RISEHOLME College

Welcome to Sport

Introduction to Fitness Training and Programming for Health, Sport and Well-being

Workbook

Starter

What do you already know about fitness training?

Using the link below test your knowledge to see what you know and find out what you will be learning about within this topic.

Section A: Components of Fitness

Identify the physical and skill related components of fitness:

Physical	Skill related

Give an example of when each of the following components are used in sports performance:

Aerobic Endurance	
Strength	
Muscular Endurance	
Power	
Agility	
Coordination	

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Balance	
Speed	
Reaction Time	
Flexibility	

For each of the sports below choose two components of fitness and explain why they are needed for good performance in that particular sport:

Sport	Component needed in the sport and why	Component needed in the sport and why
		
		

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Section B: Training Methods

Research and explain training methods for the following components of fitness:

Aerobic Endurance

Muscular Endurance

Core Stability

Flexibility

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Section C: Case Study and Session Plans

Emily is 20 years old and regularly completes in athletics. Her events are the 100m hurdles and javelin. She want to gain a competitive edge over her competitors and has come to you for advice on training for her next competition

What do you consider to be the four most important physical and skill-related components of fitness for Emily's performance? Please explain your answers.

Component 1: ……	Component 2: ……
Component 3: ……..	**Component 4: ……..**

Using the template on the next page design a 60 minute training session for Emily using two different methods of training

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Coach:		**Athlete:**	
Venue:		**Equipment:**	
Components of fitness focused on:			
Methods of training used:			
Warm up:			
Main Session			
Cool down			

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Textbook

Components of fitness

Fitness is the ability to meet the demands of your environment. It includes social, spiritual, psychological, emotional and physical well-being. Though it is often defined as one of the following, it is not only concerned with muscle size, body tone or the ability to run far or fast.

Physical fitness – focusing on the health-related aspects of fitness – good scores in components in this area mean you have only a small chance of developing health problems.

Skill-related fitness – fitness that allows the individual to perform an activity, task or sport (also known as motor fitness). Physical fitness

Physical fitness involves six main components:

1. **Aerobic endurance** – also known as stamina or cardiorespiratory endurance, it is the ability of the cardiovascular and respiratory systems to work efficiently and supply the muscles with nutrients and oxygen to maintain exercise over time. It is important not only for daily tasks such as walking to work, but also for a range of sport, leisure and recreational activities. A number of events rely on aerobic endurance, and poor aerobic endurance can lead to poor performance in some sports.
2. **Strength** – the ability of a specific muscle or muscle group to exert a force in a single maximal contraction. When you think about strength, you might think about weightlifters or boxers, but strength is required in most sports. For instance, a Formula 1 driver needs strong neck muscles to withstand the pressure put on their head when going round corners fast.
3. **Muscular endurance** – this is needed where a specific muscle or muscle group makes repeated contractions over a significant period of time (possibly over a number of minutes) against a light to moderate fixed resistance load. Sporting examples include: • a boxer making a repeated jab • continuous press-ups or sit-ups • the 400 metres in athletics.
4. **Flexibility** – this is important for all sports and for health. It relates to having an adequate range of motion in all joints of the body and the ability to move a joint fluidly through its complete range of movement.
5. **Speed** – a component of physical fitness, speed is required to maximise performance in order to move the whole body quickly or limbs rapidly. It is the ability to move over a distance in the quickest possible time. Athletic sports such as the 100-metre sprint and long jump require high levels of speed.
6. **Body composition** – the amount of body fat and fat-free lean body tissue an athlete has. It is important from a health and sports performance perspective. Lean body mass includes the combined weight of the vital organs, bones, muscles and connective tissues.

Skill-related fitness

Skill-related fitness involves five main components.

1. **Agility** – the ability of an athlete to quickly and precisely move or change direction while maintaining control of the movement.
2. **Balance** – being able to maintain stability or equilibrium while performing. There are two forms of balance: static balance, where the athlete is stationary, for example in a handstand in gymnastics, and dynamic balance, where the athlete is moving, for example a footballer sprinting with the ball.
3. **Coordination** – the ability to control movement of two or more body parts, smoothly and efficiently, to perform a task. Most sporting movements.

4. **Reaction time** – the time taken for a sports performer to respond to a stimulus and initiate their response. An obvious example is a starting pistol (the stimulus) and the sprint start (the movement) in sprint events.
5. **Power** – the ability to produce a maximal force in the shortest possible period of time, or to generate and use muscular strength quickly. Stronger athletes tend to produce a greater amount of power during an action. Power is generally needed more by athletes in specific sports and is developed using advanced training methods. For example, sprinters need power when pushing away from the blocks, golfers need it to strike a long-range drive and boxers for delivering a punch.

Training methods for physical fitness-related components

To develop different components of fitness to meet the needs of different sports, athletes, coaches and personal trainers often need to use a variety of training methods. These methods might be in indoor or outdoor environments or using a range of equipment.

Aerobic endurance training methods

The three most common methods used to improve aerobic endurance (also known as VO2 max) are:

- continuous training
- fartlek training
- interval training.

Circuit training is also used. There is insufficient evidence to suggest which aerobic training method is best, but all will lead to improvements in aerobic endurance.

Aerobic endurance training is often used by people who want to lose or manage their weight by reducing their body fat content; as such, aerobic training is often used during pre-season by football and rugby teams. Body fat is reduced because training results in increased levels of the hormones epinephrine and norepinephrine which then help break down fat to be used as an energy source. As well as the health benefits of aerobic endurance training methods, they have different benefits for sport-specific performance: they can help to improve blood volume, improve mitochondrial size and density, develop neuromuscular patterns and improve muscle tone.

Types of aerobic endurance training methods

Continuous training

Also known as steady-state or long, slow distance training: the athlete trains at a steady pace over a long distance. The intensity of continuous training should be moderate (approximately equal to or less than 70 per cent of VO2 max) over a long distance and time. This method is suited to long-

Key Terms

VO2 max - the maximum amount of oxygen that can be taken in by and used by the body. Also a measure of the endurance capacity of the cardiovascular and respiratory systems and exercising skeletal muscles.

Epinephrine – a chemical in the body used for communication between cells in the nervous system and other cells in the body. It works with norepinephrine to prepare the body for the 'fight or flight' response.

Norepinephrine – a chemical in the body used for communication between cells in the nervous system and other cells in the body. It works with epinephrine to prepare the body for the 'fight or flight' response.

distance runners and swimmers. Due to the lower level of intensity, an athlete can train for longer. It can also be useful for:

- beginners who are starting structured exercise
- athletes recovering from injury
- 'specific population' individuals such as children or elderly people.

Its disadvantages include a higher risk of injury when running long distances on harder surfaces. It can also be boring and it is not always sport specific: the sport specific benefits are small. Continuous training can be performed in a gym using a range of cardiovascular equipment (for example, treadmill, cross-trainer or exercise cycle) or outdoors at a suitable park or track area.

Fartlek training

Fartlek training is designed to improve an athlete's aerobic endurance. It is based on running outdoors, and varies the intensity of work according to the athlete's requirements. The intensity of training is changed by varying terrain, such as sand, hills, soft grassland or woodland, or by running at a more sustained pace to a landmark such as a lamp post or tree. Some of the benefits of this training method include improving aerobic endurance, improving muscular endurance and improving balance and proprioception in the ankle, knee and hip, all of which have a variety of benefits ranging from improved sport performance during a game to helping with injury rehabilitation.

Fartlek training can be more useful than continuous training because it can be individual- and sport-specific. This method also uses both aerobic and anaerobic energy systems to improve aerobic endurance and can involve changes in direction, so it is useful for team sports players as it can mimic the sport.

In fartlek training there is no rest period, but the athlete has more control and is able to decrease intensity at any time to rest. The benefits of fartlek training are that:

- it is less technical than other methods (such as interval training), making it easier to use
- athletes control their own pacing
- the boredom of conventional training is reduced.

Fartlek training can be done in a gym using a range of cardiovascular equipment (for example, treadmill, cross-trainer or exercise cycle) so long as the speed, resistance or gradient can be changed regularly. Fartlek training can be undertaken outdoors at a suitable park area where the intensity can be changed by varying terrain.

Interval training

Interval training improves both anaerobic endurance components and aerobic endurance by varying the intensity and length of the work periods. In interval training, athletes perform a work period, followed by a rest period,before completing another work period. They can repeat this pattern many times, depending on their fitness levels. When designing an interval training programme, you should consider:

- the number of intervals (rest and work periods)
- the intensity of the work and rest intervals
- the duration of the work and rest intervals. 'Sets' and 'reps' are common terms that provide structure and organisation when referring to the number of exercises in the training programme.

- Reps is short for repetitions and describes how many times you perform an exercise.
- A set tells you how many times you repeat that exercise for the set number of reps.

An example of an interval training programme for aerobic endurance could be one set of three repetitions of five-minute runs interspersed with two minutes of rest. This would be written in a training diary as 1×3×5:00 Work: Rest 2:00. This method of training allows clear progression and overload to be built into the programme by increasing the intensity of work periods, increasing the number of intervals, decreasing the duration of the rest period or increasing the intensity of the rest period (for example, using a slow jog rather than a walk).

Interval training can be performed in a gym using a range of cardiovascular equipment (for example, treadmill, cross-trainer or exercise cycle) so long as the speed, resistance or gradient can be changed at the required intervals, or outdoors at a suitable park or track area where running or cycling can be undertaken safely.

Circuit training

In a circuit training session, a number of different exercises (or 'stations') are organised around a room. Each station contains a different activity. Individuals are set a time limit to do these exercises, e.g. one minute per station. Between the stations there should be a rest period dependent on the individual or groups completing the circuit.

A circuit can be designed to improve aerobic endurance, muscular endurance or strength, or a combination of all three. To avoid fatigue, the stations should allow consecutive exercises to use different muscle groups: for example, repeated sprints (legs) may be followed by press-ups (upper body). To increase progression and overload, the individual may wish to:

- decrease the rest periods
- increase the number of stations
- increase the number of circuits
- increase the time spent at each station
- increase the number of circuit sessions per week.

Circuit training can be performed in a gym using a range of equipment, though space for all the stations can be an issue. Circuit training can use cardiovascular equipment, free weights, resistance machines or simple body weight exercises at the stations. Circuit training can also be performed outdoors at a suitable park or track area so long as you have equipment mobile enough to take with you for use at any of the stations.

Muscular strength

training methods If you visit a gym or fitness suite, you will often see people lifting different weights at different speeds. This is because a number of the training methods used to improve muscular strength can also be used to improve muscular endurance simply by doing the training differently, for example by altering the weight, the number of repetitions and the number of sets.

Key terms

Hypertrophy – an increase in the size of muscle tissue (or organs) due to growth of individual cells without an increase in the overall number of cells.

Muscle fibres – the contractile element of muscle tissue which appears banded or striped under a microscope. A single muscle contains between 10,000 and 450,000 fibres.

Common training methods used to improve muscular strength and muscular endurance include:

- resistance machines
- free weights (such as dumbbells)
- medicine ball training
- circuit training
- core stability training.

If you think about how a person's appearance changes after using muscular strength training in a gym, you may say they look 'built' or 'pumped'. These changes are due to increased muscle tone and muscle hypertrophy. Muscle tone is where muscles have a more defined appearance, whereas muscle hypertrophy is the growth of the muscle and happens when the muscle fibres increase in size.

Muscular endurance training methods

Muscular endurance is the ability of a specific muscle or muscle group to make repeated contractions over a significant period of time (possibly over a number of minutes). To develop muscular endurance you must train the muscle to overcome fatigue. Unlike muscular strength training methods, muscular endurance is not developed by increasing the weight lifted, but by increasing the amount of time a muscle spends contracting against a given resistance. Muscular endurance training should be a progression after several months of training and should come after strength training (low reps and high load) because the greater a muscle's strength, the more force it can exert during endurance training.

Muscular endurance training has similar benefits to muscular strength training. Muscle tone can increase and muscles will experience hypertrophy (although to a lesser extent). The additional benefits happen within the muscle cell. Muscular endurance places stress on the slow-twitch muscle fibres and as a result they can increase in size. This means there is more space for mitochondrial activity. The increase in size and number of mitochondria is important because they are the part of the muscle that synthesises aerobic energy. By increasing their size and number, you can increase aerobic performance and the efficiency of type I muscle fibres (and some type IIa muscle fibres). Another important change within muscle fibres is that there is a large increase in myoglobin content. This is important for aerobic performance, as myoglobin carries oxygen to the mitochondria. If you have more myoglobin, you can produce more aerobic energy in the mitochondria. These changes can increase VO2 max by up to 20 per cent.

Sports where strength training is key include athletics, football, hockey, boxing, rowing and tennis. Muscular endurance training helps the body deal with fatigue and increases tolerance to blood lactate. The training uses relatively light to medium loads of 40–60 per cent of 1RM, lifted for a set time or number of repetitions.

Key terms

Mitochondria – organelles (parts of cells) containing enzymes responsible for energy production. Mitochondria are the part of a muscle cell responsible for aerobic energy production.

Type I muscle fibres – slow twitch or slow oxidative fibres containing large amounts of myoglobin and mitochondria. They have a slow contraction velocity and are resistant to fatigue.

Myoglobin – a form of haemoglobin found in muscles that binds and stores oxygen in the mitochondria.

Repetitions and sets – muscular endurance training works on the principle of performing many repetitions against a given resistance for a prolonged period of time, or high reps and low loads. Depending on the resistance, muscular endurance training reps can range from 15 to 30, and the number of sets from 4 to 6. Muscular endurance is highly (though not entirely) dependent on Type I slowtwitch fibres. Given their resistance to fatigue, exercise should involve a higher number of repetitions than strength training;

Rest periods between sets – one aim of muscular endurance training is to increase resistance to fatigue and improve tolerance to blood lactate, so rest periods between sets are fewer and shorter than in strength training. Typical rest periods range from 30 to 60 seconds, depending on exercise intensity and the experience of the individual.

Methods:

Fixed-resistance machines

Useful during muscular endurance training (either with or without a helper). The risk of injury from repetition failure or over-extending joints is far less with resistance machines than free weights.

Free weights

Allow an individual to have constant resistance during exercise, which adds to the 'endurance' element. The use of free weights can increase the risk of injury. For safety reasons, even when using smaller weights compared with strength training, helpers (or 'spotters') should oversee an individual as there is a risk of muscular failure towards the end of the set.

<u>Core stability training methods</u>

Core stability training exercises the deep muscles of the torso all at the same time. It is vital to most sports because the core muscles stabilise the spine and provide a solid foundation for movement in the arms and legs. The core is the centre point for all sporting actions – it reduces postural imbalance and plays an important role in injury prevention.

Methods

Yoga – an ancient form of exercise focusing on strength and flexibility combined with breathing techniques to enhance physical and mental wellbeing. It is one of the best ways to build core stability, strength and flexibility in your muscles, as it focuses on the abdominal and back regions. Yoga can be performed using light free weights which create additional forces on the muscles and joints, increasing the overall strength and core stability requirements of each exercise or pose. Resistance bands can also target areas requiring precision movement while applying an additional resistance. Yoga exercises are varied but can target every area required for core stability.

Pilates – developed by Joseph Pilates, who believed mental and physical health were interlinked. His method was influenced by other forms of exercise, including gymnastics, boxing and wrestling. Pilates is similar to yoga and aims to strengthen the body with particular focus on the body's core to improve strength, general fitness and well-being. Resistance bands can also target areas requiring precision movement while applying additional resistance. Pilates develops whole-body strength, flexibility, coordination, balance, and good posture, with a decreased risk of injury compared with other forms of exercise.

Gym-based exercises – because core stability training methods tend to use body weight exercises (for example, yoga and Pilates), they can also be performed on a gym mat. Exercises such as plank, bridge and V-sit can also be done on a mat and there are various resistance machines (for example, back extension machines and abdominal crunch machines) that work aspects of core stability. Gym-based core stability exercises can incorporate a variety of equipment to aid training, such as resistance bands. A stability ball will further engage the core muscles by introducing the need for additional coordination and balance due to the 'wobble' effect. Kettle bells engage your core muscles with almost every lift, and free weights can add additional resistance to an exercise. All can be combined for a core stability circuit training programme.

Flexibility training methods

Both static flexibility and dynamic flexibility can be developed using a range of training methods. The main methods of flexibility training are:

- static stretching
- dynamic stretching
- proprioceptive neuromuscular facilitation (PNF) stretching.

The general principle of flexibility training is to overload a specific muscle group by stretching the muscles beyond what they are used to. The aim is to increase the range of movement, and work must be targeted towards the joints and muscle groups requiring improvement. The movement should not exceed the tolerance level of the tissue. For improvements in flexibility, an individual should increase the time (duration) of stretching and the number of repetitions to allow overload to take place. As flexibility is significantly affected by the temperature of muscles and connective tissues, flexibility training is best completed at the end of a training session or after some form of aerobic training. If using stretching activities as part of a warm-up, you should make sure the stretching is low-intensity and does not stretch the muscle or joint too far, too soon.

Static stretching

To improve flexibility, you can use static stretches, which are controlled and slow. There are two types:

Active – can be done individually. Active stretching involves voluntary contraction of specific muscles. Research shows that this can lead to gains in range of motion and increased functional mobility.

Passive – also known as assisted stretching, it requires the help of another person or an object such as a wall. The other person applies an external force (push or pull) to force the muscle to stretch. Passive stretching is one of the safest methods of stretching and also most helpful for relaxation.

Dynamic stretching

Think about when you have watched football players, rugby players or basketball players going through their warm-up. You will see them performing a range of movements that are like the sports movements they need during the game. These are dynamic flexibility exercises. Dynamic flexibility is important for sports that have highspeed movements and movements that take a muscle or joint past its normal range of static flexibility.

Proprioceptive neuromuscular facilitation (PNF) technique

Proprioceptive neuromuscular facilitation (PNF) stretching is an advanced form of stretching and one of the most effective ways of increasing flexibility. The types of movement vary between different muscles and muscle groups, but the general process is the same:

- Stretch the target muscle group to the upper limit of its range.
- Isometrically contract the muscle or muscle group against a partner for 6–10 seconds.
- Relax the muscle or muscle group as your partner stretches it to a new upper limit or range of movement (you should be able to stretch it further this time).

When using this type of stretching remember that pain is the body's signal that you are working out too hard in some way, so when this activity hurts too much you have taken it too far.