

BTEC Sport

Fitness for Sport and Exercise

Components of Fitness



Physical components of fitness

Component	Aerobic Endurance	Muscular Endurance	Muscular Strength	Flexibility	Speed	Body Composition
Description	The ability of the cardiorespiratory system to work efficiently, supplying nutrients and oxygen to the muscles during sustained (long lasting) physical activity.	The ability of the muscular system to work efficiently. It's where a muscle can continue contracting over a period of time against a light to moderate fixed resistance.	The maximum force that can be generated by a muscle/muscle group.	Having an adequate range of movement in all joints of the body.	How fast something is. $\text{SPEED (m/s)} = \frac{\text{DISTANCE (m)}}{\text{TIME (s)}}$ Accelerative speed: sprints up to 30m Pure Speed: sprints up to 60m Speed endurance: sprints with short recoveries in between.	The relative ratio (amount) of fat mass to fat-free mass in the body.
Application	Rowers need good aerobic endurance to row long distance events.	Tennis players need to be able to hit the ball over and over again for the entire match	Weightlifting and judo require muscular strength in order to apply maximum force to the weight/opponent.	Gymnasts and dancers require good flexibility to perform different movements with good technique	100m sprinters need good accelerative speed and pure speed. 400m require good speed endurance.	Sumo wrestlers require lots of fat mass and less fat free mass so they are able to use their weight to defeat their opponent.
Test	Multi-stage fitness test. Forestry step test. 12 minute cooper run	One-minute sit up test. One minute press up test.	Hand grip dynamometer. One rep max test.	Sit and reach test.	35m sprint test.	BMI BIA Skinfold callipers

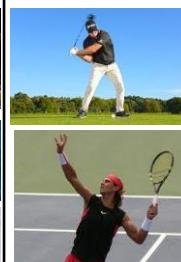
Skill-related components of fitness

Component	Balance	Power	Agility	Coordination	Reaction Time
Description	The ability to maintain a centre of mass over a base of support. Static balance: where the performer is still. Dynamic balance: this is where the performer is moving.	The product (result) of speed and strength, the amount of work done in a unit of time.	The ability of a sports performer to quickly and precisely move or change direction without losing balance or time.	The smooth flow of movement needed to perform a motor task efficiently and accurately.	The time it takes for a performer to respond to a stimulus and initiate their response.
Application	Gymnasts require good balance to perform a variety of static and dynamic movements.	In golf you require power to be able to drive the ball and cover as much distance as possible.	Agility is really important in sports like football, netball and hockey where players will need to evade their opponents.	Coordination is required in all sports to performed the desired skill with precision and accuracy e.g. being able to move your foot to kick a ball.	Reaction time is important for a 100m sprinter so they can respond quickly to the starter gun.
Test	Standing stork test.	Vertical jump test.	Illinois agility test.	Wall toss test.	Ruler drop test.

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Fitness Testing



Multi-Stage Fitness Test

Measures: Aerobic endurance
Equipment: Bleep test recording, tape measure, cones
Reliability: The weather can affect results
Validity: Motivation of performers – stopping before exhaustion.



Forestry Step Test

Measures: Aerobic endurance
Equipment: Step, stopwatch and metronome
Reliability: Performers must have time to practice stepping to the rhythm or else results will be less reliable
Validity: People with longer legs find this test easier.



Sit and Reach Test

Measures: Flexibility
Equipment: Tape measure and box
Reliability: if the performer has poor technique or hasn't warmed up properly this will affect the score
Validity: Only measures the flexibility of the back and hamstrings not a valid measure of flexibility for other body parts.



Hand Grip Dynamometer



Measures: Grip strength
Equipment: Hand grip dynamometer
Reliability: If the performer has poor technique or the grip isn't recalibrated this will affect the score
Validity: Only measures the muscular strength of the lower arm and hand. Not a valid test for measuring strength in other body parts.

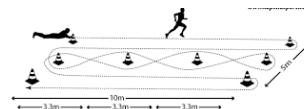
35M Sprint Test



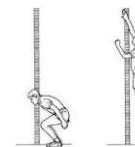
Measures: Speed
Equipment: Tape measure, tape/cones, stopwatch
Reliability: Human error, if the reaction rates of the person stopping the stopwatch are slow
Validity: Valid test for sports that involve running, less valid for those that do not e.g. swimming.

Illinois Agility Test

Measures: Speed and agility
Equipment: Cones, tape measure and stopwatch.
Reliability: The weather and incorrect footwear can impact results.
Validity: Valid test for sports that involve running, less valid for those that do not e.g. kayaking.



Vertical Jump Test



Measures: Power
Equipment: Scales, chalk, tape measure, a wall
Reliability: A poor jumping technique can impact the result
Validity: The test only measures power in the leg muscles. Not a valid test for measuring power in other body parts.

1-Minute Sit Up; 1-Minute Press Up Test

Measures: Muscular endurance
Equipment: Stopwatch and mat
Reliability: A bad technique can affect the score.
Validity: Tests only measure the muscular endurance of certain muscles, does not indicate overall muscular endurance.



BMI



Measures: Ideal weight
Equipment: Scales and tape measure
Reliability: Human error, if height and weight are not measured accurately the results will not be reliable
Validity: People with more muscle have a higher body mass, pregnant women carry more weight due to the baby. This test is not valid for these people.

Bioelectrical Impedance Analysis (BIA)

Measures: Body fat percentage
Equipment: BIA Analyser and mat
Reliability: If the sport performer drinks more/ less water than normal this can affect the results.
Validity: N/A



Skinfold Test

Measures: Body fat percentage
Equipment: Skinfold callipers
Reliability and validity: Human error, measuring at the wrong test sites or having a bad technique can affect the results.



Importance of testing

- Finds out what the performer's baseline (starting) fitness level is.
- Identify strengths and areas for improvement.
- Performer/ coach can set goals/ targets.
- Can be used to help design a training programme.
- Find out whether the training programme is working.
- Find out whether the performer is improving.



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Exercise Intensity



Heart Rate

Heart rate is the number of **times** the heart beats **per minute**. You can measure your heart rate from the following sites:

- Radial – wrist
- Carotid – neck



Heart rate is measured in **beats per minute (BPM)**. Heart rate can show the **intensity** (how hard) a sports performer is **working at**. The higher the heart rate, the greater the intensity of the exercise.

Maximum Heart Rate

$$\text{HR max} = 220 - \text{age (years)}$$

Maximum heart rate is the **highest number** of times your heart can **beat in one minute**.

Maximum heart rate is also called **HR max**.

You can workout your HR max using the calculation above.

Borg RPE Scale

In 1970, Borg a scientist came up with the Borg RPE scale. It is also called the Borg RPE Scale (6-20). RPE stands for **rating of perceived exertion**.

It is used to measure intensity. The numbers on the scale represent the levels of exertion (effort).

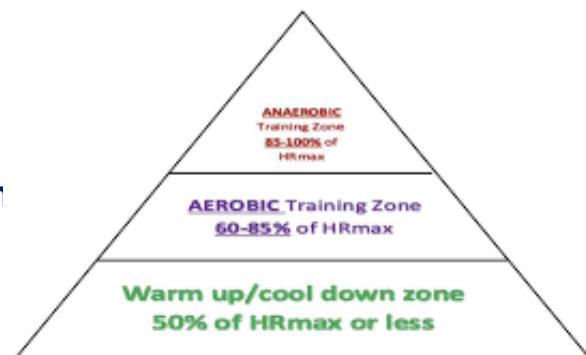
This scale can estimate heart rate during exercise. To work this out you put the rating from the Borg scale into this equation.

$$\text{HR (bpm)} = \text{RPE} \times 10$$

Heart Rate Target Zones

A sports performer needs good cardiovascular health and fitness. To do this they need to increase their training intensity. This means they need to increase their heart rate. Their heart rate should be in a target zone when training.

The target zone recommended to develop cardiovascular health and fitness is **60-85%** of their maximum heart rate.



Working Out Target Zones

You need to be able to work out a person's target zone:

1. Calculate **maximum heart rate (HR Max)**
2. Find the upper training threshold

$$\text{HR max} \times 0.85$$

3. Find the lower training threshold

$$\text{HR max} \times 0.6$$

4. Write down the target zone – it's the lower training threshold to the upper training threshold.

RPE SCALE	RATE OF PERCEIVED EXERTION
10	MAX EFFORT ACTIVITY Feels almost impossible to keep going. Completely out of breath, unable to talk. Cannot maintain for more than a very short time.
9	VERY HARD ACTIVITY Very difficult to maintain exercise intensity. Can barely breathe and speak only a few words.
7-8	VIGOROUS ACTIVITY Borderline uncomfortable. Short of breath, can speak a sentence.
4-6	MODERATE ACTIVITY Breathing heavily, can hold a short conversation. Still somewhat comfortable, but becoming noticeably more challenging.
2-3	LIGHT ACTIVITY Feels like you can maintain for hours. Easy to breathe and carry a conversation.
1	VERY LIGHT ACTIVITY Hardly any exertion, but more than sleeping, watching TV, etc.



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Training methods



Aerobic Endurance

Improves the efficiency of the cardiorespiratory system so that more oxygen and nutrients are delivered to the working muscles and more waste products are removed.

- **Interval training** (exercising at 60-80% MHR followed by recovery period)
- **Continuous training** (exercising at a constant intensity for at least 30 minutes)
- **Fartlek training** (combines continuous training with higher intensity exercise across different terrains)

- Aerobic training is good for all sports that last at least 30 minutes
- No special facilities or equipment required.
- It can take place inside and outside.
- If the training takes place outside whether can impact performance.
- You need to have enough time for at least 30 minutes' regular training.
- It can become tedious.



Muscular Endurance and Muscular Strength

Endurance: Increases the ability of the trained muscles to contract repeatedly for long periods of time.

Strength: Increases the size of someone's muscles, the larger muscles they have the more force they can exert the more strength they have.

- **Circuit training** (involves stations of exercises arranged in a circuit with rest periods included)
- **Weight training** (high reps and low weight = endurance; low reps and high weight = strength)
- **Resistance training** (stacks of weights attached to pulleys to provide resistance)

- Can be tailored to a specific sport
- Different muscle groups can be targeted
- Exercises can be changed to reduce boredom
- Need to be organised and have the correct equipment prior to training
- Need to ensure that the correct technique and safety requirements are being followed to prevent injury
- Exercises may need to be adapted to suit the individual's ability



Power

Power training involves lower weights/ resistance than resistance training and the types of exercises carried out allow the individual to perform a higher number of repetitions. This simulates the use of repeated power in some sports.

- **Plyometric training** (explosive movements making a muscle produce maximum force in the fastest possible time e.g. jumps)
- **Weight training** (low weight and high reps)
- **Resistance training** (stacks of weights attached to pulleys to provide resistance)

- Can be targeted for the muscle groups that require power
- Exercises can be changed to reduce boredom
- Can be tailored to a specific sport
- High impact exercises can cause stress on the body resulting in injuries
- Requires equipment and time to set up
- Need to ensure that the correct technique and safety requirements are being followed to prevent injury

Speed

Improves your acceleration, pure speed and speed endurance for all sports.

- **Hollow sprints** (sprints followed by a jog or walk in between, this is called a hollow period)
- **Interval training** (short, high intensity work periods followed by a rest period)
- **Acceleration sprints** (keep increasing the pace over a short distance, rest by walking or jogging)

- Good for sports that involve travelling at speed
- Good for sports that require sprinting in a straight line
- Equipment can be used to add resistance and variety
- The equipment can be expensive
- Only useful for sports that involve sprinting in one direction

Flexibility

Improves your bodies suppleness allowing your joints to move through their full range of movement. **Can play an important part in injury prevention and helps individuals to be able to perform more specific sporting techniques correctly.**

- **Static stretching** (stretching into a position to target a specific muscle group stretch needs to be held for 12-30seconds)
- **Ballistic stretching** (making fast jerky movements, usually in the form of bouncing through a range of movement)
- **Proprioceptive neuromuscular facilitation stretching (PNF)** (stretching that requires a partner to provide resistance)

- Little or no equipment, low cost and no time required for set up.
- Prepares the body for training.
- High levels of motivation required to carry out exercises
- An instructor may be needed to advise on correct technique
- Risk of overstretching which can cause injury



Challenge

Each member of a youth football team has a different level of physical fitness. At each session, their football coach gets the team to do fartlek training.

Explain the advantages and disadvantages of fartlek training.



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Principles of Training



Additional Principles of Training

Specificity: training should be specific to your preferred sport, activity, or developing physical/ skill-related goals.

Progressive overload: training needs to be demanding enough to cause your body to adapt, improving performance. Training should be increased gradually this can be done by increasing the FITT principles or recovery times. But be careful not to overload as this can result in injury or illness.

Adaptation: this occurs during the recovery period after the training programme is complete. Adaptations is how your body increases its ability to cope with training loads.

Reversibility: if you stop training, or the intensity is not sufficient to cause adaptation, training effects are reversed.

Rest and recovery: these are essential to allow your body to repair and adapt, and for the renewal of body tissues.

Variation: it is important to maintain interest; this helps an individual keep to their training schedule. Vary the training programme and exercises to prevent boredom.

Individual differences/ needs: the programme should be designed to meet your training goals, needs, ability, level of skill, level of fitness, likes and dislikes.

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Frequency

How many training sessions per week

Type

What type of training method and exercises will be used

FITT Principles

Intensity

How hard the participant will train

Time

How long will the session last

Applying Overload to FITT

Frequency: you should gradually increase how often you train. e.g. week 1 = train once a week; week 2 = train twice a week.

Intensity: you should gradually increase the intensity of your training sessions. E.g. week 1 = 3 sets of 8 reps of 5kg weight; week 2 = 3 sets of 8 reps of 7.5kg weight.

Time: you should gradually increase how long you train for. E.g. week 1 = 20 minutes rowing at level 4; week 2 = 25 minutes rowing at level 4.

Type: relates back to specificity. You should ensure your activities closely match your sport/ goals. E.g. a marathon runner should choose continuous training and increase the distances until they reach 26 miles.

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