UNIT-VII

TEST AND MEASUREMENT IN SPORTS

Content

- Define Test, Measurement & Evaluation
- Importance of Test, Measurement & Evaluation in Sports
- Calculation of BMI & Waist – Hip Ratio
- Somato Types (Endomorphy, Mesomorphy & Ectomorphy)
- Measurement of health related fitness

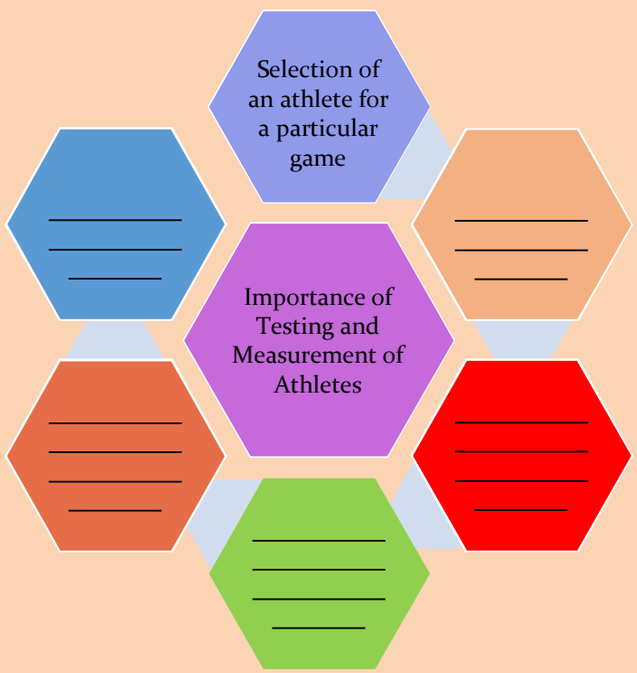
Learning Objectives

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 measurement of health related fitness

Discussion

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



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

7.1.1 WHAT IS A TEST

Remember when you tried sit-ups for the first time. As a child, you probably did 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?

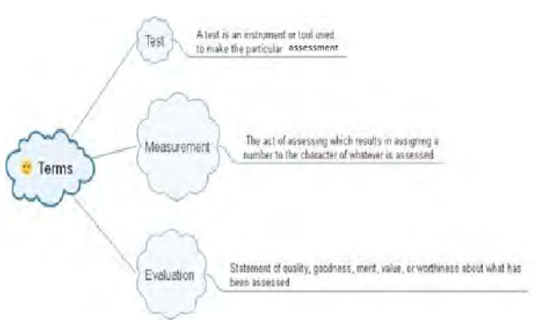
A **test** is an instrument or tool used to make a particular measurement. This tool may be written, oral, a mechanical device (such as a treadmill), physiological, psychological, or another variation.

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, number of 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 what not. Physical educationists might be interested in measuring different items for taking better decisions.Thus,to make decisions, it is extremely important to measure and evaluate in an accurate manner. Making effective decisions depends on first obtaining relevant information. This is where testing and measurement enterthe picture. The most basic principle of this text is that measurement and evaluation are essential to sound educational decision making.



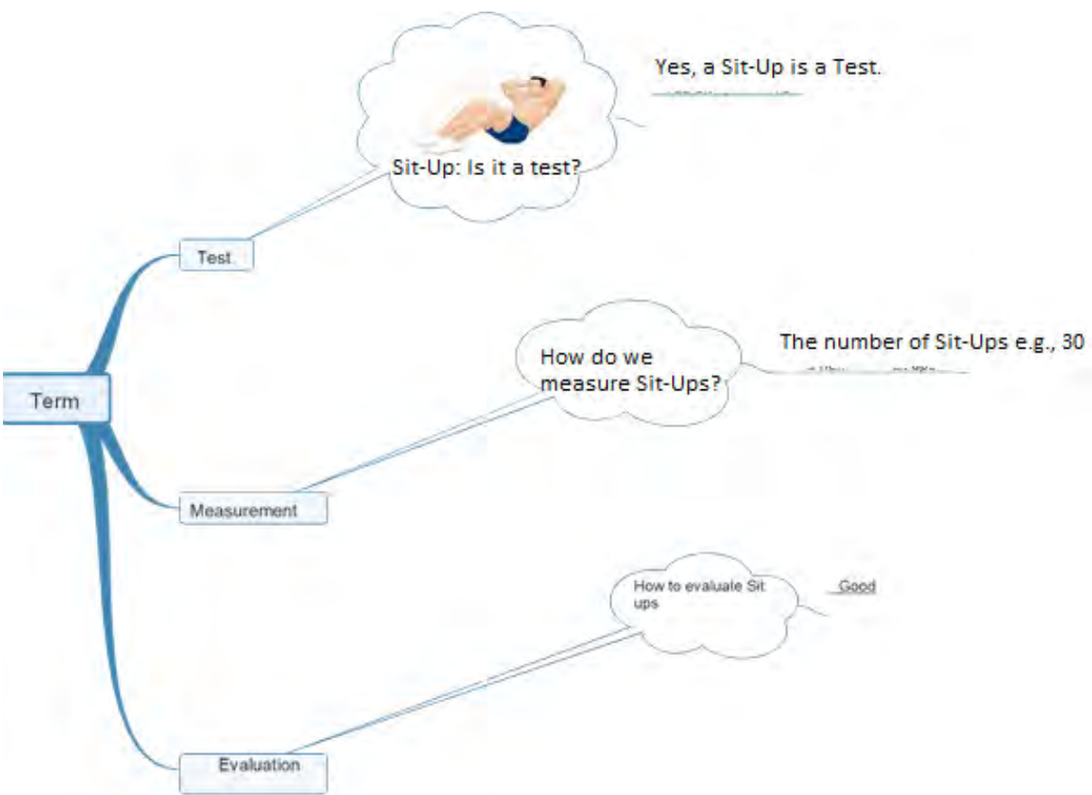
7.1.2 TEST, MEASUREMENT, EVALUATION AND ASSESSMENT

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

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

Measurement 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.



The term **assessment** is also used in a variety of ways. Much of the time the word is used broadly, like evaluation; or,it is often used to indicate the use of both formal and informal data-gathering procedures and the combining of the data in a global fashion to reach an over all judgment. At times, assessment isused more particularly to refer to

the clinical diagnosis of an individual's problems.It is important to point out that we never measure or evaluate people. We measure or evaluate characteristics or properties of people: their scholastic potential, knowledge of algebra, honesty, perseverance, ability to teach, and so forth.

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 access 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 administrating 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

7.1.3 SCALES OF MEASUREMENT

Measurement numbers are composed of scales. There are four scales of measurement:

- **Nominal measurement scales** – Nominal measurement scales are used to name or label thingsor to depict categories. Nominal scales put things or people into categories. e.g., Gender is categorized in Male andFemale.
- **Ordinal scales** – Ordinal scales order or rank things. In measurement, an assigned rank given to a person or thing is an ordinal number. e.g., First, Second and Third rank in sports.
- **Interval scale** – The most commonly used scale in measurement in physical education is the interval scale. Interval measurement scales are based on a

continuum where the interval (or distance) between any two numbers is always the same. The intervals are equal to each other. e.g., 2, 4, 6, 8 are at equal interval of 2. This scale does not have an absolute meaning of zero.

- **Ratio scale** – The most advanced, the most sophisticated, and the most precise measurement scaleis the ratio scale. The ratio measurement scale is distinguished from the interval measurement scale by the fact that it has an absolute, true zero that has meaning. e.g., if somebody's pulse is zero mean there is no life in the individual. If something weighs zero, it means it is weightless.

I. Tick the correct option.

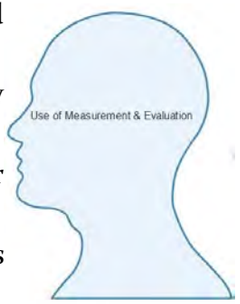
1. Zero degree temperature is an example of scale of measurement.
   a. Nominal
   b. Interval
   c. Ordinal
   d. Ratio
2. Mohan's height is 3ft 11in. 3ft 11 in is an example of
   a. test
   b. measurement
   c. evaluation
   d. assessment

II. Answer the following questions briefly.

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

7.2.1 IMPORTANCE OF TEST, MEASUREMENT & EVALUATION IN SPORTS

There are several ways, then, in which evaluation procedures aid the teacher:



(1) they help in providing knowledge concerning students' entry behaviours.

(2) they help in setting, refining, and clarifying realistic goals for each student.

(3) they help in evaluating the degree to which the objectives have been achieved.

(4) they help in determining, evaluating, and refining the instructional techniques.

The importance of readiness for learning is a well- accepted principle. To teach effectively we must establish where a student is, and start from there. We should have estimates of the student's capacity for learning, as well as estimates of what he currently knows. We cannot, for example, teach lofted kick to a student who cannot hitt he ball. To be effective teachers, we must be aware of what our students already know.

7.2.2 IMPORTANCE OF MEASUREMENT AND EVALUATION

A physical educationist might be interested in knowing whether the students are physical fit or whether they are equipped with sufficient fundamental skills for them to participate in different activities. So, in order to give them the best form of physical education Programme, a physical education is needs to have the knowledge of Test, Measurement and Evaluation be cause the ultimate goal is to make an informed decision. Measurement and evaluation aid the student by

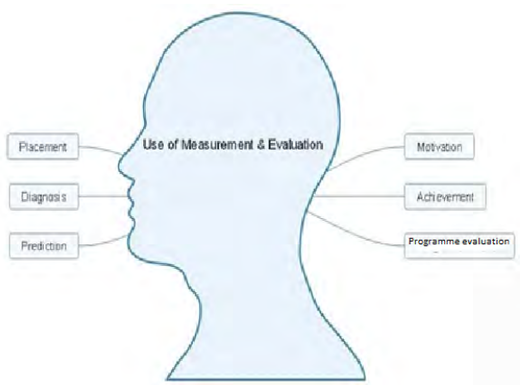
(1) communicating the teacher'sgoals,

(2) increasing motivation,

(3) encouraging good study habits, and

(4) providing feedback that identifies strengths and weaknesses.

Overall there are six general points that highlight the importance of measurement and evaluation in physical education and sports: placement, diagnosis, prediction, motivation, achievement, and programme evaluation.



Placement: Every student cannot be given the same training programme. Placement refers to the grouping of the students into categories like high fitness and low fitness, swimmers and non- swimmers, skilled and unskilled because students must be put into categories for being imparted the most suitable training. In other words, test and measurement is important to provide a means of classifying students for instruction and participation.

Diagnosis: Diagnosis is important to determine the strengths, weaknesses and limitations of individuals in physical education activity so that appropriate training can be provided. Diagnosis helps to determine the need(s) of the student. Thus, it is important to measure the abilities and capacities of each student in physical education activities.

Prediction: Test scores can be viewed as predictors of one's future success in school. Physical Education teachers may use the physical activity patterns, cardiovascular endurance, blood pressure, body fat, or other factors to predict the student's fitness level.

Motivation: Testing, measurement and evaluation gives the status of physical fitness, sports skills and other parametres which motivate the student to do better and better.

Achievement: In a Programme of instruction or training, a set of objectives must be established by which participants' achievement levels can be evaluated. For instance, in this course,

your final achievement level will be evaluated and a grade will be assigned on the basis of how well you met some objectives set forth by the instructor.

Programme evaluation: The goal of Programme evaluation is to demonstrate (with sound evidence) the successful achievement of Programme objectives to your superiors. A physical education teacher, may be asked to demonstrate how the students are receiving appropriate physical fitness training. So, one might compare students' fitness test results with the test results of students in another school district or with national test norms.

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 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 test and measurement in Diagnosis?
2. What is role of Test 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.

7.3.1 BODYMASS 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. The medical literature infers the term overweight to an overfat condition despite the absence of accompanying body fat measures while obesity refers to individuals at the extreme of the overweight (overfat) 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] that you have already studied in Chapter 3) it becomes possible to more accurately place body fat level on a continuum from low to high, independent of body weight. Overfatness, 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 byapplying formula.
- Find the Waist Hip Ratio using the givenformula.

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 (m2)

Example

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

= 31.6 kg .m-2, 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

7.3.2 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 heartdisease.
- **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) = Gw / Gh, where Gw = waist girth, Gh = 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 is183 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.

I. Tick the correctoptions.

1. Skinfold technique is used tomeasure
   - 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.

7.4 SOMATOTYPES (ENDOMORPHY, MESOMORPHY & ECTOMORPHY)

Why should you use somatotyping? Of what value is it in exercise and sports science? These are important questions that are often asked. The somatotype gives an overall summary of the physique as a unified whole. Its utility is in the combination of three aspects of physique into a somato type rating. It combines the appraisal of adiposity, musculo-skeletal robustness and linearity into the three-numbered rating and conjures up a visual image of the three aspects of thephysique. A diposity is related to the relative fatness or endomorphy; the relative muscle and bony robustness is related to the fat-free body or mesomorphy; and the linearity or ectomorphy gives an indication of the bulkiness or mass relative to stature in the physique. From a few simple measurements, the somato type gives a useful summary of a variety of possible measures or observations that can be made on the body. The somato type tells you what kind of physique you have and how it looks. It has been used to describe and compare the physiques of athletes at all levels of competition and in a variety of sports. Somato types of athletes in selected sports are quite different from each other, whereas somato types are similar in other sports. Somato typing has also been used to describe changes in physique during growth, ageing and training, as well as in relation to physical performance.

Somatotype is a method for describing the human physique in terms of a number of traits that relate to body shape and composition. The definition of the traits, and the form of the scales that are used to describe the relative importance of the traits, vary from one body-type method to the other. Attempts to establish such methods date from Hippocrates, and continue to the present time. A classic approach that led to today's commonly used method, was introduced by Sheldon.

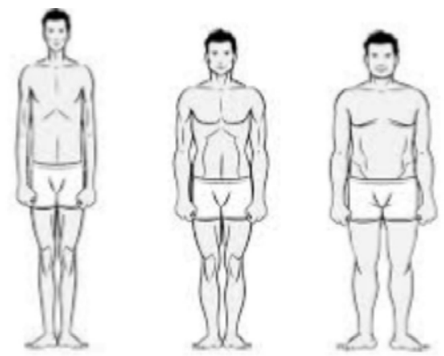
The somatotype system presented by Sheldon was based on subjective method based on photography of the participants. The Sheldon somatotype was further modified by H.Carter in 1967 for developing an objective method of classifying body type based on anthropometric methods.

The present chapter delimits itself to the basic understanding of the characteristics associated with the three different body types known as Endomorph, Mesomorph, Ectomorph.

The first component, called **Endomorph**, describes the relative degree of adiposity of the body, regardless of where or how it is distributed. It also describes corresponding physical aspects, such as roundness of the body, softness of the contours, relative volume of the abdominal trunk, and distal tapering of the limbs. Endomorph are rounded shaped or pear shaped body with high percentage of body fat. They reflect wide hip and narrow shoulders along with under developed muscles. Due to this, they may not be found to be athletic or highly active in sports and less active toward exercise.

The second component, called **Mesomorph**, describes the relative musculo-skeletal development of the body. It also describes corresponding physical aspects, such as the apparent robustness of the body interms of muscle or bone, the relative volume of the thoracic trunk and the possibly hidden muscle bulk. The definitions of endomorphy and mesomorphy reflect the anatomical model of body composition. Mesomorph are square shaped and muscular in structure. They have well developed muscles, wedge-shaped body, narrow hips and broad shoulders. Mesomorphs are also found have less fat percentage, therefore found to be more physically active in sports, fitness and high intensity activities.

The third component, called **Ectomorph**, describes the relative slenderness of the body. It also describes corresponding physical aspects, such as the relative 'stretched-outness, 'the apparent line a rity of the body or fragility of the limbs, in absence of any bulk, be it muscle, fat or other tissues. Ectomorph are thin and fine-boned in shape and mostly have narrow chest and abdomen. Being underweight is a common reflection of ectomorphs. They also demonstrate narrow shoulders and hips with less percentage of fat. They may not be found to be athletic in characteristics, especially due to being more prone to injuries and lack of muscularity required for competitive sports.



Somatotype modified by H. Carter is a quantified expression or description of the present morphological conformation of a person. It consists of a three-numeral rating, for example, 3.5-5-1. The three numerals are always recorded in the same order, each describing the value of a particular component of physique.

Category is the qualitative description of the individual somatotype, in terms of the dominant component or components. For example, a subject with a high rating on mesomorphy and an equally low rating on endomorphy and ectomorphy, will be called a mesomorph or a balanced mesomorph.

The principal rating of the component values is based on a visual inspection of the subject, or his or her photograph – preferably a front, a side and a back view – taken in minimal clothing. This rating is called the photoscopic (oranthroposcopic) somato type rating. If the investigator cannot performa photoscopicrating, the component values can be estimated from a combination of anthropometric measurements. The calculated three-numeral rating is then called the anthropometric somatotype. The recommended somato typing procedure is a combination of an anthropometric followed by a photoscopic evaluation.

I. Tick the correct option.

1. Somatotype is a method for describing
   - i. human body length
   - ii. human physique
   - iii. human skull
   - iv. human behaviour

2. The term ectomorphy describes
   - i. the relative volume of the abdominal trunk
   - ii. the relative slenderness of the body ageing
   - iii. the roundness of the body
   - iv. the musculo-skeletal development of the body

II. Answer the following questions briefly.

1. What is somatotype?
2. What is endomorph?
3. What is ectomorph?

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

1. Explain the procedure of measuring somatotypes.

7.5. Measurement of health related physical fitness

Components of health related physical fitness has already been defined and discussed in unit-iii and the present unit will discuss about the test battery items, test protocols and evaluation norms for assessment of physical fitness.

Health related physical fitness as defined in earlier chapters, need to have multiple test items which are combined together to form a battery or group of tests. There are many health related physical fitness test batteries used across the world for different age groups and demographics. One of the prominent health related fitness test is 'AAHPERD Health related test' developed for college students in 1980 at USA. The test item of AAHPER health related physical fitness test are:

FITNESS COMPONENTS	TEST ITEMS

Body Composition	Triceps and subscapular skinfolds
Low Back Hamstring Flexibility	Sit and Reach
Abdominal Muscle Strength/Endurance	Bent knee sit-ups in one minute
Cardiorespiratory Endurance	Mile run or Nine-minute run

In this chapter, we will discuss about a health related physical fitness test battery for Indian school children between the age group of 9-18 years, developed by Fit India Mission in 2019.

HEALTH REALTED FITNESS COMPONENTS	TEST ITEMS
a. Body composition	BMI
b. Cardiorespiratory endurance	600 mt Run/Walk
c. Muscular strength and Muscular endurance	Partial Curl-up and Push-Up
d. Flexibility.	Sit and Reach

Let's discuss briefly discuss about the test procedures for the test items:

7.5.1 BMI (Body Composition): Body Composition refers primarily to the distribution of muscle and fat in the body. Body mass index is calculated from the measures of body Weight (W) and height(H). It is also referred as BMI, for which the formula is Weight (w) divided by Height (h) in squares (BMI = W/ (H x H), where weight (W) is in kilograms and height (H) is in meters. The higher the score usually indicates higher levels of body fat.

Procedure

i.) Height measuring procedure (protocol):

a. Barefoot, stand erect with heels together
b. Both heels touching the base of the stadiometer,
c. Arms hanging naturally by the sides.
d. The heels, buttocks, upper part of the back and usually, but not necessarily, the back of the head are in contact with the vertical wall.
e. The subject is instructed to "look straight ahead" and "take a deep breath".
f. Mark the highest point on skull (Vertex).
g. Measure before exhalation
h. Measurement is read to the nearest 0.1 cm.

ii.) Weight measuring procedure:

a. Place the scale on firm flooring (such as tile or wood) rather than carpet.
b. Have the participant remove shoes and heavy clothing, such as sweaters.
c. Have the participant stand with both feet in the center of the scale.
e. Record the weight to the nearest decimal fraction (for example, 25.1 kilograms).

7.5.2 Partial Curl Up -30sec (Abdominal/ Core Strength): The curl up test measures abdominal muscular strength and endurance of the abdominals and hip-Flexors, important in back support and core stability.

Procedure:

a) Lie down on flat surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards) closer to the ground, body and near to the first parallel strip on the floor.

b) Curl the trunk up and raise it towards the knees in a smooth motion by keeping the arms stretching above/along the ground towards the six inch apart parallel strip).

c) Return to the earlier position to complete one set of curl by lowering the trunk back to the floor so that the shoulder blades or upper back touch the floor.

d) Complete maximum sets possible in 30 seconds and stop after the time finish signal is received.

Equipment:

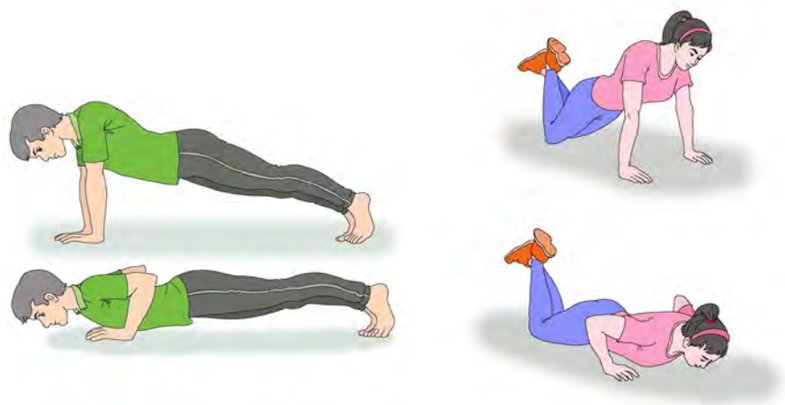
A comfortable mat with a marking of two parallel strips (6 inch apart).

Stopwatch.

Scoring:

Record the maximum number of Curl ups in a certain time period 30 seconds.

7.5.3 Push Up for Boys/Modified Push Up for Girls (Muscular Endurance): Upper body strength and endurance is tested through the Push-Up test for boys and modified Push-Up for girls.



Procedure:

Standard push-up for Boys -

a) Initial position for push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angle to the body.
b) Push-up is executed by keeping the back and knees straight, the participant lowers the body to a predetermined point or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended.
c) Repeat the sets to the maximal numbers till exhausted, as there is not time limit.

Modified Push-up for Girls: Position will be with knees bent, ankles crossed and resting on the floor.

Scoring: Total number of correct push-up will be recorded as scores.

7.5.4 Sit and Reach Test (Flexibility): is the test for assessment of flexibility of the lower back and hamstring muscles. It is a simple test of stretching the trunk forward by placing the hand on a measuring scale fixed to the flexometer (sit and reach box) and positioning the feet on to the sit & reach box without bending knees.

Procedure:

a) Sit bare foot on the floor with soles of the feet placed flat against the Sit and Reach box. Both knees should be locked and pressed flat to the floor.

b) Measure the initial positing score by placing the hands on to the measuring scale.

c) For final position, reach forward along the measuring scale with the palms facing downwards, and the hands on top of each other.

d) Hold the final position for one-two seconds while the distance is recorded, avoid jerky movements.

Equipment :

Sit and Reach box (Flexometer) - Sit and Reach box with 12" x 12" (sides); 12" x 10" (front and back) ; 12" x 21" (top), fixed with a measuring scale on the top panel.

Scoring:

Difference between initial position and final position is recorded in cm and mm as the final score.

7.5.5 6oomt Run/ Walk (Cardiovascular endurance): the test is recommended to assess cardiovascular endurance for school children by asking them to run or walk for 6oomt and record the time for coving the distance.

Procedure:

a) The track can be a standard track or a modified arena of 6oomt distance.

b) The participant can run or walk for the given distance.

c) Participant should be motivated to cove the distance in shortest possible time.

Discussion

SLAUGHTER-LOHMAN FORMULA TO CALCULATE BODY FAT FOR CHILDREN

Body composition assessment for school children can also be effectively done with various other ways including using of skinfold measurements. Lets read a procedure for skinfold test using two sites for body fat measurement with the help of skinfold calliper as explained by M.H.Slaughter and T.G.Lohman in 1988.

Objective: The Slaughter-Lohman formula calculates the percentage of body fat from the taking of two skinfolds. This is based on an age range from 8 to 18 years old.

Slaughter-Lohman Equation Skinfold Sites

- Triceps
- Calf

Equipment: Skinfold calliper

Procedure: To calculate the percentage of body fat, measure take the skinfolds (in mm) with a skinfold calliper and perform the followings equations:

Formula:

- *Boys*: % Body Fat = 0.735 (Triceps skinfold + Calf skinfold) + 1.0
- *Girls*: % Body Fat= 0.610 (Triceps skinfold + Calf skinfold) + 5.1

Score: Time taken for completion (Run or Walk) in min, sec, mm

Test Battery Norms for Evaluation

Norms for the Health related Fitness Indicators as per Khelo India battery of fitness assessment test can be referred by scanning this code

I. Tick the correct options.

1. Sit and Reach test is for the assessment of.....
   i. Strength
   ii. Flexibility

7.5.6 Endurance

7.5.7 Speed

2. Test for 600 mt run/walk is for the assessment of.....
   i. Strength
   ii. Flexibility
   iii. Endurance
   iv. Speed

II. Answer the following questions briefly.

1. What is the process of Body Mass Index testing?
2. What is the difference between Push-Up and modified Push-Up test?
3. What is the procedure to measure height?

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

1. Explain in brief the procedure of testing abdominal strength?

Suggested Reading:

Clarke, H. D. (1987). Application of Measurement to Physical Education. Englewood Cliffs, Prentic 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.