


# ›BODYTONING‹

CHRISTOPHER M. NORRIS



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## DEDICATION <

For Hildegard and Sophie, my girls

## PREFACE ◀

### BODYTONING FOR A BETTER LIFE

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Our modern day lifestyle is considerably less active than that of our parents and grandparents. Although the change from the heavy industry and 'hard graft' of the industrial revolution has brought with it many health benefits, it has also brought with it modern day health problems. Many of the infectious diseases of the last century have gone, to be replaced by heart and circulatory disorders as the number one cause of death. Exercise as part of a general lifestyle change is one of the most important factors in the prevention of these modern health problems. Equally, four out of five people suffer from severe back pain at some times in their lives, and this condition recurs in a staggering 60 per cent of cases. Again, exercise has been shown to be of overriding importance in both the prevention and treatment of this condition. The message is clear, *if you want to stay healthy, exercise regularly.*

In this book we will look at the safest and most effective ways to exercise using gym-based equipment. The principles and programmes are based on science rather than hearsay, an approach which takes away the guesswork involved in exercise selection.

Chapter 1 looks at the preparation for training and deals with the all important principles of warm-up. In chapters 2, 3 and 4 we will look at the way the body works and how exercise affects you when you work out. We then move on to exercise techniques and apparatus in chapters 5 and 6. For the practical side of the book, we will look at core stability, stretching and cardiovascular (CV) training to begin with and then move on to weight training using both machines and barbells and dumb-bells ('free weights'). We include non-weight exercises in the form of bands and stability balls, and then describe programmes for both fitness and to target the aches and pains which so often accompany a modern day lifestyle. Finishing with advanced techniques for sport, *Bodytoning* represents the complete guide to gym-based exercise.

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## BODYTONING

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# PREPARATION FOR TRAINING <

## WARM-UP

In terms of injury, the preparation we do before starting a workout can be more important than the contents of the workout itself. Jumping straight into exercise is both ineffectual and dangerous. Just as a car needs to be warmed up before it will run smoothly, it takes time for the body to 'get going' and change from normal resting levels to a point at which it is ready to face the rigours of intense exercise.

Because the body tissues are stiffer and less pliable when cold, muscles are more easily pulled and joints can be damaged. In addition, the heart beat is speeded up with a jolt instead of increasing gradually, and can become irregular rather than showing its normal smooth rhythm. These changes affecting the heart can be potentially very serious, especially in an older or less active individual. The function of a warm-up is therefore to prepare the body for action, and in so doing both to reduce the likelihood of injury and to make the subsequent exercise routine more effective.

### *Warm-up types*

A warm-up can be either *passive*, during which the body is heated from the outside, or *active*, where exercise is used to form the heat internally. An example of a passive warm-up is to have a sauna or hot shower, while an active warm-up can be achieved through gentle jogging. Both types can be effective, but are appropriate to different situations.

An active warm-up is the type normally used before exercise, while the passive warm-up is useful when working with an injury, for example before stretching a muscle tightened from a previous strain. From the point of view of injury and rehabilitation, the obvious advantage of the passive warm-up is that it does not require the athlete to move the injured tissues in order to create body heat. Another, often neglected, advantage of the passive warm-up is that it does not significantly use up any of the body's energy supplies. This can be important before competition, when a passive warm-up is used to maintain body heat after an active warm-up has been performed. The major disadvantage of a passive warm-up, however, is that when the body is heated from outside, the heat may not penetrate deep enough to affect the tissues being used in a workout. For example the heat from a standard heat lamp may only penetrate the body by 1 cm. This is fine for superficial muscles, but will not significantly affect the joints. For this to occur either a specialist form of deep heating (diathermy) must be used, or an active warm-up must be chosen.



## Effects of a warm-up

A good warm-up will have a number of effects. First, it will make the actions which follow it smoother through *rehearsal*. This is the reasoning behind taking a practice swing before hitting a golf ball, for example, and is useful before any activity which requires *skill*. When we lift a weight or perform any bodytoning action, the movement actually involves dozens of smaller actions all linked together. Muscles must contract at the right time and with the right amount of strength, and joints must move far enough but not too far. These individual components of a movement all come together to form a single action called by scientists a *motor programme*. Each different bodytoning exercise will have a different motor programme, and it is important that a warm-up reminds you of the right sort of motor programme for the exercise you are about to do. Although you are familiar with an exercise when you work out, you will start to forget its technique as soon as you leave the gym. By the time you come back into the gym some days later, you will have performed hundreds of other movements at home and at work, so your gym movements are no longer fresh in your mind. One function of a warm-up is to familiarise you with the motor programme required for an exercise before you use the movement with heavy weights. This is especially important when an exercise uses high speed.

Next, a warm-up will increase your *heart beat* and raise *blood pressure* steadily and safely, rather than causing them to jump dangerously from resting to training levels. This is particularly important in the older or less active individual where the cardiovascular (CV) system of the body may be at risk of injury or disease. Sudden changes in heart rate or blood pressure could put this individual at risk of a heart attack. Throughout the day, at normal resting levels only 15–20 per cent of the total amount of blood in the body goes to the muscles. The rest will be in the body organs. When we exercise however 75 per cent of the blood must be in the working muscles and so we have to divert it from the body organs, and this must be done gradually.



### Why warm-up?

In the early 1970s studies were conducted which graphically illustrate the importance of a warm-up to the CV system (Barnard *et al.* 1973). Researchers asked subjects to run vigorously on a treadmill for 10–15 seconds initially *without* a warm-up. In 70% of these subjects, *dangerously abnormal heart beats* were seen using a standard hospital heart rate machine (ECG). These changes were greatly reduced and in most cases not seen at all when the same subjects ran on the treadmill after a warm-up. The researchers also looked at blood pressure, and found that subjects running without a warm-up had a much *higher blood pressure* (168 mmHg) than those who used a warm-up (140 mmHg).



The warmth produced in the body by a warm-up will increase the flow of blood (*local blood flow*) through the tissues and has a number of effects. The contraction and relaxation of muscle is more effective because the chemical reactions involved in this process are speeded up by heating. Similarly the electrical impulses travelling along nerves move faster, and so movements are smoother and less sluggish. Finally, muscles and joints contain fluids which can be stiff. Heating these fluids with a warm-up reduces the stiffness and makes movements easier. All in all warmth makes the body move more effectively.

A *general* warm-up affects the whole body, and should always be followed by a *specific* warm-up that concentrates on the part or parts of the body which will be used in a particular exercise. For example if you are to perform a bench press action (see p. 109), a general warm-up may be on a static cycle or cross training machine. This will warm the body and increase the heart beat, but do little for the arms which will be worked in the bench press action. A specific warm-up for the bench press would involve shoulder, chest and arm movements aiming to stretch the chest (pectoral) muscles and practise a 'pressing' action.

## WARM-UP TECHNIQUES

The amount of activity required in a warm-up will depend on a person's fitness level and on the intensity of the exercise or sport to be undertaken. This is because different people raise their body temperature at different rates, depending on body size, amount of body fat and rate of energy metabolism. In addition, different sports will make very different demands on the body's tissues. For this reason the warm-up before a vigorous game of squash, for example, would need to be more extensive than that which might precede a casual round of golf. Equally, a top-level sprinter will require a more thorough warm-up session than a weekend sportsman, because the sprinter is likely to be able to push himself to a higher level of physical activity.

Practically, the warm-up may be practised in three parts: *pulse raising*, *mobility* and *rehearsal*.

### *Pulse raising*

To be effective, a pulse raising activity should be performed which is intense enough to raise the heart rate (pulse rate) and cause mild sweating. When this happens, the inside (core) temperature of the body has increased by about 1°C. It is best to perform the warm-up wearing a full track suit or other insulating clothing; this keeps in body heat and maintains the benefits of the warm-up until the sport is to be performed. Gentle jogging, light aerobics, or using CV machines in the gym such as static cycles, recumbent cycles, cross trainers, rowers and treadmills are all useful for pulse raising activities.

### *Mobility*

Mobility exercises should be performed sufficient to take the joints through their full range of motion, the exact range being determined by the movements to be used during

the workout (see also components of fitness p. 9). The aim is to ensure that the movements used in the workout will not overstretch the tissues. A distinction must be made here between *maintenance stretching* and *developmental stretching*. Maintenance stretches are used prior to a workout to take the tissues to their maximum comfortable range. For developmental stretching, exercises are used which aim to increase this range of motion, and so a thorough warm-up is performed first. In other words maintenance stretches form part of a warm-up, while developmental stretches are practised in a separate stretching session.

### *Rehearsal*

Finally, for complex moves (especially free weight exercises) the specific action of the individual exercise should be rehearsed during the warm-up period. This normally means performing the first set of exercises with a light resistance, or even an unweighted bar or stick. For example when performing a bench press movement, the pin of the machine may be taken out and the exercise performed initially using the first fixed weight alone. For a free weight squatting movement the weight discs may be removed from the bar and the exercise repeated using the bar alone. For a clean and jerk action, a wooden pole may be all that is necessary for the rehearsal portion of the warm-up. For rehearsal, rather than light sweating which indicates that the correct core temperature has been achieved, it is technique which is the deciding factor. Only when the individual can perform the movement correctly has the rehearsal portion of the warm-up achieved its aim.



### **Arousal**

In addition to rehearsing an action, there is another mental effect of warm-up, and that is 'arousal'. When we go into a gym after a hard day's work, we may feel lethargic and 'under aroused'. The warm-up may then serve to psyche us up and encourage us to exercise. If we go into an important sports competition however, we may feel 'over aroused' with our heart pumping, palms sweating and that sick feeling in the pit of our stomach. Now, the arousal level is too high, and the appropriate warm-up would actually be to relax and take some time to chill out before we compete. The warm-up then has to prepare us mentally, taking into account our present level of arousal.

### **WARM-DOWN**

Just as it is vital to begin an exercise session slowly, so it is important to end it in the same way. When you exercise hard your heart beat is increased, and the process is actually helped by the contraction of the exercising muscles. This system, known as the 'auxiliary muscle pump', is important to the functioning of the cardiovascular system.

If you stop exercising suddenly, the muscles no longer contract and pump blood along the vessels which travel through them. The demand placed on the heart is greater and the pulse actually increases, even though you have stopped exercising!

A good example of this is provided by the use of electric treadmills in the gym. When inexperienced users run on these they sometimes get carried away, and get faster and faster until they start to become exhausted. Instead of slowing down, they jump off the treadmill in a panic, momentarily increasing the demand on the heart – sometimes with tragic consequences.

Another important feature of the warm-down period is that it can help to reduce muscle ache (see chapter 3) by flushing fresh blood through the muscle used in the workout. Use similar exercises to those chosen for the warm-up. Start the warm-down at the intensity of your workout and gradually slow down until your pulse is back to its normal resting level. In this way you are increasing the blood flow to the muscles which have been worked and taking away the chemicals which cause muscle soreness. Using a warm shower after exercise is a passive way to warm down, as is gentle massage. Both will encourage blood flow through the muscle without working it and so producing even more chemicals.

## CLOTHING

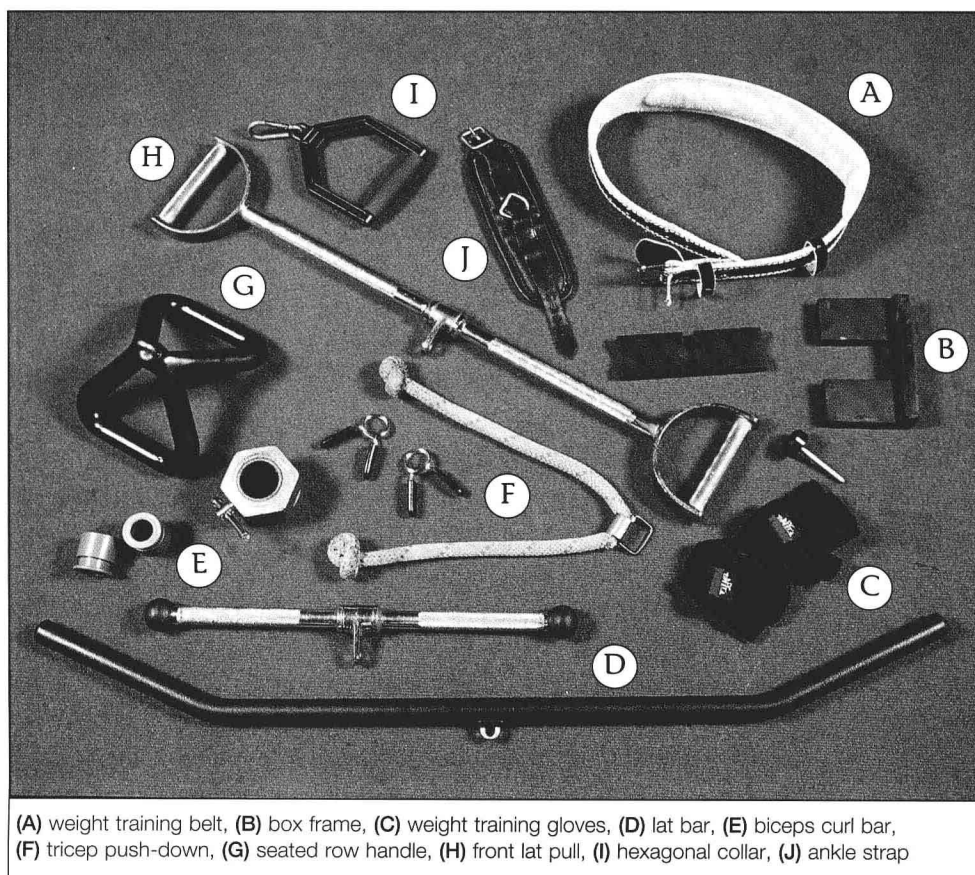
Clothing for the gym should be comfortable. Loose-fitting clothes are essential for unrestricted movement, but they should not be so loose that they could get trapped in moving gym machinery. Shorts and T-shirts or a leotard are fine, but fleecy garments should be worn during the warm-up and then removed later as you get hot. Shoes for the gym should support the foot and provide adequate grip while allowing free movement. Training shoes are the obvious choice, but specialist shoes designed for one sport do not necessarily transfer to another. For example, running shoes often restrict the sideways movements of the foot and can be uncomfortable when performing some leg exercises with weights. Whatever shoes you choose, make sure that the laces are kept short so that you do not step on them and trip.

Many people wear different types of joint strapping, the most popular being for the wrist and knee. If you have an injury you should not train except under the direction of your physiotherapist. When recovering from an injury and restrengthening a part of the body, a strapping is not normally used. However, preventive strapping properly applied does have a place if you have a particular weakness which has not responded to treatment. Usually the elastic supports worn in the gym serve two functions. They keep a joint warm, especially if they are made of neoprene; this can be of particular advantage in the case of an arthritic joint. They also offer psychological support by giving the athlete confidence that the joint will not collapse. Provided supports are not used to cover up an injury and work through pain, they are harmless.

Weight training gloves are useful. These are fingerless gloves, usually leather palmed and string backed, or neoprene. They have a padded area over the palm where you grip

a weight training bar, and help to prevent the build-up of hard skin which occurs there with regular training. In addition, the padding on the palm of the glove will absorb shock on the hand and wrist, and relax the grip slightly. This is because the fingers' tendons are stretched further when gripping a narrow object and stretched less when gripping a broader object. The size of grip is more important with some elbow conditions such as tennis elbow. The size of grip must feel comfortable and on the whole gripping on a slightly larger area which is spongy is more comfortable than a hard metal bar. Many weight training machines have rotating plastic or rubber handles but free weights do not, making gloves especially important for free weight exercises.

A weight training belt is another piece of equipment which is regaining popularity. These were originally used by weight lifters to protect the lower back when lifting very heavy weights. They are thick leather or reinforced neoprene belts, usually about 10–15 cm wide. Worn around the waist, the stiffness supports the lower spine in two ways: it reminds the user to keep the lower spine flat; and it increases the pressure within the abdomen, which in turn reduces the strain placed on the spinal discs. However, belts will only support the spine if worn tightly, so when you see someone with a bright red belt hanging down loosely over the hips, it is for fashion and not for protection!



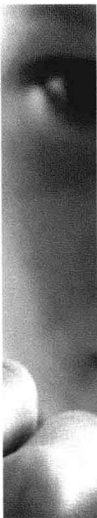
## SAFETY

Modern gyms are usually clean, well lit and inviting. Although they look very appealing, however, they contain many potential dangers, and so basic safety standards must always be applied if accidents are to be avoided.

The way you prepare yourself and the care you take with the apparatus are both important. Loose clothing, long hair and dangling jewellery can all catch on the moving parts of weight training machines, taking the user into the apparatus and causing severe injury. Large rings can get caught and slice into your finger. If a sharp ring will not come off, cover it with tape or wear a weight training glove over it.

Exercising in bare feet is not wise. Weights can be dropped and toes can be stubbed. In addition you may step on sharp objects or slip on wooden or rubberised flooring. Thin rubber shoes and flip-flops are little better, and really have no place in the gym even in the height of summer.

Now to the equipment itself. Always check this before use because broken or defective machinery can cause injury. Collars on free weights can work loose and fall off, and



### Take off your rings!

Wearing a ring can cause two types of injury, 'laceration' and 'de-gloving'. A laceration occurs when the sharp portion of the ring catches on the user or another person. The momentum of the moving hand causes the sharp ring to cut deeply into the skin tearing as it goes. A de-gloving injury occurs when the ring catches on a piece of moving machinery. The ring cuts into the skin and stays where it is as the hand moves. The result is that some (or all) of the skin is peeled off the finger often requiring plastic surgery to repair it. The message is simple, if you are wearing a sharp unprotected ring you should not work out!

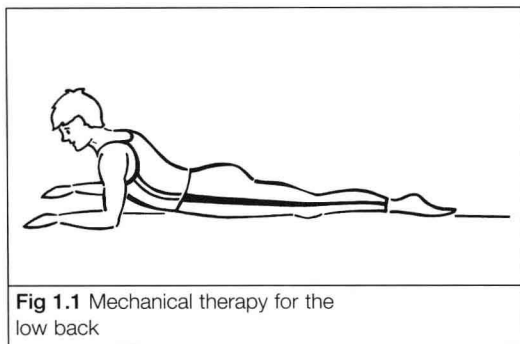


stiff machines may be set in motion with a jolt. The weights on solid dumb-bells should always be checked to ensure that they are screwed up tightly before use. When working on free weights it is always better to work with a partner and use a 'buddy' system. Before you lift, your buddy checks your weights and during your lift they check your technique. You do the same for him/her and in this way you are less likely to overlook important safety issues when you are 'psyched up' to lift.

With multi-stack apparatus, make sure the selector key is pushed right into the machine and twisted so that it is locked into place. If pulley cables become snagged, get help; don't try to free them by yourself. Never touch the pulleys and cables when they are in use. Finally, make sure that the machinery is correctly adjusted for your size. It may take a few extra moments to change the settings, but this is time well spent in terms of comfort and safety.

## THE SPINE

Unfortunately, the spine is at risk when weights are lifted; however, good lifting technique and general care of the back will reduce the likelihood of injury considerably. Dangers come from three sources: poor alignment, repeated bending and fast, uncontrolled movements. If your alignment is optimal (see p. 41) the forces on the joint are minimised and the muscles are worked correctly. With poor alignment joint loading forces are increased, stressing the tissues surround the joint (ligaments and the joint capsule in particular). In addition the muscles may be overstretched (lengthened) or cramped up (shortened) unnecessarily making injury more likely.



**Fig 1.1** Mechanical therapy for the low back

In the case of bending, the discs in the base of the spine are squeezed out of shape and pressed closer to the delicate nerves travelling from the spinal cord to the legs. Repeated bending can cause irritation of these nerves, leading to back pain or sciatica. Try therefore to keep forward bending to a minimum when weight training, and maintain the natural hollow in the base of the

spine when standing or sitting to place the spinal discs in their optimal alignment.

During general weight training the spinal discs are compressed and water is squeezed from them. This has the effect of actually shortening the spine after a workout. To help offset this, stretch the spine after training by holding onto the high bar and hanging for between 30 and 60 seconds. It is also useful to include exercises which stretch the spine, such as chin-ups, dips and lateral pull downs, in the latter part of a workout that involves compression exercises (for example, squats and shoulder presses).

Because bending the spine causes problems, arching the spine can help to offset them. This fact enables us to compensate to a certain degree for some of the problems which may occur while training. The following is one of the physiotherapy techniques known as 'mechanical therapy' (Fig. 1.1). Lie on the floor as though you were about to do a push-



### Compression of lumbar discs

Researchers have shown that squat exercises can create compression forces on the lumbar disc of 6–10 times body weight (Cappozzo *et al.* 1985). These forces greatly affect the discs and lead to a dramatic loss in body height. In a 25 minute bout of weight training the average height loss has been shown to be 5.4 mm (Leatt *et al.* 1986) while static loading (standing still with a weight across the shoulders) can lead to a height reduction of 11.2 mm (Tyrrell *et al.* 1985).



up exercise. Keep your legs and hips down on the floor and push up with the arms, arching your spine as you do so. Look forwards, pause momentarily in this position, and then lower yourself down onto the floor again. Repeat this movement ten times. You should find that this starts to relieve any back pain caused through repeated bending. Obviously this exercise is not a 'cure-all', so it is best to avoid repeated bending as much as possible – prevention being better than cure!

Rapid movements, particularly twisting, can also tax the spine. Rapid trunk twisting or bending should be avoided because the weight of the spine and trunk builds up momentum. This momentum will tear at the spinal tissues at the very end of the movement, overstretching them and making them swell. As the swelling forms slowly, you will not actually feel pain until you get up the next morning. Then, your back will be stiff and take time to 'get going'. The best bet in this case is to rest for a few days, and, when you resume training, correct any faulty exercise techniques. If pain still persists, have a word with your physiotherapist.

When lifting free weights from the floor, correct technique is important for protection of the spine. Before you lift, take up a stable position with your feet astride and at least one foot flat. Bend your knees and get down to the level of the weight, keeping your spine hollow as you move. Grip the weight securely, and use the power of your legs, not your back, to lift. As you do this, look up! Bring the weight close into your waist as soon as possible in order to reduce the leverage forces acting on the spine. When you put the weight down, reverse this sequence, always using the strength of your legs and not your back.

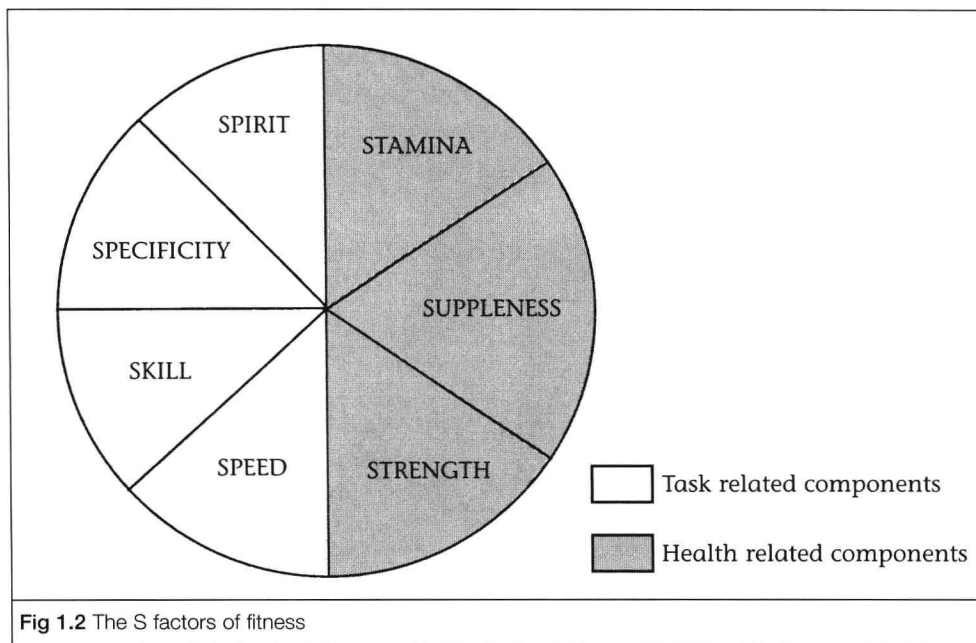
## THE COMPONENTS OF FITNESS

What is fitness? Is a delicate ballet dancer 'fit' to play in a rugby scrum, or a sumo wrestler 'fit' to run marathons? Common sense tells us that these athletes would not be considered suitable for the alternative sports suggested, and yet most would agree that both top-class ballet dancers and wrestlers are fit.

The answer to this conundrum is that two types of fitness exist: that which is necessary for general health (health-related fitness); and the extreme requirements for excellence at a particular sport or activity (task-related fitness). We can consider the components of fitness as 'S' factors (Fig. 1.2). In the case of general health, three S factors are important: stamina, suppleness and strength.

Table 1.1. Safety check-list for the gym

- Always warm up before training.
- Check machinery before use.
- Set up machinery to suit your body size and weight.
- Tie back long hair and be careful with loose clothing.
- Remove jewellery or place tape over rings which will not come off.
- Wear serviceable footwear – no flip-flops!
- Use correct exercise techniques and keep the weight under control.
- Watch your body alignment – keep a neutral, stable spine.
- Practise good back care – lift correctly.
- Train within your own limitations.
- Never train through an injury – see a physiotherapist.



## HEALTH-RELATED FITNESS

### *Stamina*

Within the term 'stamina' we need to look at both cardiovascular (CV) endurance and local muscle endurance. CV endurance relates to the condition of the heart, lungs and circulation. It describes the ability to keep doing a particular exercise without getting breathless. Exercises that improve CV endurance are rhythmical in nature; examples include fast walking, swimming and cycling, all of which make the heart beat faster and keep it at this rate for some time. This type of exercise strengthens the heart muscle, expands the lungs and conditions the blood vessels, and it is these changes which help to protect an individual from heart problems.

When training to improve CV endurance, three factors are important: how hard an exercise is (intensity); how long it goes on (duration); and how often it is performed (frequency). The intensity of an exercise can be assessed by measuring the heart rate. The maximum heart rate (HRmax) is generally said to be  $(220 - \text{age})$  beats/min (see p. 20). In order to gain the benefits of CV endurance training, the heart rate must increase to what is known as the target heart rate (THR); this is a percentage of the age-determined maximum.

There is a trade-off between intensity and duration of exercise. Generally speaking, the harder an exercise is, the less you need to do of it; there are however upper and lower limits of intensity, duration and frequency of training. On average, three periods of CV endurance work are required each week, at an intensity of between 70 and 90 per cent of HRmax. The lower percentage is more suitable for beginners, and exercise of this intensity should be continued for about 30 to 40 minutes. Higher intensities will suit the



more experienced athletes, and need only be carried out for 20 to 30 minutes. If a person simply runs 'flat out' for 2 minutes the intensity of the exercise is sufficient, but the exercise will not have been kept up for long enough to allow the necessary changes to occur in the body. Similarly, a casual stroll around the park may be of a sufficient duration, but the exercise intensity is too low.

It is also important to realise that the duration of the CV endurance training refers only to the aggregate of the times at which the heart beat is high. It does not refer to the duration of the workout itself. You may spend 40 minutes in the gym, but possibly half of this time is spent resting or waiting for apparatus to become free. The heart rate will reduce in these periods and they will not count towards improving your CV endurance.

Local muscle endurance is improved by working muscles against low resistances over a longer period. The aim is to improve the ability of the muscle to work largely without oxygen. To do this the amount of lactic acid which is formed in the muscle (see p. 16) is a deciding factor. The more tolerance an individual can build up to the accumulation of lactic acid, the greater the local muscle endurance. In general, the intensity of muscle endurance training is low, but the duration high. The amount of weight that can be lifted in a single repetition is measured (the 'one repetition maximum' or 1RM) and exercises are performed as a percentage of this amount. For endurance weights at 10–20 per cent 1RM may be used, but for higher numbers of repetitions 15–25 repetitions is normally the minimum to be used in weight training. For circuit weight training, times of 30–90 seconds may be used. The relationship between strength, endurance and repetition number is covered on p. 88 – and the principles behind circuit weight training (CWT) on p. 162.

### *Suppleness*

This refers to the amount of movement at a joint, and is an important factor in determining its health. Suppleness exercises are slow and controlled. They move a joint through its full range of motion so you feel the 'stretch'.

Three types of stretching are generally used: static, ballistic and neuromuscular. Static stretching is the type used in yoga for example. The fully stretched position is held, and any tightness gradually subsides.

Ballistic stretching is often used in sport and involves adding small 'bounces' when at the fully stretched position in an attempt to extend the range of movement still further. This type of stretching can be dangerous if the small bounces become large and uncontrolled. This is a specialist type of stretching not suitable for the beginner. It should only be performed under the supervision of a physiotherapist or experienced personal trainer. It is vital that the bounces are small controlled oscillations rather than rapid uncontrolled swinging at the end of range.

The third type of stretching, termed neuromuscular, uses the muscle reflexes. When a muscle is contracted and held (isometric contraction) the muscle tone relaxes below resting level as the contraction is released. During this period a stretch may effectively be put on to perform Contract Relax (CR) stretching. Using another muscle reflex, when a