

## LECTURE 6

# Components of Fitness

- **Simple definitions**
- **Additional examples – for everyday activities**
- **Some complications**
- **Aerobic and Anaerobic**
- **Muscle Strength – more details**
- **Flexibility – more details**

If you have done a lower-level course in this subject area, such as a GCSE, you may well be familiar with components of fitness. But if not, we've provided some simple definitions below so that you know what we are talking about. They are taken from the BBC website which itself contains additional links to explore the subject further. Here's the BBC link:

<https://www.bbc.co.uk/bitesize/guides/zxd4wxs/revision/2>

## Body Composition

**Definition:** The percentage of body weight which is fat, muscle and bone

**Example:** Gymnasts have a lean body composition to allow them to propel themselves through the air when performing on the asymmetrical bars

## Cardiovascular fitness

**Definition:** The ability of the heart, lungs and blood to transport oxygen

**Example:** Completing a half marathon with consistent split times across all parts of the run

## Flexibility

**Definition:** The range of motion (ROM) at a joint

**Example:** A gymnast performing a routine which ends in them doing the splits

## Muscular Endurance

**Definition:** The ability to use voluntary muscles repeatedly without tiring

**Example:** A rower repeatedly pulling their oar against the water to propel the boat towards the line

## Muscular Strength

**Definition:** The amount of force a muscle can exert against a resistance

**Example:** Pushing with all one's force in a rugby scrum against the resistance of the opposition pack

## Agility

**Definition:** The ability to change the position of the body quickly and control the movement

**Example:** A badminton player moving around the court from back to front and side to side at high speed and efficiency

## Balance

**Definition:** The ability to maintain the body's centre of mass above the base of support

**Example:** A sprinter holds a perfectly still sprint start position and is ready to go into action as soon as the gun sounds

## Coordination

**Definition:** The ability to use two or more body parts together

**Example:** A trampolinist timing their arm and leg movements to perform the perfect tuck somersault

## Power

**Definition:** The ability to perform strength performances quickly

**Example:** A javelin thrower applies great force to the spear while moving their arm rapidly forward

## Reaction time

**Definition:** The time taken to respond to a stimulus

**Example:** A boxer perceives a punch from their left and rapidly moves their head to avoid being struck

## Speed

**Definition:** The ability to put body parts into motion quickly

**Example:** A tennis player moving forward from the baseline quickly to reach a drop shot close to the net

# So far so good

However, things are more complicated than that in reality. If you do some independent research in the library or online you will find different organisations or awarding bodies who will say that, for example, there are only six components of fitness, or they will divide the components into various sub-sections. Indeed, if you click on the BBC link above, you'll see that they divide them into two large sub-sections: skill-related and health-related. So - you are not going to get straightforward answers that everyone agrees with.

What's more, you'll notice that in their examples, the BBC concentrate exclusively on sports-related activities, while ignoring other types which require a high level of physical skill. Just to give one example: balance. A ballet dancer who is frequently required to stand on one leg (often on the point of her toe) with her other leg held straight out to the side has to have developed an incredible degree of balance.

But perhaps more importantly for a personal trainer, who will often be training ordinary, non-athletic people, we need to have examples of everyday situations that require those components of fitness.

So let's take them in order.

**Body Composition:** An obese person will often find even the simplest of physical tasks difficult because of the different distribution of fat, muscle and bone in their body, compared to, say an Olympic swimmer.

**Cardiovascular fitness:** Mowing a large lawn with a non-mechanical lawnmower.

**Flexibility:** Being able to pick up a number of things you have dropped on the floor without crouching down.

**Muscular endurance:** Carrying two heavy bags of shopping home from the supermarket.

**Muscular strength:** Pushing a wardrobe away from the wall so that you can clean behind it.

**Agility:** Dodging from side to side to avoid a whole volley of water balloons thrown at you by your kids (or grandkids) who think it's a great summertime game.

**Balance:** Putting on your socks without sitting down.

**Coordination:** Driving a car: pressing the clutch and changing gear while at the same time, steering.

**Power:** Tipping a full wheelbarrow of soil onto the garden.

**Reaction time:** Someone dodging a snowball in a snowball fight.

**Speed:** Running after the dog when it suddenly bolts off, having caught sight of a rabbit.

But even now, I'm afraid that we haven't finished with the complications!

It might be, that looking at these components of fitness, you think that training a client will be straightforward. Take each component in turn, give them some exercises for that component and there's your session done. Unfortunately, for the vast majority of time, that wouldn't work.

For example, let's take the example of a tennis player who according to the BBC definition, needs **Speed**. They also need **Power** to drive the ball over the net, **Coordination**, so that when they throw the ball into the air to serve, they can actually hit it with the racket. They need good **Reaction Time** to respond to a super-fast serve and **Agility** to get themselves round the court in different directions in, say, response to a drop-shot. Not to mention **Flexibility** to enable them to hit a ball beyond their natural reach. And of course, **Cardiovascular Fitness** and **Muscular Endurance** to enable them to run around the court for a match that may last three or four hours!

So that's at least **EIGHT** out of the eleven components of fitness we've listed!

Now let's look at another complication, this time from the point of view of an ordinary client who comes to you for personal training sessions. You notice straight away from a body composition point of view, that they are overweight and from the way they move and from what they tell you, you will judge that they are out of condition. What they will often say is that they want to "tone up" – but what they will really mean (even if they can't put it in so many words), is that they think they need cardio exercises to lose weight. However, YOU know as a professional, that what they need are strength and weight-bearing exercises. But if you say that, particularly to a female client, they will experience an internal conflict because to them, weight-bearing exercises mean bulking up and looking like a body builder, which is not what they want. It's not true of course, but that's often the perception.

So - to summarize: we're saying all this to emphasise that as a personal trainer, there's a lot more to it than simply dishing out exercises for each component of fitness.

# Aerobic and Anaerobic

Two terms that we haven't used so far are "aerobic" and "anaerobic" but which underpin most of the components of fitness that we've been talking about, so it's essential to get a clear understanding of what they're about.

## Aerobic/Anaerobic Exercise

There is a lot of confusion over these two terms. Ask a person in the street what they think of as aerobic exercise, and more often than not, they'll say it means doing running, cycling, rowing or stepping as opposed to such things as pushing, pulling or lifting weights. But as with many things that we are discovering, that only contains a grain of truth.

Aerobic is related to "air" – the air (or rather the oxygen) that we breathe in. If we do an exercise which provides enough oxygen to support our metabolism, then the body uses mainly fat for fuel. It's low intensity and we don't get out of breath when we do it. What's more, the lactic acid that the body creates during the process, gets dispersed. Also, apart from the obvious benefits, it is a low-stress exercise and we can keep it going over a long period of time - walking is a good example.

Anaerobic on the other hand is related to "without air". An anaerobic exercise is more intense where the intake of oxygen isn't enough to support the metabolism. We get out of breath trying to suck more oxygen into the body but because we can't get enough, the body switches from using fat as fuel to using mainly sugar. That gives you energy but unless it's replaced regularly, it's not enough to keep you going for a long period of time. And because there's not enough oxygen coming in to disperse the lactic acid, that starts to build up and make the muscles begin to burn.

Another way to distinguish the two types of exercise is that aerobic is low-stress and anaerobic is high stress. When the body is relying more on sugar (as in anaerobic exercise), the stress-hormone, cortisol is released in order to raise the sugar in the blood and that produces lactic acid which can't be dispersed fast enough, as we've said.

The way to tell if your client is doing aerobic or anaerobic exercise is to listen to their breathing. If they are able to breathe through their nose and if they are able to hold a conversation with you while they are doing the exercise, then it's likely they are in the low-stress aerobic zone. Once they start panting and finding it difficult to talk without breaking up their sentences, then they are likely to be in the high-stress anaerobic zone.

Another way of telling, is to use a heart-rate monitor and there are a number of formulae you can apply to determine when the heart rate is in the aerobic zone.

A common one is to subtract the age of the client from 220 which gives you the MAXIMUM rate their heart should be beating. Then 70 -80% of that figure is the highest level of the aerobic zone. There are differences of opinion among experts but they agree that it's around the 70% to 80% range.

Here's an example to make it clearer.

Jamel is a male client aged 47.

220 minus 47 equals 173 (Jamel's maximum heart rate).

70% of 173 equals 121.3

80% of 173 equals 138.4

Therefore, in order to keep in the aerobic zone, Jamel's heart rate should stay between 121.3 and 138.4.

The reason you would want to keep in the aerobic zone is that you can sustain the exercise over a long period of time (an hour, 90 minutes or even more) and because it is low stress, you are not putting strain on the body: the heart, the nervous system, the adrenal glands. And you are not creating sugar cravings.

Let's finish this section by giving a definition of both aerobic and anaerobic with examples taken from both sports activities and everyday life.

### **Aerobic**

Definition : The highest amount of oxygen consumed during maximal exercise in activities that use the large muscle groups in the legs, or arms and legs combined.

Example: a long-distance running athlete doing a five-mile jog round a lake (so that they don't exceed 70% to 80% of their maximum heart rate).

OR

A member of the Rambler's Association going for an afternoon's hike through the countryside.

### **Anaerobic**

Definition: Anaerobic means 'without air' and refers to the body producing energy without oxygen. This is typically exercise that is performed at a higher intensity.

Example: An Olympic athlete competing in a 200-metre sprinting contest.

OR

An office worker running as fast as they can down the road to catch the bus.

We're now going to look at some of the components that we've already covered in more detail: muscular strength, and flexibility...

# Muscular Strength

We've chosen to examine muscular strength in more detail because it is so fundamental to exercise training. It's common knowledge that from the age of around 30, unless we exercise the muscles regularly in order to strengthen them, they start to deteriorate relentlessly year by year until in advanced old age, we become frail (an official medical term). This means that in the worst cases, the muscles are unable to perform even the simplest of tasks, like getting up out of a chair.

So developing muscle strength is vital and a fundamental part of what personal trainers should be aiming to do with their clients.

We've already seen that a definition of muscular strength is the amount of force a muscle can exert against a resistance but there are several different types of muscle fibre that produce force in different ways and at different intensities.

For our purposes we are going to just concentrate on two: known as Type 1 and Type 2.

Type 1 fibres produce a low level of force and because they don't tire easily, they can continue producing that force over a long period of time. They're often known as "slow-twitch" and people who have predominantly Type 1 fibres are very suited to activities such as long distance running or hiking.

Type 2 (or fast-twitch) fibres on the other hand, can produce a high level of force very quickly, but they also tire very quickly. So movements that require a high-level of explosive force rely on Type 2 fibres. You can easily see that a person with a predominance of Type 2 fibres would be good at 100 metre sprints for example.

So how do the muscles increase in strength? It's generally known by a process called **hypertrophy**. If we work the muscles at high intensity, they fatigue and damage a little and in the process of repairing and rebuilding themselves, they get stronger – ie increase in strength.

There are three types of muscle strength: concentric, eccentric and static or isometric. Let's take them one by one.

Concentric strength is when the muscles **contract** or shorten while encountering some form of resistance, pushing a heavy weight along the floor for example.

Eccentric strength is when the muscles **stretch** while encountering resistance, slowly lowering a weight to the ground, for example.

Static or isometric strength is when you contract muscles against an immovable force, pushing against the wall of a building for example.

# Flexibility

We said just now that the muscles get stronger by being damaged a little, which then gives them the opportunity to repair, and in the process, increase in strength. The danger of course, is damaging them too much which can cause sprains or strains, and this is where the all-important idea of flexibility comes into play. Damage to the muscles themselves is called a strain but more serious (and often long-lasting) damage can be made to ligaments and other connective tissue surrounding a joint, and this is known as a sprain. Flexibility, as we have seen in the definition at the beginning of this lecture, is the range of motion available round a joint or joints, so it makes sense to think that increasing that range of motion will make damage less likely. And one of the most effective ways of doing this is by stretching.

In the past, there has been some debate about the effectiveness of stretching to increase flexibility and certainly many personal trainers give it only a little attention – or none at all – in their sessions. But as we will see, it does play a role in preserving good muscle health and preventing strains and sprains.

One of the key factors is not the muscles themselves but the body's nervous system. The muscles have **mechanoreceptors** within them that pick up tensions and changes in the muscle length, which then kick in to contract the muscle and stop excessive stretch.

There are two main receptors: muscle spindles and golgi tendon organs. The first is within the muscles themselves and the second is located at the point where the muscle attaches itself to the tendon by the joint.

So by performing stretching exercises, you are not so much increasing the length of the muscles although that does play some part. Rather, you are teaching the nervous system to relax its hold and prevent the reflex tightening of the muscles.

One of the counterintuitive facts that is difficult to comprehend is that high-level performers, whether they're concert pianists, dancers or long-distance runners, operate much more effectively and at a much higher level if they are relaxed at the same time as working their muscles to the utmost.

## To summarize:

- There is no agreement as to the number and type of components of fitness. Some authorities say there are as little as four while others would say there are thirteen or more
- Many components of fitness involve other components of fitness
- Exercises frequently involve a whole range of components of fitness
- Aerobic and/or anaerobic systems underpin all exercise programmes
- The development of muscle strength is fundamental to the work of personal trainers with their clients
- The training of the nervous system to develop relaxation while working at high intensity will increase the effectiveness of any physical activity