

Measurement & evaluation of human performance

Topic 6 Measurement

6.3.1 Distinguish between the concepts of health-related fitness and performance-related (skill-related) fitness

Sub-topics

1. Statistical Analysis

2. Components of fitness

3. Principles of training programme design

- The components of fitness relate to the requirements of a given sporting activity, and can help to explain success or failure in sport.
- A distinction can be made between components that are generally considered to be **health related** (health benefits may be gained through improvements in these components), and those that are **skill related**, although both will affect performance in sport.

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- **Health related** factors are physiologically based and determine the ability of an individual to meet the physical demands of the activity.
- **Skill related** factors are based upon the neuromuscular system and determine how successful a person can perform a specific skill.

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- Both health and skill related are required in all activities, but the relative importance of each dimension may differ.
 - For example, a person may be physically suited to tennis, possessing speed, endurance and strength requirements, but may not possess the hand eye coordination to strike the ball successfully. In this instance the individual may be more suited to an activity such as distance running that requires fewer skill related components.

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6.3.2 Outline the major components of fitness

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Strength

- Relates to the ability of the body to apply a force. The recognized definition of strength is, *the maximum force that can be developed in a muscle or group of muscles in a single maximal contraction.*

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However, it is how we apply strength that is important in the sporting context. Three classifications have been identified:

- **Maximum strength:** an athlete who requires a very large force to overcome a resistance in a single contraction e.g. weight lifting
- **Elastic strength (Power):** an athlete who requires to overcome resistance rapidly yet prepare the muscle quickly for sequential contraction e.g. sprinting, triple jump
- **Strength endurance:** an athlete who is required to undergo repeated contractions and withstand fatigue e.g. rowing, swimming

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Local Muscle Endurance

Is the ability of a particular muscle group to keep working at the desired level of effort for as long as the situation demands. It is often controlled by the body's tolerance of the increasing levels of lactic acid which the activity creates. It is of high importance in:

- The arms in a 200m swim.
- The legs in a marathon
- The arms, abdominals and quadriceps in a 2000m rowing race.

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Speed

- the ability to put body parts into motion quickly, or the maximum rate that a person can move over a specific distance.

- It is a major factor in high intensity explosive activities such as sprinting, vaulting in gymnastics or fast bowling in cricket. However, it is not simply concerned with the rate at which a person can move his/her body from A to B. It also involves putting limbs into action rapidly, such as with the throwing of the javelin.
- It is genetically determined by fast twitch fiber composition, with body mechanics and leverage also playing a role.

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Power

Is the combination of strength and speed. A powerful movement is achieved quickly as possible, while imparting as much strength as possible. It is of high importance in:

- Tackling in rugby or football.
- Spike in volleyball
- Drive in golf

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Cardio-respiratory fitness (aerobic capacity)

- Is dependent upon the ability of the cardiovascular system to transport and utilize oxygen during sustained exercise. It can be defined as:
the ability to provide and sustain energy aerobically.
- Cardio-respiratory endurance is the component of fitness that underpins all aerobic activities which include long distance running, cycling or swimming as well as being a contributing factor to many other sporting situations.

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Flexibility

- *the range of movement at a joint.*
- It is determined by the elasticity of ligaments and tendons, the strength and opposition of surrounding muscles and the shape of articulating bones.
- Although it is commonly associated with gymnastics, it is in fact a requirement in all sports since the development of flexibility can lead to both an increase in speed and power of muscle contraction.

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1. Statistical Analysis

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Body Composition

- *the component parts of the body in terms of the relative amounts of body fat compared to lean body mass.*
- For the average 18 year old, men range from 14-17%, while woman range from 24-29%.
- For the athlete high body fat can result in a reduction in muscle efficiency and contributes to greater energy expenditure since more weight requires more energy to move around and a consequent increase in oxygen consumption.

Sub-topics

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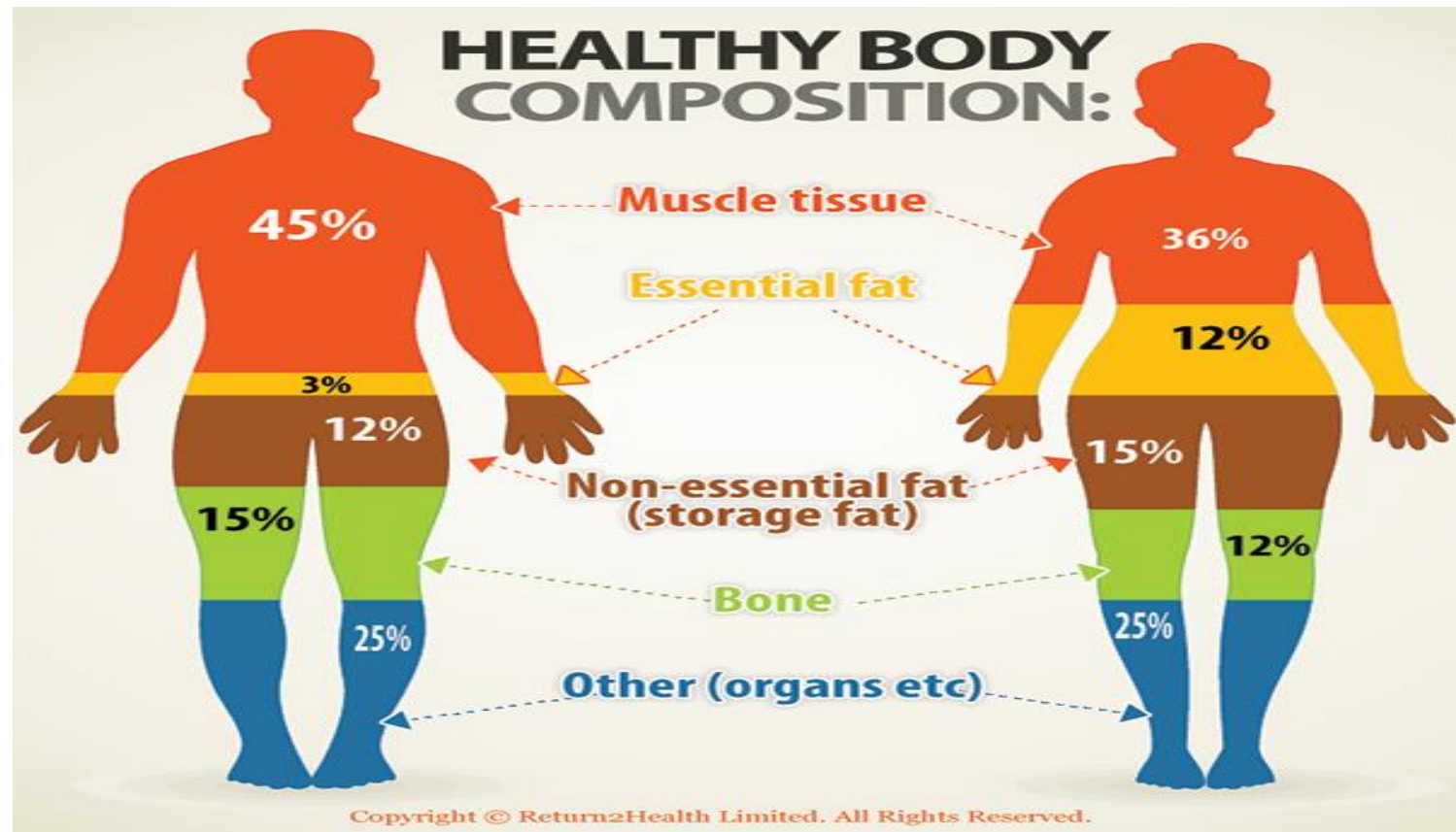
Body Composition

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Skill/motor fitness

Involves the components of fitness that are skill related. These include speed and power, as well as agility, balance, coordination and reaction time.

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Sub-topics

1. Statistical Analysis

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Agility

- *the ability to move and change direction and position of the body quickly and effectively while under control.*
- With reference to this definition we can see that many factors are involved in agility, including balance, coordination, speed and flexibility.
- It is required in a range of activities from tumbling in gymnastics to receiving serves in volleyball. Although activities can be undertaken to improve agility, development of this skill related component is limited.

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Balance

- *the maintenance of the center of mass over the base of support. This can be while the body is static or dynamic (moving).*
- It is an integral component in the effective performance of most motor skills. In gymnastics, for example, it may be required to perform a balanced position when performing a handstand (static). Or when staying on feet in a rugby tackle (dynamic).

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Coordination

- The interaction of the motor and nervous systems and is the ability to perform motor tasks accurately and effectively.
- When serving in tennis for example, the tennis player must coordinate the toss of the ball with one hand with the striking of the ball with the racket head at the optimum position.
- A swimmer performing breast stroke must coordinate the pull of the arms with the strong kick phase to ensure effective performance.

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Reaction time

- *the time taken to initiate a response to a given stimulus.*
- The stimulus may be visual, for example, in responding to a serve in tennis, or aural in responding to a gun in athletics or verbal guidance from players and coaches.
- Reaction time is dependent upon the ability of an individual to process information and initiate a response by the neuro-muscular system. It can be improved through training.

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6.3.3 Outline and evaluate a variety of fitness tests

(Consider the validity, reliability and limitations of the following tests)

Sub-topics

1. Statistical Analysis

2. Components of fitness

3. Principles of training programme design

- Aerobic capacity:
 - Multistage fitness/beep test (leger test)
Discuss the validity, reliability and limitations of the above test.
 - Harvard Step Test
Discuss the validity, reliability and limitations of the above test. Outline the difference in protocol between the Queens College and Harvard Step tests.

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Sub-topics

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- Aerobic capacity:
 - Coopers 12 minute run: Research the protocol/norms of the test.

Discuss the validity, reliability and limitations of the above test.

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- Flexibility:
 - Sit and reach test

Discuss the validity, reliability and limitations of the above test.

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6.3.3 Outline and evaluate a variety of fitness tests

(Consider the validity, reliability and limitations of the following tests)

Sub-topics

1. Statistical Analysis

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- Muscle endurance:
 - Research the protocols/norms for the following tests:
 - maximum sit-ups
 - Maximum push-ups
 - Flexed arm hang
 - Discuss the validity, reliability and limitations of the above tests.

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(Consider the validity, reliability and limitations of the following tests)

Sub-topics

1. Statistical Analysis

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- Agility:

Research the protocols/norms of the following test:

- Illinois Agility Test

Discuss the validity, reliability and limitations of the above test.

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(Consider the validity, reliability and limitations of the following tests)

Sub-topics

1. Statistical Analysis

2. Components of fitness

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- Strength:

Research the protocols/norms of the following test:

- Hand grip dynamometer

Discuss the validity, reliability and limitations of the above test.

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(Consider the validity, reliability and limitations of the following tests)

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1. Statistical Analysis

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- Speed:
- 40 meter sprint

Discuss the validity, reliability and limitations of the above test.

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(Consider the validity, reliability and limitations of the following tests)

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- Body Composition:

Body Mass Index

Discuss the validity, reliability and limitations of the above test.

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1. Statistical Analysis

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- Body Composition:

Anthropometry: Use the below site to learn more about anthropometric testing. Complete a series of skin fold tests as an example.

<http://www.topendsports.com/testing/anthropometry.htm>

Discuss the validity, reliability and limitations of the above test.

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1. Statistical Analysis

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- Body Composition:

Underwater weighing

<http://www.topendsports.com/testing/tests/underwater.htm>

Discuss the validity, reliability and limitations of the above test.

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Research the protocols/norms and implement the following tests:

- Balance (Stork stand)
- Coordination (hand ball toss)
- Reaction time (drop test)
- Power (vertical jump/standing broad jump)

Discuss the validity, reliability and limitations of the above test.

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Research Task: Consider process involved in the establishment of standardized norms and what cultural variations may be apparent.