an increase in fat – free mass in adulthood rather than rise in adipose tissue. BMI did not increase among adolescents with low birth weight in his study.

d. Television factor: Adesina et al (2012) explained that television viewing greater than three hours per day was associated with increased prevalence of overweight and more than five hours a day with more Obese subjects lowering of metabolic rate, reduction of time in higher intensity activities, and more frequent snacking are the risks associated with this condition. Fast foods are frequently advertised on television. Adolescents and children are often the targeted market. (Little, Humphries, Patel and Dewey, 2016) carried out a study on factors associated with BMI, under weight, overweight, and obesity among adults in a population of rural South India: a cross-sectional study, their study revealed that physical activity, television, socio economic position and diet are associated with these conditions

e. Natural condition. According to Hung and Grang. (2013) Natural conditions have effect on Body Mass Index to avoid hyperthermic stress in a warmer environment. Mammalian metabolism and excess body heat produced by voluntary muscular activity must be dissipated to the environment. Relatively large bodysurface area and body volume, and relatively low body weight are caused by having legs and arms that are relatively long in proportion to the size of the trunk of the body, to assist in heat loss, low body volume decreases the amount of metabolizing tissue and also decreased the distance required for the radiation of heat from the internal organs and muscles to the surface of the body. A small surface and large body volume is the body type best suited for heat retention, Body fat,- especially the thickness of the subcutaneous fat layer may also increase in a colder environment. Adipose tissue is relatively inert metabolically due to poor vascularization and acts as an insulating barrier against heat loss by radiation. A thin subcutaneous layer of fat helps to minimize heat retention in warmer environment.

f. Trishnee and Rajesh (2013) reported that BMI has some major drawbacks, and that, the relationship between BMI and body fat percentage is affected by environmental factors such as physical activity level, age, gender and ethnicity. Esma; Metin, and Ash (2014) carried out a study to determine the factors that contribute to the BMI of adults and evaluate the eating habits of the individuals. The study revealed that age, educational, marital, smoking status and sleep duration were found to affect BMI.

g. **Age:** Cross-sectional and longitudinal studies indicate a gradual increase in the average BMI of Americans up to the ages of 50 to 60years. Population studies indicate a decline in body weight and BMI among the elderly in the seventy and eight years, obesity and overweight reach maximal rates among middle-aged adults. (www.nim.nih.gov/books1NBK221834/).

h. **Sex:** determine where the body stores fat, men build up fat in their belly or abdomen. While women build up fats in their buttocks and hips. Excess fat, especially around the abdomen, may put people at risk of health problem, even when individual have a normal weight (Flegal, Kruzon, Carroll, Fryar and Ogden, 2016)

i. Goldani, Haeffner, Agranonik, Barbier, Berriol & Silver (2007) carried out an assessment on the influence of early life factors such as birth weight, gestational age, maternal smoking and social class on BMI in young adulthood with adjustment for adult socioeconomic position. These findings revealed that early life social influences on BMI were more

important and were not reversed by late socioeconomic position.

j. Asil, Surucuoglu, Cakiroglu, Ucar, Ozcelik, Yrimaz and Akan (2014) carried out a study to determine the factors that contribute to the body mass index of adults, their study revealed that age, education, smoking status, marital and sleep duration affect body mass index.Many studies have been published in which the association between BMI and the percentage of body fat investigated, most studies shows that the relation between BMI and the percentage of body fat depends on age and sex it differs across ethnic groups (THE LANCET,2004) Sawaya (2006) also stated that there is sufficiently good evidence to prove that smaller size and poor growth is associated with impaired development, complex environment, cultural, economic factors and inadequacy of food.

Advantages of Body Mass Index

Body Mass Index is a simple measurement that is used to determine the level of fat in the body of an individual. It is simple, requires no special training, it is convenient to use, it is not expensive and easy to use. BMI is the method most commonly used to classify individuals into specific weight categories, that is, underweight, normal weight, overweight and Obese to determine an individual's weight – related health risk (Tuttle, Montoyu, Alexander, Kaminsky, 2020). The following are some of the advantages highlighted by Gibson (1990). The methods are precise and accurate, provided standardized techniques are used,procedures use are simple, safe and non-invasive techniques,relatively unskilled personnel can perform measurement procedures, information is generated on past nutritional history,method are suitable for large sample sizes such as representative population samples,method can be used to monitor and evaluate changes in nutritional status over time, seasons, and generations, methods canbe adopted to develop screening tests in situation such as nutrition emergencies to identify those at high risk.

A BMI measurement is useful to assess who needs further testing to identify health risks such as heart disease. Individual at risk will need further assessment. Assessments may include skin fold thickness test, diet, physical activity level, family history and other appropriate health screenings. (www. euro. Who .int /en / health- topics / disease- prevention/ nutrition / a- healthy – lifestyle/ body- mass-index-bmi). There are many variables to take into account to be 100% accurate all the time. Actual amount will vary according to person, but a fairly decent measure of weight level can be achieved through BMI.BMI of an individual is useful for doctors. A patient's BMI can be used by medical doctor as a biometric marker with regards

their overall health. It is used as diagnostic tool. It guides an individual health and fitness goal, such as an individual with BMI of 14, can improve by taking more calories per day to achieve a healthy range. (gymnation. com/ blogs / the – benefits- of calculating- bmi/).

Limitation of BMI

BMI calculation is solely dependent onthe net weight and height of the individual and does not consider the distribution of muscle and bone mass. BMI does not differentiate between body fat and muscle mass. There is also a potential risk of overestimating fatness in individuals with high muscle mass, such as athletics and underestimating the fat deposit in those with less lean body mass, such as the elderly (Reeja and Sunil 2016).

Woodruff and Duffied (2000) stated the following problems of using BMI. Difficulties in the calculation, BMI may be unfamiliar to some field workers, difficulty of getting accurate BMI with an individual experiencing famine oedema, which is the leakage of fluid into tissues artificially increases the individual's weight. Also, BMI cannot be used during pregnancy because of the extra weight of the fetus, other products of conception, and added maternal tissues. BMI fails to discriminate between percentage body fat and lean mass. due to its atherogenic and endocrinal influence on the underlying organs and associated chronic conditions such as cardiovascular disease can be present in a normal weight individual, BMI is unable to differentiate between location and type of adipose tissue. (Sigma.nursingreprository.org/bitstream/handle/10755/603260/STT-imprey.pdf, sequence=1

Body Mass Index cannot identify protein and micro nutrients deficiencies.BMI is a monitoring tool, simple and easy to use. But, such ease of access can lead to excess – of – use, as the value of this metric to healthcare professionals is over estimated (Juan, Carla, 2014).

BMI only provides a rough estimation of body fat because it does not involve any direct measures of tissue. Athletes and gym enthusiasts who carry a great deal of muscle may seem heavy for their height or overall size, because muscle is denser than fat. It does not account for differences in activity level, and frame size. BMI is a set equation.It cannot be adjusted for the size of skeleton. (Andrea Boldt, 2020).

Body mass does not directly assess body fat, muscle and bone are denser than fat, so an athlete or muscular person may have a high BMI, yet not have too much fat, BMI does not differentiate between muscle and fat (www.hsph. Harvard .edu / obesity- prevention- source/ obesity-definition- full-story/)

BMI is ideally suited for population level. studies describing obesity by BMI can result in inaccurate assessment of

adiposity, because the numerator in the calculation of bmi does not distinguish lean muscle from fat mass, thus a person with excessive visceral fat can have a normal BMI, yet will have high mortality risk. (Gurunathan& Myles, 2016)

BMI, like any other measurement, it is not perfect because it is only dependent on height and weight and it does not take into consideration different levels of adiposity based on age, physical activity levels and sex, it either over estimates adiposity in some cases or under estimates it in others, Pregnant women will have a higher BMI because of increased with pregnancy. (www euro/ who, int / en/ health-topics/ disease-prevention / nutrition / a- healthy – lifestyle / body- mass - index –bmi).BMI does not take into account all the factors that make us healthy. BMI calculation may show very muscular, pregnant or have a large frame as overweight or obese. A person with a big frame will have a higher BMI when he or she may be healthy. It is inaccurate because it only takes into account height and weight of an individual. (www.Very well fit.com/your-bmi-how-to-calculate-your-bmi3577625).

Vogile, L.K(2015) stated that BMI requires accurate height and weight measurement, height can be difficult to assess accurately in a person with cerebral palsy,(C P)who have scoliosis, lower limb deformities and difficulty standing, Even if accurate measure are available, BMI does not reflect body composition, information that health care providers require to effectively manage the nutritional needs of persons with C P. Not all clinics have wheelchair scales, and transferring adults with C P out of their usual mobility devices can be difficult and unsafe without trained personal and equipment.

The time of day can affect measurement of height due to diurnal variation in height, weight can differ depending on the type and amount of clothing worn, or food consumed. The potential for error from these factors can be reduced with the use of standards and guidelines for measuring height and evaluating weight. (Julia Buss,2021).

BMI provide medical professionals with a sense of whether or not a patient is at risk for certain diseases, it does not take into account all the body composition, including body`s ratio of lean mass to fat mass. While BMI give the doctor basic guess at a patient`s body fat percentage,it does not give entire picture when it comes to patient overall health. (Basile, L.M.2021)

Conclusion

Body Mass Index is used to investigate how far an individual's body weight departs from the normal weight. WHO regard a BMI of less than 18.5 as underweight and may indicate malnutrition, BMI greater than 25 is considered over weight, and above 30 is

considered obese. BMI is calculated as weight in kilograms divided by height in meters squared. BMI investigate nutritional status of an individuals, This will assists the health personals to know whether an individual is at risk of chronic disease due to excess fat in the body, also to know if an individual fall in the range of underweight which can result to low immune system. There are different factors that influences BMI such as, physical exercise, socioeconomic status, Birth weight, Television factors, Natural condition, Age and Sex. One of the limitations of BMI is that, it does not differentiate between body fat and muscle mass, also, BMI cannot be used during pregnancy because of the extra weight of the fetus.

Recommendation

Considering the importance of Body Mass Index, factors affecting BMI, and the limitation of BMI;

i. Government should carryout a programme to investigate the BMI of the population. This will revealed the numbers of persons at risk of non-communicable disease.
ii. An individual should take responsibility to know their nutritional status by knowing their levels of BMI.
iii. Athletics, Oedema patients and pregnant women should considered other methods of nutritional assessment, due to their special body composition.
iv. Physical activities is very important to attain a healthy status, therefore, everyone should endeavor to involve in physical activities.
v. Nutrition also play key roles.Food should be consumed in right proportion both in quality and quantity at the right time.

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