

**UNIT**  
**6**

# TEST, MEASUREMENT AND EVALUATION



## Content

Define Test, Measurement & Evaluation

Importance of Test, Measurement & Evaluation in Sports

Classification of Test in Physical Education and Sports

Test administration guidelines in Physical Education and Sports

BMI, Waist-Hip Ratio, Skinfold Measures (3-site)





# Learning Outcomes

After completing this chapter, you will be able to:

- After completing this chapter, you will be able to:
- define the terms test, measurement, and evaluation,
- differentiate norm and criterion referenced standards,
- differentiate formative and summative evaluation,
- discuss the importance of measurement and evaluation processes,
- understand BMI: A popular clinical standard and its computation
- differentiate between Endomorphy, Mesomorphy & Ectomorphy
- describe the procedure of Anthropometric Measurement

### Discussion

1. Working in groups, complete chart given below listing the importance of testing and measurement in sports.



2. What are the tests that could be administered to the athletes?

#### 6.1.1 WHAT IS A TEST

Remember when you tried sit-ups for the first time. As a child, you probably did a number of sit-ups. You were performing sit-ups to improve your strength endurance. Do you remember your Physical Education teacher counted your sit-ups in your Physical Education class and said, "You were very good!" Numbers are a part of everyone's life and they can be used in measurement. Measurement is a way of giving meaning to numbers. Further, decision making is a daily task. Many people make hundreds of decisions daily; and to make wise decisions, one needs information. The role of measurement is to provide decisionmakers with accurate and relevant information to make informed choices.





### Do you know?

A **test** is an instrument or tool used to make a particular measurement. This tool may be written, oral, a mechanical device (such as a treadmill), physiological, psychological, or another variation.

**Measurement** is the act of assessing. Usually this results in assigning a number to the character of whatever is assessed.

**Evaluation** is a statement of quality, goodness, merit, value, or worthiness about what has been assessed. Evaluation implies decision making.

Example 1: A physical education teacher records the 30 sit-ups that a student completes in 1 min and reports the score as Good. In this example, Test is Sit-ups, Measurement is 30 sit-ups and Evaluation is Good.

In our day-to-day life we all collect data and information before making decisions. e.g., you might gather information about your friend's marks, health, fitness, type of vehicle her/his family uses, number of the vehicle, number of students in a class etc. Physical Educationists collect data related to fitness characteristics because of the relationship between fitness, physical activity and quality of life. The variables measured might include the amount of physical activity, blood pressure, weight height, strength etc. Physical educationists might be interested in measuring different items for taking better decisions. Thus, to make qualified decisions, it is extremely important to measure and evaluate the components of the individual's physical fitness in an accurate manner. Making effective decisions depends on first obtaining relevant information, and then evaluating it. This is where testing and measurement enter the picture. The most basic principle of this text is that measurement and evaluation are essential to sound educational decision making.

## 6.1.2 TEST, MEASUREMENT AND EVALUATION

The terms test, measurement, evaluation, and assessment are occasionally used interchangeably, but most users make distinctions among them.

**Test** is usually considered the narrowest of the three terms; it implies the tools, instruments or set of questions to measure a dimension, quality or condition, of any person, object, event.

**Measurement** refers to the quantitative form of assessment and also refers to the scores obtained through test. Measurement is requisite for evaluation in a quantitative form of numbers or scores.





**Evaluation** is “the process of delineating, obtaining, and providing useful information for judging decision alternatives.” Other definitions simply categorize evaluation as professional judgment or as a process that allows one to make a judgment about the desirability or value of something. Thus, measurement is not the same as evaluation. Two athletes may obtain the same measure (test score), but we might evaluate those measures differently because of the different criteria for evaluation available in terms of norms and criterion measures.

### Definitions

A test is a tool to evaluate the skill, knowledge, capacities or aptitudes of an individual or a group.

- Webster’s Dictionary

Test refers to any specific instrument, procedure or technique used by an administrator to elicit a response from the test-taker.

- H M Barrow and Megee

Test is the form of questioning or measuring used to assess retention of knowledge, capacity or ability of some endeavour.

- Barry L Johnson and Jack Nelson

A test is an instrument or a tool used to make a particular measurement. The tool may be written, oral, mechanical, or an other variation. Measurement refers to the process of administering a test to obtain quantitative data.

- H M Barrow

Measurement aids evaluation process in which various tools and techniques are used in collection of data.

- Barry L Johnson and Jack Nelson

An evaluation is an assessment, as systematic and impartial as possible, of an activity, project, Programme, strategy, policy, topic, theme, sector, operational area, institutional performance..

- United Nations Evaluation Group

Evaluation is the process of education that involves collection of data from the products which can be used for comparison with preconceived criteria to make judgement.

- H M Barrow and Megee





I. Tick the correct option.

1. Mohan's height is 3ft 11in. 3ft 11 in is an example of
  - a. test
  - b. measurement
  - c. evaluation
  - d. assessment
2. Test is a \_\_\_\_\_
  - a. Tool
  - b. Technique
  - c. Adjustment
  - d. Assessment

II. Answer the following questions briefly.

1. What is a test?
2. What is measurement?
3. What is Evaluation?

III. Answer the following questions in 150-200 words.

1. Describe the relationship between test, measurement & evaluation.

### 6.2.1 Importance of test, measurement & evaluation in sports

The importance of test, measurement and evaluation should be considered from three different perspectives,

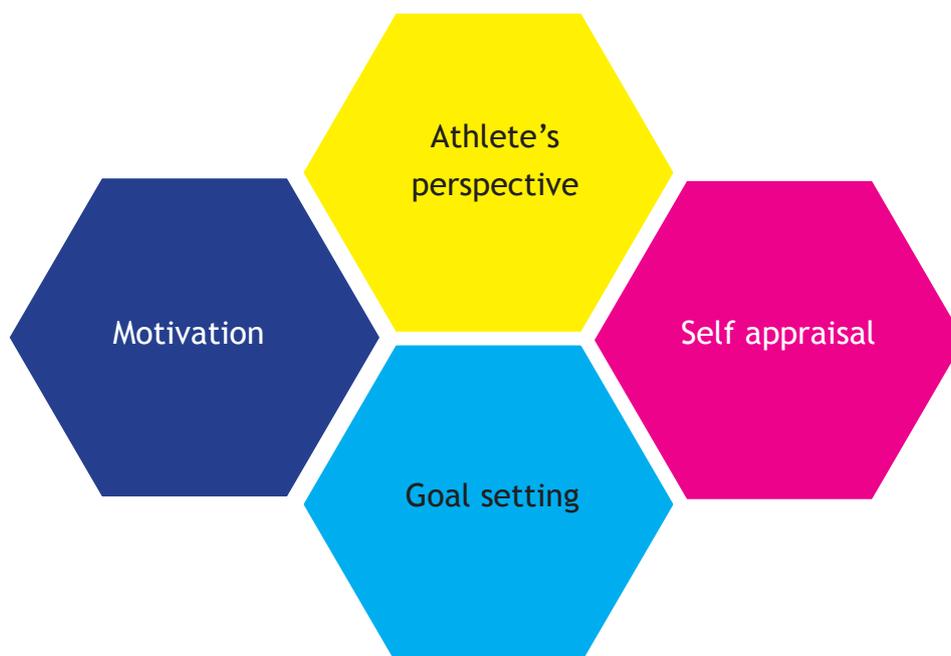
- i. from an athlete or participant's perspective;
- ii. from the PE teacher/Coach/ Trainer's perspective; as well as
- iii. from the Training programme's perspective.

Let's try to understand these three perspectives in detail.

A. Importance of Test, Measurement and Evaluation from athlete's perspective

- i. Motivation of athletes for continuity.
- ii. Self Appraisal of performance
- iii. Goal Setting for performance enhancement





Tests, Measurement, Evaluation are of immense importance for athletes and sports participants. If there is an appropriate test being applied at an appropriate time and at an appropriate frequency, it will be a greatly motivating for the athletes to continue with their activity. It will also be a mode of self-appraisal of their own performance, and surely it will help athletes and participants to set up new goals for their performance enhancement.

**B. Importance of Test, Measurement and Evaluation from coach/trainer's perspective**

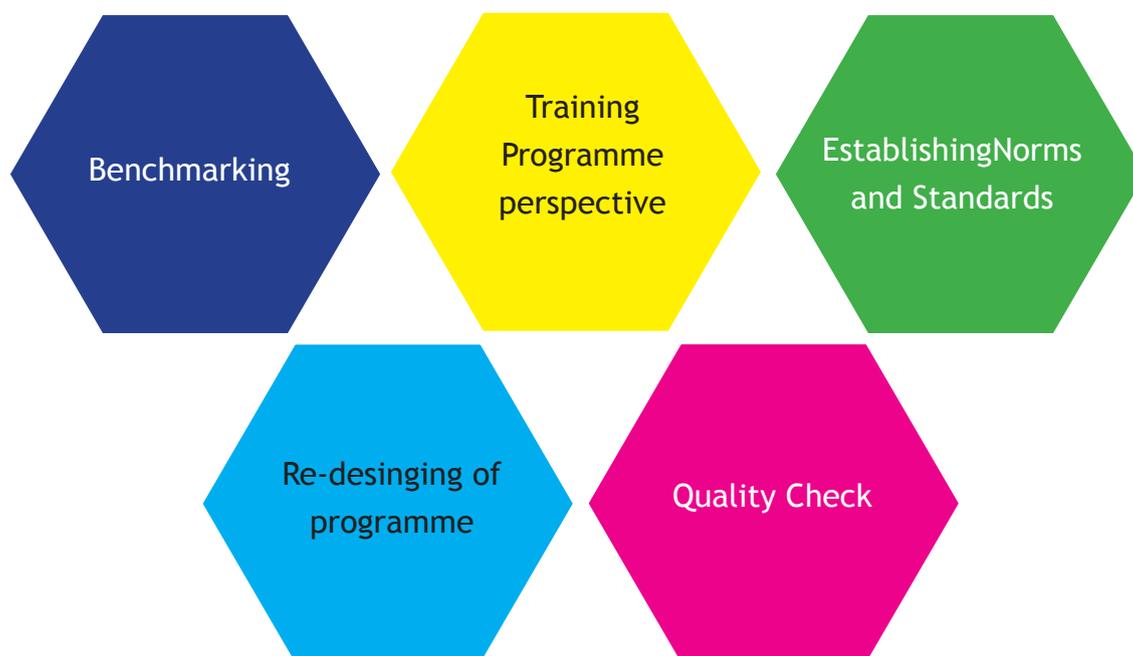
- i. Diagnosis of problems and errors in teaching-learning process
- ii. Grouping or divisioning of athletes as per ability or skill.
- iii. Prediction of performance of athletes
- iv. Self-assessment of teaching effectiveness





In addition to the student's perspective, another important dimension which needs to be discussed regarding importance of Tests, Measurement and Evaluation is from the Coach/ PE Teacher/ Trainer's perspective. Tests, measurement and evaluation have a lot of importance in helping them acquire adequate feedback about their pedagogy and student satisfaction, and identify areas for improvement. Without a reliable test, measurement and evaluation system, coaches may lack support of authentic feedback about their task and training methods. Tests can provide necessary feedback as these testing and evaluation processes help in diagnosing pedagogical issues and reasons to improve athletes' performance and satisfaction.

### C. Importance of Test, Measurement and Evaluation from the Training Programme perspective



- i. Benchmarking of training programmes or comparison of training programme with desired objectives and outcomes of athletes.
- ii. Norms and Standards can be established for future objectives related to skill, fitness or other abilities.
- iii. Re-desinging of programme based on previous test results.
- iv. Quality Check and control process of training system and athlete development programmes.

Along with the importance of tests, measurement and evaluation for athletes and coaches, it is also very important from the perspective of the training programme too. Training programmes in physical education and sports are dynamic in nature which need regular updates and modifications based on the need of training and

competition demands. The desired modification should be based on scientific processes, for which testing of training programmes, benchmarking with other existing training approaches, developing quality control process and evaluating with norms and standards are essential.

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**I. Tick the correct options.**

1. The term 'placement' refers to
  - i. giving all students the same training programme
  - ii. placing students into categories based on their skills
  - iii. determining the strengths and weaknesses of individuals
  - iv. predicting a student's future success in a particular sport
2. Test and measurement scores are NOT helpful in
  - i. determining the strengths, weaknesses and limitations of a student
  - ii. discouraging the student from participating in a particular activity
  - iii. helping a student pick up the sports activity of his/her choice
  - iv. predicting the student's future level of achievement

**II. Answer the following questions briefly.**

1. What is the role of tests and measurement in Diagnosis?
2. What is role of tests and measurement in Placement?

**III. Answer the following questions in 150-200 words.**

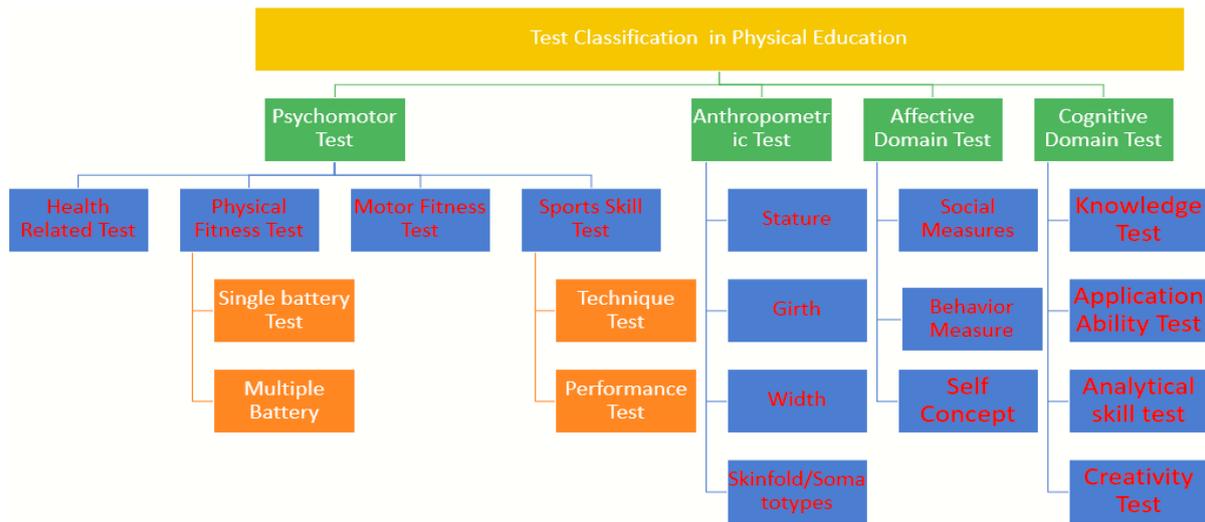
1. Distinguish between Test, Measurement and Evaluation. Highlight their importance in Sports.

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### **6.3.1 Classification of Tests in Physical Education and Sports**

In sports, exercise and physical activities there are various parameters of an athlete or a participant which need to be tested. As you know, the aim of different tests is to measure different types of traits and attributes. In sports and physical activities, skill and physical fitness tests alone do not perfectly classify, justify or validate the participants' ability and progress in performance. Other factors, such as anthropometric components, motivation and desire, concentration focus etc. could affect the ultimate performance. Therefore, a variety of tests need to be applied for sports skill and fitness level assessments. These tests are categorized according to their nature and purpose such as Psychomotor Test, Anthropometry test, Affective domain (emotional) test, Cognitive Domain test. These tests are helpful for a comprehensive assessment of an athlete or any participant in exercise and fitness program. Lets discuss the following classification of tests:





### 6.3.2 Psychomotor Tests

Psychomotor tests are to assesses the participant's ability to perceive instructions and perform motor responses often including measurements related to movements. In these tests, participants are required to perform motor activities to their best ability and neuro- coordination. There is a vast range of tests in this category which can be classified in numerous ways. Here we are dividing these tests into the following categories: Health Related Fitness Tests, Physical Fitness Tests, Motor Fitness Tests and Sports Skill Tests.

- Health Related Physical fitness is defined as a set of attributes that people have or achieve that relates to the ability to perform physical activity and demonstrates indications of a healthy lifestyle. These tests are performed to measure physical characteristics of an individual. Health related physical fitness tests only measure those components which require physical presence without involving any effort or physical activity from the participants. These tests include assessment of health status through BMI and other somato-type methods along with basic physiological elements like heart rate, lung capacity etc. which are essential for leading a healthy lifestyle and can be achieved through participation in regular physical activity.
- Physical Fitness is defined as a set of attributes that people have or achieve that relate to the ability to perform physical activity of moderate to vigorous (MVP) level and reflect reserve energy to work during any emergency needs. It is also characterized by (1) an ability to perform daily activities with vigour, and (2) a demonstration of traits and capacities that are associated with a low risk of premature development of hypokinetic diseases (e.g., those associated with physical inactivity). Physical Fitness Tests are designed to assess these attributes.





- Motor Fitness is defined as a set of attributes that people have or achieve that relates to the ability to perform physical actions engaging neuromuscular coordination which are associated with sports. Motor fitness tests include the components of physical fitness, but in addition, also include coordination abilities like hand-eye coordination, movement coupling, balance, agility and other coordination abilities specific to particular sports or activity.
- Sports Skill Tests are designed to evaluate the ability of a participant to perform physical tasks associated or related to particular sports and its related skills. Every sports has its own sports skill tests that are designed scientifically and have standard norms to evaluate the performance of an athlete's skill sets.

### 6.3.3 Anthropometric tests

**Anthropometric Testing** is the science of assessing the human body's surface measurements, anthropometric evaluation of an athlete's body is very important in order to assess the fitness of body to a particular type of sports. Different sports require different body specifications (like height, weight, body build, body composition etc.) which provide an extra aid to the athletes possessing ideal body structure. The anthropometrical variables that account for athletes' performance includes stature (height), girth (circumference). width, somatotype, through measurement of body mass, height, push-ups, and biceps girth.

#### A. Body Measurements

1. Body Weight.
2. Stature/Height.
3. Waist-Hip Ratio
4. BMI (Height-Weight Ratio)

#### B. Skeletal Girth (Diameters)

1. Bi-acromial Diameter (Shoulder Width).
2. Bicristal Diameter (Abdominal Width).
3. Bitrochanteric Diameter (Hip Width).
4. Humerus Bicondylar Width (Elbow Width).
5. Wrist Diameter.
6. Femur Bicondylar Diameter (Knee Width).
7. Ankle Diameter.





## C. Circumferences

1. Chest Circumference.
2. Upper-Arm Circumference.
3. Fore-Arm Circumference.
4. Thigh Circumference.
5. Calf Circumference.

### 6.3.4 Physical tests

These tests are performed to measure physical characteristics of an individual. Physical tests only measure physical presence without involving any effort of the subject. It measures size or components of body or body parts. It requires a tester and a subject to be tested. Examples of tests are measurement of height, weight, circumference, diameter, skinfolds, blood test, X-rays etc.

### 6.3.5 Affective domain tests

Affective domain tests refer to sociopsychological area that deals with human feelings and relationship behaviour of individuals. These tests are to be measure behavior and emotions. In these tests subjects are required to perform mental activities with their best efforts by writing (pen-paper test) their responses, through interviews or projective methods. These tests deal with the techniques of measuring several aspects affective domains which is important for an athlete's performance. Social Behaviour Tests, Personality tests, Tests that assess stress, emotional aspects etc. are part of Affective Domain Tests. These tests are standard tests constructed and designed scientifically by experts.

### 6.3.6 Cognitive domain tests

Cognitive domain is concerned with mental performance or achievement. Tests concerned with cognitive domain involve testing of knowledge and various other mental achievements of athletes like attention span, concentration, focus, intelligence, creativity. Educational institutes teaching subjects like maths, science, literature assess cognitive aspects of students, but with physical education and sports cognitive domain is challenging to assess, as least importance is given to this domain. However, it is very essential that this be evaluated for effective performance and progress. To evaluate athletes and sports participants effectively, a PE Teacher, coach or trainer must have a clear understanding of the cognitive aspects associated with a particular sport or physical activity. It will help the person administering the



test to select and administer appropriate cognitive tests and measurements that are relevant to the training outcome. The cognitive test score can be compared with appropriate standards, and finally, determine grades for scientific judgement on athletes' cognitive abilities.

**I. Tick the correct options.**

1. BMI is an example of which of the following:
  - i. Anthropometric Tests
  - ii. Physical Fitness Tests
  - iii. Psychomotor Tests
  - iv. Written Tests
2. Which type of test may be used to test social behaviour?
  - i. Anthropometric Tests
  - ii. Physical Fitness Tests
  - iii. Psychomotor Tests
  - iv. Affective domain Tests

**II. Answer the following questions briefly.**

1. Explain Psychomotor test with an example.
2. Demonstrate with examples the difference between Physical and Psychomotor test.

**III. Answer the following questions in 150-200 words.**

1. Discuss the classification of tests with suitable examples

### 6.4.1 Test Administration Guidelines in Physical Education and Sports

Administration of tests deals with the total organization, management, execution, supervision of tests along with proper follow-up function and adequate reporting and utilization of test results. Unsystematic, inefficient or inaccurate testing may be mainly due to ignorance of proper procedure of test administration. The person administering the test must prepare to avoid such situations in the process of test administration. The whole process may be divided into three parts:

- i. Pre- planning
- ii. Testing Operation
- iii. Post- Test Functions





## Pre-Test Planning

### 1. Economy of Testing

- Test stations
- Test Personnel
- Grouping of Subject
  - Individual testing
  - Mass testing
  - Squad testing

### 2. Logistic Management plan

#### 3. Data record plan

- . Score units
- . Score compilation process
- . Score sheet plan

## Test Operations

1. Explanation
2. Demonstration
3. Warm-Up
4. Motivation
5. Safety/Security

## Post-Test Functions

1. Test Record-collection&conversions.
2. Interpretation of Result
3. Preparation of report
4. Construction of Table/graphs

### Pre- Planning

1. The test planning document must be prepared keeping in mind all stakeholders of the test.
2. Testing stations, score sheets/questionnaire, organization of group, test layout etc. must be prepared before the testing.
3. The information regarding testing purpose, scientific authenticity of test, group size, age, sex must be considered.
4. The test must be planned in such a way that it proves to be most economical in terms of cost of instrument/equipment, economy of time and number of personnel required.

### Testing Operation

1. All the equipment and facilities to be carefully checked and placed in proper position before subject arrives.
2. All instructions, explanation, demonstration, layout plan illustration should be given to the subject well in advance.
3. Before administering a psychomotor test, a short warm-up is required to avoid injury and assure better performance.
4. Motivation strategies should be adopted for the subjects which help to perform best during the test.
5. The responsibility of the person administering the test and testing personnel is to ensure safety precautions during explanation and demonstration.



6. During testing period the person administering the test should cross check with all necessary points from the check list

### Post-Test Functions

1. All answer sheets or score sheets must be compiled in a safe place and raw scores should be converted into standard scores or may be compared with norms.
2. Test scores must be interpreted as per standards and norms by applying appropriate statistics.
3. To illustrate the results, appropriate tables, graphs and profile may be prepared.
4. A report should be prepared after the event which indicates the nature, scope and objectives of the testing programme.

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#### I. Tick the correct options.

1. Collection of score sheet is a \_\_\_\_\_ function.
  - i. Pre-test
  - ii. Testing
  - iii. Post-test
  - iv. None of Above
2. Testing of scientific authenticity of test is done in which phase?
  - i. Pre-test
  - ii. Testing
  - iii. Post-test
  - iv. None of Above

#### II. Answer the following questions briefly.

1. Write the guidelines of Testing operation phase.
2. Explain pre planning of test administration.

#### III. Answer the following questions in 150-200 words.

1. Discuss Test administration guidelines by giving suitable example

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### 7.5.1 Body Mass Index (BMI)

Confusion surrounds the precise meaning of the terms overweight, overfat, and obese as applied to body weight and body composition. Each term often takes on a different meaning depending on the situation and context of use.





Medical literature infers the term overweight as being abnormal or excessive fat accumulation that presents a risk to health. While obesity refers to individuals at the extreme of the overweight continuum. The Body Mass Index (BMI) is the measure most often used for this distinction. The overweight condition refers to a body weight that exceeds some average for stature, and perhaps age, usually by some standard deviation unit or percentage. The overweight condition frequently accompanies an increase in body fat, but not always (e.g., male power athletes), and may or may not coincide with the comorbidities like glucose intolerance, insulin resistance, dyslipidaemia, and hypertension (e.g., physically fit overfat men and women).

When bodyfat measures are available (hydrostatic weighing, skinfolds, girths, bioelectrical Impedance Analysis [BIA], Dual energy X-ray Absorptiometry [DXA] it becomes possible to more accurately place body fat level on a continuum from ~~low to high, independent of body weight. Over fatness, then, would refer to a~~ condition where body fat exceeds an age- and/or gender-appropriate average by a predetermined amount. In most situations, “overfatness” represents the correct term when assessing individual and group body fat levels. The term obesity refers to the overfat condition that accompanies a constellation of comorbidities that include one or all of the following components of the “obese syndrome”: glucose intolerance, type 2 diabetes, hypertension, increased risk of coronary heart disease and cancer.

#### Extension Activity

Record the height and weight of all students in your class.

- ◆ Find the BMI by applying formula.
- ◆ Find the Waist Hip Ratio using the given formula.

Clinicians and researchers frequently use the body mass index (BMI), derived from body mass and stature, to assess “normalcy” for body weight. This measure exhibits a somewhat higher, yet still moderate, association with body fat and disease risk than estimates based simply on stature and body mass.

#### BMI Computation

BMI computes as follows:

BMI = Body mass (kg) / stature (m<sup>2</sup>) Example

Male stature: 175.3 cm, 1.753 m ; body mass: 97.1 kg . BMI = 97.1 / (1.753)<sup>2</sup>

= 31.6 kg .m<sup>-2</sup>, or simply 31.6

BMI	Classification
< 18.5	Under weight
18.5-24.9	normal weight
25.0-29.9	Overweight
30.0-34.9	class I obesity
35.0-39.9	class II obesity
≥ 40.0	class III obesity

## 7.5.2 Waist to Hip Ratio (WHR)

The waist to hip ratio determines the possibility of health risks and is an indication of whether you have an apple- or pear-shaped figure. The waist to hip ratio measurement is calculated by dividing the measurement of your waist by your hip measurement.

- **Aim:** the purpose of this test to determine the ratio of waist circumference to the hip circumference, as this has been shown to be related to the risk of coronary heart disease.
- **Equipment required:** tape measure
- **Procedure:** A simple calculation of the measurements of the waist girth divided by the hip girth.

Waist to Hip Ratio (WHR) =  $G_w / G_h$ , where  $G_w$  = waist girth,  $G_h$  = hip girth. It does not matter which units of measurement you use, as long as it is the same for each measure.

- **Scoring:** The table below gives general guidelines for acceptable levels for hip to waist ratio. Acceptable values are excellent and good. You can use any units for the measurements (e.g. cm or inches), as it is only the ratio that is important.
- **Target Population:** This measure is often used to determine the coronary artery disease risk factor associated with obesity.
- **Advantages:** the WHR is a simple measure that can be taken at home by anyone to monitor their own body composition levels.
- **Other Comments:** The basis of this measure as a coronary disease risk factor is the assumption that fat stored around the waist poses a greater risk to health than fat stored elsewhere in the body.

According to the World Health Organization (WHO), a healthy WHR is:

- 0.9 or less in men





- 0.85 or less for women giving from Tableno-1

e.g., A man who is 183 cm tall, and weighs 95 kgs.

**Assessment:** As per Table No 1, ideal weight should be in between 72.6 - 88.9 kg, hence he is overweight.

Table No. 1: Height and Weight Table

Adults Weight to Height Ratio Chart		
Height - Ft. In. (cms)	Female	Male
4' 6" - (137 cm)	63 - 77 lb - (28.5 - 34.9 kg)	63 - 77 lb - (28.5 - 34.9 kg)
4' 7" - (140 cm)	68 - 83 lb - (30.8 - 37.6 kg)	68 - 84 lb - (30.8 - 38.1 kg)
4' 8" - (142 cm)	72 - 88 lb - (32.6 - 39.9 kg)	74 - 90 lb - (33.5 - 40.8 kg)
4' 9" - (145 cm)	77 - 94 lb - (34.9 - 42.6 kg)	79 - 97 lb - (35.8 - 43.9 kg)
4' 10" - (147 cm)	81 - 99 lb - (36.4 - 44.9 kg)	85 - 103 lb - (38.5 - 46.7 kg)
4' 11" - (150 cm)	86 - 105 lb - (39 - 47.6 kg)	90 - 110 lb - (40.8 - 49.9 kg)
5' 0" - (152 cm)	90 - 110 lb - (40.8 - 49.9 kg)	95 - 117 lb - (43.1 - 53 kg)
5' 1" - (155 cm)	95 - 116 lb - (43.1 - 52.6 kg)	101 - 123 lb - (45.8 - 55.8 kg)
5' 2" - (157 cm)	99 - 121 lb - (44.9 - 54.9 kg)	106 - 130 lb - (48.1 - 58.9 kg)
5' 3" - (160 cm)	104 - 127 lb - (47.2 - 57.6 kg)	112 - 136 lb - (50.8 - 61.6 kg)
5' 4" - (163 cm)	108 - 132 lb - (49 - 59.9 kg)	117 - 143 lb - (53 - 64.8 kg)
5' 5" - (165 cm)	113 - 138 lb - (51.2 - 62.6 kg)	122 - 150 lb - (55.3 - 68 kg)
5' 6" - (168 cm)	117 - 143 lb - (53 - 64.8 kg)	128 - 156 lb - (58 - 70.7 kg)
5' 7" - (170 cm)	122 - 149 lb - (55.3 - 67.6 kg)	133 - 163 lb - (60.3 - 73.9 kg)
5' 8" - (173 cm)	126 - 154 lb - (57.1 - 69.8 kg)	139 - 169 lb - (63 - 76.6 kg)
5' 9" - (175 cm)	131 - 160 lb - (59.4 - 72.6 kg)	144 - 176 lb - (65.3 - 79.8 kg)
5' 10" - (178 cm)	135 - 165 lb - (61.2 - 74.8 kg)	149 - 183 lb - (67.6 - 83 kg)
5' 11" - (180 cm)	140 - 171 lb - (63.5 - 77.5 kg)	155 - 189 lb - (70.3 - 85.7 kg)
6' 0" - (183 cm)	144 - 176 lb - (65.3 - 79.8 kg)	160 - 196 lb - (72.6 - 88.9 kg)
6' 1" - (185 cm)	149 - 182 lb - (67.6 - 82.5 kg)	166 - 202 lb - (75.3 - 91.6 kg)
6' 2" - (188 cm)	153 - 187 lb - (69.4 - 84.8 kg)	171 - 209 lb - (77.5 - 94.8 kg)
6' 3" - (191 cm)	158 - 193 lb - (71.6 - 87.5 kg)	176 - 216 lb - (79.8 - 98 kg)
6' 4" - (193 cm)	162 - 198 lb - (73.5 - 89.8 kg)	182 - 222 lb - (82.5 - 100.6 kg)
6' 5" - (195 cm)	167 - 204 lb - (75.7 - 92.5 kg)	187 - 229 lb - (84.8 - 103.8 kg)
6' 6" - (198 cm)	171 - 209 lb - (77.5 - 94.8 kg)	193 - 235 lb - (87.5 - 106.5 kg)
6' 7" - (201 cm)	176 - 215 lb - (79.8 - 97.5 kg)	198 - 242 lb - (89.8 - 109.7 kg)
6' 8" - (203 cm)	180 - 220 lb - (81.6 - 99.8 kg)	203 - 249 lb - (92 - 112.9 kg)
6' 9" - (205 cm)	185 - 226 lb - (83.9 - 102.5 kg)	209 - 255 lb - (94.8 - 115.6 kg)
6' 10" - (208 cm)	189 - 231 lb - (85.7 - 104.8 kg)	214 - 262 lb - (97 - 118.8 kg)
6' 11" - (210 cm)	194 - 237 lb - (88 - 107.5 kg)	220 - 268 lb - (99.8 - 121.5 kg)
7' 0" - (213 cm)	198 - 242 lb - (89.8 - 109.7 kg)	225 - 275 lb - (102 - 124.7 kg)

In both men and women, a WHR of 1.0 or higher increases the risk for heart disease and other conditions that are linked to being overweight.



### 7.5.3 Skinfold measures (3-site)

A skinfold is constituted by a double layer of skin plus underlying fatty tissue (subcutaneous fat). For measuring a skinfold thickness, the skinfold is lifted with the help of thumb, forefinger and middle finger of the left hand and the two jaws of the skinfold calliper are applied about half a cm below the picked fold at usually the pre marked level.

Since, the fatty tissue is quite compressible, therefore, the skinfold is measured at a standard pressure of 10 gm/mm square. Standard skinfold callipers are supposed to exert a pressure of 10 gm per millimetre square on the skin fold. The reading of the skinfold is read approximately 2 seconds after releasing the full pressure on the jaws of the calliper.

**Equipment :** The equipment used for measuring all skinfold widths is a standard skinfold calliper. A number of callipers are in use. But the most reliable are Harpenden, Lange and Lafayette skinfold callipers.

#### I. Tick the correct options.

1. Skinfold technique is used to measure
  - i. weight
  - ii. fat percentage
  - iii. girth measurement
  - iv. over fatness
2. WHR is calculate by
  - i. multiplying waist by hip measurement
  - ii. adding hip by waist measurement
  - iii. dividing hip by waist measurement
  - iv. subtracting waist from hip measurement

#### II. Answer the following questions briefly.

1. What is BMI?
2. What is WHR?
3. What is Overweight and obesity?

#### III. Answer the following questions in 150-200 words.

1. Vilas, a male person whose weighs is 90 kg and his height is 1.7 m. Calculate his BMI. Also state the category in which he falls.



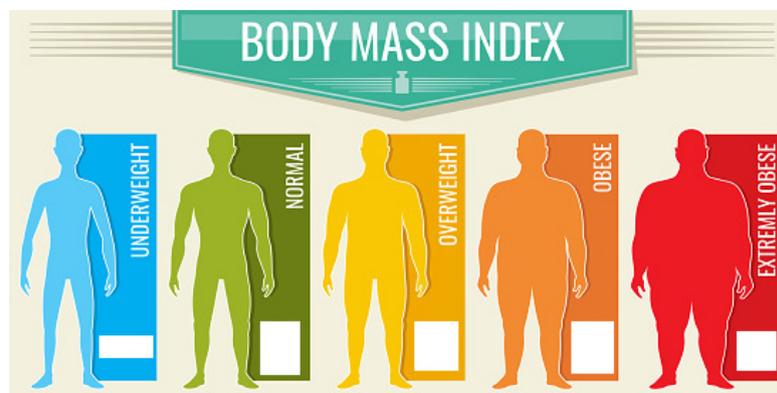


#### IV. Complete the diagram about some of the tests.

	Body Mass Index	Waist to Hip Ratio	Skinfold Measures
Purpose of test			
How the test is administered			

#### V. Case Study

BMI is considered a very useful test for body composition. People with high BMI are advised to workout and pay attention to their weight with the help of workout and improvement in their dietary habits. Based on this answer the following questions:-



- What is the range for Normal BMI?
- 30-34.5 is the range for \_\_\_\_\_.
- A person with BMI 26 is \_\_\_\_\_.
- Calculate BMI for a male whose weight is 90kg and his height is 1.7m.

#### VI. Art Integration

Design Posters for the Physical Education Testing area, giving instructions and illustrations for each test.

#### Suggested Reading:

- Clarke, H. D. (1987). Application of Measurement to Physical Education. Englewood Cliffs, Prentice Hall.
- Kansal, D. (2008). Text Book of Applied Measurement & Evaluation & Sports. New Delhi: Sports & Spiritual Science Publications.
- Morrow, J. R. (2000). Measurement and Evaluation in Human performance. Human Kinetics.

