



# Factors Affecting Performance Training

## Summary

To be effective, fitness training should prepare the athlete for the demands that are placed on them in their chosen sport or activity. This means selecting the right types of training and following established training principles. This video examines aerobic and strength (resistance) training, and uses these types of training to help illustrate the following principles:

- \* Specificity
- \* Progressive overload (incorporating FITT)
- \* Threshold
- \* Warm-up/cool down
- \* Reversibility
- \* Variety
- \* Assessment

(This video functions as a companion video to "Factors Affecting Sports Performance: Energy Systems").

## Worksheets and Glossary

The accompanying worksheets have been designed to reinforce the fundamental concepts explained in the video, and to build on this knowledge using information that is beyond the scope of the video itself. A comprehensive glossary explains specific terms used in the video and the worksheets.

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## SPECIFICITY

In order to maximise an individual's performance in specific activities the principle of specificity needs major consideration. An athlete should not just ponder 'am I fit' but 'fit for what'? This principle refers to the specific requirements needed by an individual for a specific task.

Specificity needs to be considered when planning fitness programs for example the;

- Specific components of fitness required
- Dominant energy systems used
- Muscle groups involved
- Specific skills required.

To help understand this important principle of training, complete the table below.

<b>SPORT/ACTIVITY</b>	<b>FITNESS COMPONENT(S)</b>	<b>MUSCLE GROUPS</b>	<b>DOMINANT ENERGY SYSTEMS</b>	<b>SKILLS REQUIRED</b>
<b>JAVELIN</b>				
<b>TRIATHALON</b>				
<b>TOUCH</b>				
<b>100M SPRINTER</b>				
<b>1500M SWIMMER</b>				
<b>SOFTBALL PITCHER</b>				
<b>SOCCER GOALKEEPER</b>				
<b>LONG JUMP</b>				
<b>RUGBY WINGER</b>				
<b>NETBALL SHOOTER</b>				
<b>FLOOR GYMNASTICS</b>				

Are there any other factors that may be considered when planning a fitness program?

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## PROGRESSIVE OVERLOAD

In order to improve fitness levels an individual needs to make their body work harder than it is use to. The body responds to this by adapting to the increased load. When the load is progressively increased the body continues to adapt until the body's upper limits are reached. This is known as progressive overload.

1. Describe in your own words the principle of progressive overload and provide a relevant example.  
\_\_\_\_\_  
\_\_\_\_\_
2. Explain what is meant by the term 'adapt'.  
\_\_\_\_\_
3. The adaptations that occur are why an individual's fitness improves over time with the appropriate overload.  
Investigate the adaptations that take place in response to:
  - a. Aerobic training  
\_\_\_\_\_  
\_\_\_\_\_
  - b. Strength training  
\_\_\_\_\_  
\_\_\_\_\_
4. Outline the FITT Principles.  
\_\_\_\_\_  
\_\_\_\_\_
5. Explain how the FITT Principles can be used to progressively overload an athlete in order to improve an athletes
  - a. Aerobic capacity  
\_\_\_\_\_  
\_\_\_\_\_
  - b. Strength  
\_\_\_\_\_  
\_\_\_\_\_
6. Describe the terms
  - a. VO2 max  
\_\_\_\_\_
  - b. Aerobic threshold  
\_\_\_\_\_
  - c. Anaerobic threshold  
\_\_\_\_\_
  - d. Oxygen deficit  
\_\_\_\_\_  
\_\_\_\_\_
  - e. Oxygen debt  
\_\_\_\_\_
7. Explain how an athlete would know they have exceeded their anaerobic threshold.  
\_\_\_\_\_  
\_\_\_\_\_

## **PRINCIPLES OF TRAINING**

### **Specificity** – Fit for what?

An individual must decide the purpose or reason for improving their fitness and then design a program that will achieve that goal eg a weightlifter needs a program to increase power, therefore the exercise involved should include heavy resistance work (weight training). Aspects to consider include specific energy systems, muscle groups utilised and fitness components eg speed, agility, etc.

**Progressive Overload** – this refers to the fact that fitness can be improved by overloading the body systems (muscular, circulatory, nervous) that is making them do more than normal. The body will gradually adapt to the increased demand placed upon it. This is known as a **training effect**.

The FITT Principles are used to create this overload.

- a) **Frequency** – how often?
- b) **Intensity** – how hard?
- c) **Time** – how long?
- d) **Type** – the type of exercise chosen [specificity]  
eg continuous running to improve cardio respiratory fitness.

Once the body adapts the overload can be gradually increased so that improvement is maintained. This is achieved by manipulating the FITT principles. For example increasing training frequency from 3 to 4 times a week or working at a higher intensity or increasing the amount of time training or changing the type of activity. This is known as **PROGRESSIVE OVERLOAD**.

**Reversibility** – just as your fitness levels will increase with regular training it is also true that you will revert back to pre-training fitness levels if your frequency, intensity or the time spent training declines. Therefore **continuity** of training is important for all year fitness levels.

**Warm-up/Warm-down** – this is an important principle for all types of training in order to prevent injuries and improve performance. This is achieved through whole body activity stretching and specific skill activities.

**Training Thresholds** – refers to the minimum amount of exercise required to produce significant improvement in physical fitness. The **aerobic threshold** is approximately 70% of maximum heart rate (220 – age) and the **anaerobic threshold** is approximately 85% of MHR.

**Assessment** – fitness/skill testing before and during exercise programs. This can be used as part of a pre-screening process prior to commencing a physical fitness program. This information can be used to assess the individual strengths and/or weakness or whether the exercise is suitable or potentially hazardous (contraindicated). These tests provide base levels that will help the individual assess the effectiveness of their program.

**Variety** – it is important to alter some aspect of the training program on a regular basis. This is because the rate of adaptation will slow after two weeks of the same program because the body has become used to the training stimulus. Variety also helps maintain interest and motivation.

## APPLYING THE PRINCIPLES OF TRAINING TO AEROBIC CONDITIONING

### Specificity

Any program designed to improve aerobic fitness must focus on using large muscle groups for an extended period of time. Types of training may include: **Long Slow Distance (LSD)** – gradual and steady improvement of aerobic fitness. Can be used early in a training program or when fatigued. Intensity approximately 70%MHR with emphasis on distance not speed.

**Maximal Aerobic Training** – Intensity approaching anaerobic threshold (85% MHR). Lactic acid will accumulate and is therefore very fatiguing but more performance specific.

**Fartlek (Speed play)** – Continuous training with regular changes in pace. Incorporates both aerobic and anaerobic systems suitable preparation for many team games.

**Interval Training** – Involves periods of high intensity work followed by a recovery period, e.g. 6 x 200m with 2 minute recovery between efforts. Designed to improve anaerobic and aerobic capacity. Interval training can be overloaded by manipulating any one of the following at a time

- distance and duration
- recovery interval
- repetitions and sets

To improve aerobic capacity you need to improve your anaerobic threshold and VO<sub>2</sub> max as well as improve local muscular endurance. Aerobic conditioning is the basis for all health and sport related training programs. Improved aerobic capacity allows you to reach your aerobic state faster, accumulate less lactate, and recover more rapidly.

### Progressive Overload

Once adaptations have occurred and aerobic fitness has improved the FITT principles can be manipulated to progressively overload the body. This will produce further adaptations and thus improved aerobic fitness by, for example, increasing frequency or intensity or the time or change the type of activity.

**F**- frequency 3-4 times a week or accumulate 30 minutes of moderate activity on most days of the week (health related fitness).

**I** - Intensity 70-85% maximum heart rate (220-age)

**T** – Time 20-30 minutes for general health. Athletes influenced by length of performance.

**T** – Type should be specific to the sports performance and involve the large muscle groups of the body for extended periods of time.

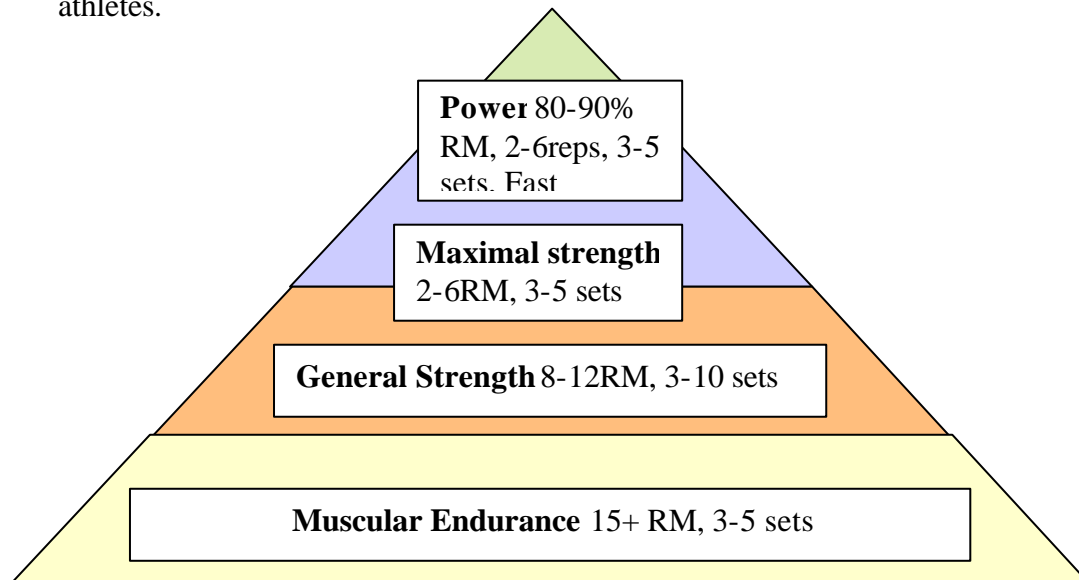
### Question

Fay is a 36year old secretary. She has steadily gained weight over the past 10 years and feels lethargic during the day. Using the principles of training design a program for Fay to improve her ability to cope with her daily routine.

## APPLYING THE PRINCIPLES OF TRAINING TO STRENGTH/RESISTANCE TRAINING

### Specificity

Most sports that require strength require that strength be exerted at speed. Therefore the primary goal of most sport-related strength programs is to develop POWER in their athletes.



To develop power the athlete must start by establishing a good strength base to maximise power and prevent injury.

### Progressive Overload

This involves gradually increasing the load as the body adapts to the overload placed upon it. This can be achieved by manipulating the FITT Principles.

**F** - frequency- 3-5 times per week

**I** - Intensity- high, dictated by the weight (resistance) and reflected by reps, sets, and %RM (repetition maximum)

**T** - Time- depends on the number of muscle groups and exercises. Recovery times between sets should be 30sec – 2mins or longer for power activities so that the exercises can be performed at maximum intensity.

**T** - Type- should be specific to the speed of contraction, muscle group, and movements required in the sport. Free weights are best as balance and coordination is required as well as strength and includes development of the stabilizers.

It is important to note that recruitment of muscle fibre is dictated by the tension created within the muscle. Training with low volume heavy loads results in greater recruitment of fast twitch fibres than high volume lower loads, which target slow twitch fibres.

**Questions**

1. Describe how the other principles of training may be applied to strength training.
2. Sam is an 18 year old elite basketball player. Use the principles of training to design a program to improve Sam’s rebounding height.
3. Explain how and where plyometric activities may be used in a resistance program.

**WARM UP / COOL DOWN**

Explain the purpose of the warm up. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

To be effective the warm up should follow a set sequence. Complete the table below detailing the phases, time frame and examples of activities for a warm up

<b>PHASES</b>	<b>TIME (MINS)</b>	<b>EXAMPLES</b>
1. Whole body activities		
2.		1. Static 2. PNF 3. Ballistic/ dynamic 4. ROM
3.	FIVE	

Explain the purpose of the cool down. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Outline the sequence and time frame that should be followed in performing an effective cool down. \_\_\_\_\_  
\_\_\_\_\_

Describe the benefits of consuming carbohydrate rich fluids in the first 15 minutes immediately after exercise. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Plan a warm up and cool down for a sport of your choice. In your response detail the

- Sport
- Age group of the participants
- Time frames for each phase
- Names and examples of activities for each phase

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## REVISION QUESTIONS

Fill in the missing word. Choose words from the list of words below.

**Fartlek, isotonic, callisthenics, PNF, isometric, dynamic, resistance, plyometrics, circuit, aerobic, anaerobic, isokinetic, static, interval.**

If an athlete wished to improve their aerobic conditioning the athlete should work closer to their \_\_\_\_\_ threshold.

In order to improve strength it is necessary for an athlete to increase \_\_\_\_\_.

Continuous training that incorporates periods of high and low intensity work is called \_\_\_\_\_ training.

'Exercise stations' are used in \_\_\_\_\_ training. Typically this type of training is used to improve \_\_\_\_\_.

Push-ups, sit-ups and burpees are examples of \_\_\_\_\_ that may be used as part of a warm up.

Placing the muscle in a lengthened position and performing a isometric contraction for 10 seconds and then increasing ROM is known as \_\_\_\_\_ stretching.

\_\_\_\_\_ is a form of power training involving a rapid prestretch (eccentric contraction) of a muscle group followed immediately by a powerful concentric contraction.

Tension created in a muscle without a change in joint angle is called an \_\_\_\_\_ contraction

## EXTENSION QUESTIONS

Explain why assessment plays a vital role in the development of effective training programs.

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Discuss how a netball player could minimise the detraining effect of reversibility following an ankle injury.

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Outline how a soccer coach might implement the principle of variety while still incorporating specificity in their aerobic program.

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## GLOSSARY

<b>ADAPTATION</b>	A training effect in response to overloading the body systems.	<b>OXYGEN DEBT</b>	After exercise has ceased where O <sub>2</sub> supply exceeds demand
<b>AEROBIC</b>	With oxygen	<b>OXYGEN DEFICIT</b>	When beginning exercise where O <sub>2</sub> supply is inadequate for demand
<b>AEROBIC THRESHOLD</b>	Minimum intensity required to improve aerobic fitness. Approximately 70% MHR	<b>PLYOMETRICS</b>	A form of power training involving rapid prestretch and a powerful concentric contraction
<b>ANAEROBIC</b>	Without oxygen	<b>PNF STRETCHING</b>	Proprioceptive Neuromuscular Facilitation Stretching method involving isometric contraction at progressive muscle lengths
<b>ANAEROBIC THRESHOLD</b>	Approaching VO <sub>2</sub> Max. Approximately 85% MHR	<b>POWER</b>	Combination of strength and speed
<b>BALLISTIC/DYNAMIC STRETCHING</b>	Rhythmical movements used to lengthen a muscle	<b>PROGRESSIVE OVERLOAD</b>	A principle of training which gradually increases the demands place on the body as it adapts
<b>CONCENTRIC CONTRACTION</b>	Shortening of a muscle under tension	<b>REPS</b>	The number of times an exercise is completed without rest
<b>ECCENTRIC CONTRACTION</b>	Lengthening of a muscle under tension	<b>REPETITION MAXIMUM (RM)</b>	The maximum weight that can be lifted a specified number of times
<b>FAST TWITCH</b>	White muscle fibres used in explosive movement	<b>REVERSIBILITY</b>	Components deteriorate through lack of training
<b>FITT PRINCIPLES</b>	Used to manipulate overload frequency, intensity, time, type	<b>ROM</b>	Range of movement
<b>GENERAL STRENGTH</b>	A method of resistance training used to increase hypertrophy	<b>SET</b>	Number of reps done in succession
<b>HYPERTROPHY</b>	Increase in muscle tissue	<b>SLOW TWITCH</b>	Red aerobic fibres used in endurance activities
<b>ISOKINETIC CONTRACTION</b>	Maximum tension developed through the full ROM	<b>SPECIFICITY</b>	Matching specific components to a specific task
<b>ISOMETRIC CONTRACTION</b>	Tension developed in muscle with no change in joint angle	<b>SPEED</b>	Distance covered per unit time
<b>ISOTONIC CONTRACTION</b>	Lengthening and shortening of muscles under tension	<b>STATIC STRETCH</b>	Placing muscle in a lengthened and held position
<b>LACTIC ACID</b>	By-product of the incomplete breakdown of glucose	<b>TRAINING THRESHOLDS</b>	The minimum amount of load required to improve fitness
<b>MAXIMUM STRENGTH</b>	Ability of a muscle group to exert maximum force	<b>VO<sub>2</sub> MAX</b>	The maximum amount of oxygen that can be taken

			up the body
<b>MUSCULAR ENDURANCE</b>	Ability of a muscle group to perform repeated or prolonged contraction		