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Body Weight Classification Using Body Mass Index: A Theoretical Review

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Abstract:

This theoretical study aimed to analyze and classify body weight levels using Body Mass Index (BMI) through a review of key concepts related to body composition and anthropometric measurements. It also examined the scientific principles of height and weight assessment and the main indicators used in evaluating body status.

Body Mass Index is one of the most widely used indicators in health and sports sciences due to its simplicity and wide application in epidemiological and clinical studies . It is commonly used to classify individuals into different weight categories such as underweight, normal weight, overweight, and obesity.

However, BMI does not accurately reflect body composition, particularly fat and muscle mass, which limits its diagnostic precision and requires complementary anthropometric measurements for more accurate evaluation.

The study concluded that BMI, when supported by additional anthropometric indicators, remains an effective scientific tool for classifying body weight levels and assessing health status.

Keywords: Body Mass Index; Body Weight; Anthropometric Measurements; Body Composition; Obesity.

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1. INTRODUCTION

Obesity and excess body weight are among the most prominent contemporary health problems, showing a noticeable increase across different societies due to their strong association with several chronic diseases such as cardiovascular diseases, diabetes, and hypertension. This has made them a major focus of researchers in public health and sports sciences (Ministry of Health, Saudi Arabia, 2022).

The assessment of body status has become essential, as anthropometric measurements are considered one of the most important scientific tools in this field. These measurements rely on simple indicators such as height, weight, and body circumferences, and are widely used in large-scale field studies due to their practicality and ease of application (Public Authority for Food and Nutrition, 2021).

Body Mass Index (BMI) is one of the most commonly used indicators for evaluating body status and classifying individuals into different weight categories, due to its simplicity and widespread use in global health systems (Al-Hazzaa, 2009, p. 437). However, BMI does not accurately reflect internal body composition, particularly fat mass and muscle mass, which limits its accuracy in certain cases, especially among athletes , this theoretical study aims to analyze and classify body weight levels using BMI, while highlighting its importance and limitations in assessing body status, and emphasizing the need to complement it with other anthropometric measurements for a more comprehensive and accurate evaluation.

2. Concepts and Terminology

2.1 Definition of Body Weight

Body weight is considered one of the fundamental anthropometric measurements used to assess an individual's body status, as it reflects the total mass of body components, including fat mass, lean mass, bones, and body fluids. It is widely used in evaluating health and nutritional status, especially when combined with height measurements (Abdel Fattah, 2018, p. 52).

2.2 Anthropometric Measurements

Anthropometric measurements are defined as a set of scientific methods used to measure different body dimensions such as height, weight, body circumferences, and skinfold thickness. They are widely used due to their simplicity and low cost, especially in field studies (Hassanein, 2015, p. 41).

These measurements contribute to:
Assessing physical growth
Determining nutritional status
Monitoring the effects of physical activity
Identifying obesity

2.3 Body Mass Index (BMI)

Body Mass Index (BMI) is one of the most widely used indicators for assessing body status. It is calculated by dividing body weight in kilograms by the square of height in meters:

BMI = Weight (kg) ÷ Height² (m²)

This index is used to classify individuals into different weight categories due to its simplicity and widespread use in health studies (Al-Hazzaa, 2019, p. 112).

2.4 BMI Classification

BMI is used to classify individuals into different weight categories, including underweight, normal weight, overweight, and obesity, based on standardized health criteria (Ministry of Health, Saudi Arabia, 2022, p. 15).

2.5 Limitations of BMI

Despite its importance, BMI does not accurately reflect internal body composition, as it does not distinguish between fat mass and muscle mass. It may also provide misleading results in athletes, which requires its use alongside other anthropometric measurements

3. Anthropometric Measurements

Anthropometric measurements are considered among the most important scientific tools used in the fields of physical activity and health sciences. They aim to assess various dimensions of the human body such as height, weight, body circumferences, and skinfold thickness in order to evaluate body composition as well as the individual's health and nutritional status (Hassanein, 2017, p. 52).

These measurements are characterized by being:
Simple to apply
Low in cost
Applicable to large samples
Relatively accurate when standardized instruments are used

They are also widely employed in several fields such as sports medicine, physical education, health nutrition, and studies of physical growth (Abdel Fattah, 2018, p.

74).

3.1 Importance of Anthropometric Measurements

Anthropometric measurements play a fundamental role in understanding human body composition. They are used for:

Assessing physical growth across different age stages

Determining the level of physical fitness

Early detection of obesity and thinness

Monitoring the effects of training programs

Assisting in athlete selection according to sports specialization

Recent studies indicate that anthropometric measurements are among the best field methods for assessing body status when combined with other indicators such as Body Mass Index (BMI) and body fat percentage (Al-Hazzaa, 2020, p. 101).

3.2 Types of Anthropometric Measurements

Anthropometric measurements are classified into several main categories, including:

- Length Measurements

Such as body height, trunk length, and limb length.

- Weight Measurements

These represent the total body mass.

- Circumference Measurements

Such as waist, chest, thigh, and arm circumferences.

- Breadth Measurements

Such as shoulder and pelvic breadth.

- Skinfold Thickness Measurements

These are used to estimate body fat percentage with relative accuracy.

3.3 Anthropometric Measurement Instruments

Anthropometric measurements rely on several scientific instruments, including:

Medical scale for body weight measurement

Stadiometer for height measurement

Measuring tape for circumference measurements

Caliper for skinfold thickness assessment

Anthropometer for breadth measurements

These instruments require periodic calibration to ensure measurement accuracy (Hassanein, 2017, p. 95).

3.4 Conditions for Accurate Anthropometric Measurement

To obtain accurate and reliable results, the following conditions should be

considered:
Standardizing measurement conditions
Using the same instruments for all participants
Conducting measurements at the same time period
Minimizing clothing during measurements
Training the evaluator properly
Ensuring the correct posture of the participant

4. Height and Weight Indices

Height and weight indices are considered indirect methods for estimating body composition, as they rely on the relationship between height and weight variables in order to approximately classify an individual's body status
These indices are used for:
Assessing nutritional status
Determining the level of obesity
Monitoring body changes
Supporting medical and sports decisions

4.1 Height-Squared Index

The height-squared index is considered one of the classical indicators used to estimate fat-free body mass, as it depends on the relationship between body weight and squared height.
This index was used in earlier studies to estimate body build and composition. However, its limited accuracy has reduced its use in modern research compared with the Body Mass Index (BMI) (Hassanein, 2017, p. 63).

4.2 Body Mass Index (BMI)

Body Mass Index (BMI) is one of the most widely used indicators worldwide for assessing body status. It is calculated using the following equation:
Body Mass Index (BMI) = Weight (kg) ÷ Height² (m^2)
BMI is used to classify individuals into different weight categories such as:
Underweight
Normal weight
Overweight
Obesity
This indicator is characterized by:
Ease of calculation

Worldwide application
Extensive use in epidemiological studies
However, despite its importance, BMI does not accurately reflect internal body composition (Al-Hazzaa, 2020, p. 115).

Table 1. Body Mass Index (BMI)

BMI (kg/m²)	Classification
Less than 18.5	Underweight
18.5 – 24.9	Normal Weight
25 – 29.9	Overweight
30 – 34.9	Class I Obesity
35 – 39.9	Severe Obesity
40 and above	Morbid Obesity

Source: Saudi Ministry of Health, 2022, p. 15)

5. Importance of Anthropometric Measurements

Anthropometric measurements are considered among the most important scientific methods used to study individuals' body characteristics. They aim to measure different body dimensions such as height, weight, circumferences, lengths, and skinfold thicknesses in order to identify body composition and evaluate the individual's physical and health status. These measurements have gained great importance in the fields of physical education and sports, sports medicine, and public health because they provide accurate information that helps explain individual differences and assess physical growth and fitness levels (Ben Aissa, 2021, p. 45).

The importance of anthropometric measurements lies in their effectiveness

in evaluating health status and detecting problems related to obesity, thinness, or malnutrition. They are also used to monitor body changes resulting from physical activity or the application of different training programs. In addition, these measurements help determine body components such as muscle mass and fat mass, which contributes to designing appropriate training and nutritional programs according to each individual's characteristics (Ben Aissa, 2021, p. 47).

6. Anthropometric Measurement Methods

Anthropometric measurements are considered among the most important scientific tools used in assessing human body composition. They rely on measuring variables such as body weight, height, body circumferences, and skinfold thickness in order to estimate individuals' health status, physical fitness level, and nutritional condition. These methods are characterized by being field-based, low-cost, and easy to apply, which makes them widely used in sports and health research (WHO, 2023; Djemaa et al., 2023).

Studies published in Al-Manzoma Sports Journal have shown that anthropometric measurements are an effective tool for analyzing body composition in athletes, particularly in endurance and strength sports. They are used to determine body fat percentage, muscle mass, and indicators of physical development, which helps in assessing physical condition and improving the talent identification process (Djemaa et al., 2023).

6.1 Body Weight Measurement

Body weight is considered one of the simplest and most important anthropometric measurements, as it is used to estimate total body mass. It is measured using an electronic or mechanical medical scale.

Measurement Conditions:

The individual should wear minimal clothing

Standing in a stable position

Using a calibrated scale

Body weight is considered an important preliminary indicator in obesity assessment when combined with height measurement (CDC, 2022).

6.2 Height Measurement

Height is measured using a stadiometer or a fixed height-measuring device. The individual stands upright with the heels and back touching the device.

Measurement Conditions:

The head should be in the horizontal position (Frankfurt plane)
The body should remain straight without bending
Feet should be firmly placed on the ground
Height is mainly used in calculating Body Mass Index (BMI) (WHO, 2023).

6.3 Body Circumference Measurements

Body circumferences are used to assess fat distribution in the body, particularly abdominal fat.

Main Circumference Measurements:

Waist circumference
Hip circumference
Chest circumference
Arm and thigh circumference

Waist circumference measurements are considered among the most important modern indicators for assessing the risk of cardiovascular and metabolic diseases (NIH, 2022).

6.4 Skinfold Thickness Measurement

This method is used to indirectly estimate body fat percentage using a caliper device.

Main Measurement Sites:

Biceps
Triceps
Subscapular region
Abdominal region
Thigh

This method is regarded as one of the relatively accurate techniques for estimating subcutaneous fat when properly applied (ACSM, 2022).

6.5 Modern Body Composition Assessment Methods

In recent years, modern techniques such as Bioelectrical Impedance Analysis (BIA) have emerged. This method relies on the passage of a weak electrical current through the body to estimate:

Body fat percentage
Muscle mass
Total body water

This technique is widely used in modern clinics and sports centers because of its speed and relative accuracy (Kyle et al., 2004; updated reviews, 2021).

6.6 Comparison Between Measurement Methods

Method
Accuracy
Cost
Application
Weight and Height
Moderate
Low
Widely used
Body Circumferences
Good
Low
Assessment of abdominal fat
Skinfold Thickness
Very Good
Moderate
Body fat estimation
BIA
High
Moderate to High
Body composition analysis

6.7 Importance of Modern Measurement Methods

Anthropometric measurement methods contribute to:
Improving the accuracy of obesity assessment
Supporting early medical diagnosis
Monitoring training program outcomes
Enhancing the accuracy of scientific studies in sports and health

7. Body Mass Index (BMI) Limitations

Body Mass Index (BMI) is one of the most widely used indicators for assessing body status and classifying individuals as underweight, normal weight, overweight, or obese. However, despite its widespread use in health and sports studies, BMI has several scientific limitations that affect the accuracy of interpreting its results (WHO, 2023).

7.1 Inability to Differentiate Between Fat Mass and Muscle Mass

One of the major limitations of BMI is that it does not distinguish between

fat mass and muscle mass. As a result, individuals with high muscular mass, such as athletes, may be classified as overweight or obese despite having low body fat percentages.

Recent studies have confirmed that BMI does not accurately reflect true body composition, which may lead to inaccurate classifications in certain population groups (ACSM, 2022).

7.2 Limitations in Athletes

BMI is considered less accurate when applied to athletes, particularly in strength sports and bodybuilding, where muscle mass is significantly higher compared to non-athletes.

Recent literature indicates that relying solely on BMI in athlete assessment may produce misleading results. Therefore, it is recommended to combine BMI with additional indicators such as body fat percentage and waist circumference (Heymsfield et al., 2016; updated review, 2021).

7.3 Failure to Consider Fat Distribution

An important limitation of BMI is that it does not take fat distribution into account, especially visceral fat in the abdominal region, which is strongly associated with health risks such as cardiovascular diseases and diabetes.

For this reason, international health organizations recommend using waist circumference as a complementary indicator to BMI (NIH, 2022).

7.4 Influence of Age and Sex

Normal body composition differs according to age and sex; however, BMI does not accurately reflect these differences. It may produce the same value for two individuals who differ significantly in age, sex, or physical activity level.

7.5 The Need for Complementary Indicators

Because of these limitations, it has become necessary to use BMI within a comprehensive assessment system that includes:

Waist circumference

Body fat percentage

Skinfold thickness

Bioelectrical Impedance Analysis (BIA)

Recent studies have confirmed that combining these indicators provides greater accuracy in obesity assessment compared with using BMI alone (WHO, 2023).

7.6 Limitations of BMI in Field Practice

Recent research in Algerian sports science has highlighted that Body Mass Index (BMI) alone is not sufficient for accurately assessing body composition, particularly among physically active individuals and athletes. A study published in Al-Manzoma Sports Journal found that BMI may lead to misclassification of individuals' body status because it does not distinguish between fat mass and lean muscle mass, which is particularly problematic in sports where muscular development is high (Mahdi et al., 2021).

The study further emphasized that relying solely on BMI in sports and health evaluation may underestimate or overestimate true body composition status. Therefore, the authors recommend the integration of BMI with other anthropometric indicators such as body fat percentage, skinfold thickness, and body circumferences in order to obtain a more accurate and comprehensive assessment of physical condition and health status (Mahdi et al., 2021).

8. Conclusion

Based on the content presented in this theoretical study, it is clear that anthropometric measurements are among the most important scientific tools used to assess body composition and determine individuals' health and nutritional status, due to their simplicity and effectiveness in field applications. Moreover, height and weight indices, particularly the Body Mass Index (BMI), represent essential and widely used tools for classifying individuals into different weight categories such as underweight, normal weight, overweight, and obesity.

Despite the significant importance of BMI in epidemiological and health studies, it has several scientific limitations, most notably its inability to distinguish between fat mass and muscle mass, and its failure to consider fat distribution within the body. This may lead to inaccurate interpretations in certain populations such as athletes or children.

Accordingly, relying on BMI alone is not sufficient for an accurate assessment of body composition. It should instead be supported by additional indicators such as waist circumference, skinfold thickness, and modern body composition analysis methods to achieve a more comprehensive and precise evaluation.

In conclusion, this study emphasizes the importance of integrating traditional and modern anthropometric indicators in the field of sports science and

health in order to improve the quality of scientific assessment and support decision-making in both health and sport domains.

9. Recommendations

In light of the findings of this theoretical study on anthropometric measurements and Body Mass Index (BMI), the following recommendations can be made:

-It is necessary not to rely solely on Body Mass Index (BMI) for assessing body composition, but rather to complement it with other indicators such as waist circumference and skinfold thickness measurements.

-Anthropometric measurements should be regularly integrated into health and sports programs due to their importance in monitoring individuals' physical and nutritional status.

-Health and physical education specialists should be made aware of the limitations of BMI, especially when assessing athletes and children.

-Modern body composition analysis techniques, such as Bioelectrical Impedance Analysis (BIA), should be used to obtain more accurate results.

-Future research should be encouraged to combine traditional and modern indicators to develop a more comprehensive approach to obesity assessment.

-Health education on the risks of obesity and the importance of anthropometric measurements in early detection and prevention should be strengthened.

-Anthropometric measurement and BMI topics should be more deeply integrated into university curricula in sports science and physical education, with a stronger practical focus.

-The training of measurement and evaluation specialists should be improved through practical training courses to ensure accurate field measurements.

-Standardized anthropometric measurement protocols should be adopted in laboratories and research centers to ensure consistency across studies.

-National databases of body measurements across different age groups should be developed to support scientific research and health decision-making.

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