Aerobic Capacity

Strand 7 Fitness Concept

Aerobic Capacity

- Aerobic capacity is the ability to take in and use oxygen, allowing participation in longer periods of constant exercise
- The maximum volume of oxygen that can be used by the body per unit of time is referred to as VO2 (max)
- Dependent on three factors: effective external respiration (breathing in), effective oxygen transport from the lungs to the cells, and effective use of oxygen within the cell
- VO2 (max) is mostly genetically determined (from your parents), although age, sex and training also play an important part

Aerobic Capacity

- Blood pressure increases with age, as does body fat percentage
- A high VO_2 (max) does not necessarily mean that the athlete will be outstanding at endurance events (events where you have to perform constantly for a long period of time)
- A much better indicator is the percentage of their VO_2 (max) that an athlete can work at for prolonged periods of time without crossing their anaerobic threshold (cells stop taking in oxygen)
- Elite endurance athletes - 85%
- Non-athletes - struggle to maintain 65%
- Most male endurance athletes have a VO_2 (max) in excess of 70ml/min/kg
- Most female endurance athletes have a VO_2 (max) in excess of 60ml/min/kg

Aerobic Capacity

- Training needs to be continuous
- Duration will depend on fitness but should be minimum 12 minutes
- Body needs time to adjust to extra oxygen demand
- 30-40 minutes sufficient for recreational athletes
- Intensity depends on fitness
- HEART RATE is a good guide
- Frequent training also essential - at least twice a week
- When your HR response to workload drops, your body has adapted to that level of work - time to overload again

Types of Training

Continuous running

- jogging or running continuously at a steady pace

Fartlek

- the word means ‘speed play’ in Swedish.
- the athlete varies the pace at which they are running (simulating game situations)
- involves steady-state running interspersed with sprints and recovery periods (walking)
- can include uphill and downhill work

Interval training

- periods of work interspersed with periods of recovery
- four variables: (1) duration/distance of interval, (2) intensity of interval,(3) duration of recovery period, and (4) no. of work/recovery intervals

Types of Training

- Aerobic training involves long distance, low intensity
- Anaerobic work involves short distance, high intensity
- Allows variety to be added to the training session
- Can incorporate skills practices to suit particular sports

Target Heart Rates

- To manually calculate your target heart rate zone, first determine your maximum heart rate, which is 220 minus your age. (This calculation represents a general guideline only.)
- For example, if you are 15, your maximum heart rate is 220 - 15 = 205.
- Next, calculate your target heart rate zone. This is generally 50% to 75% of the maximum heart rate for most people during the first six months of regular exercise.
- For example, 50%-75% of your maximum heart rate of 205 is (205 x 50) ÷ 100 = 103; (205 x 75) ÷ 100 = 154.
- So your target heart rate zone for exercise, in this example, would be 103-154 heartbeats per minute.

More on Target Heart Rate

- If you haven't been exercising, the American Heart Association (AHA) recommends that you then start at 50%, with the goal of gradually building up to 75% during this six-month period, **but only after checking with your physician.**
- **People who have not been exercising or who intend to change their exercise program significantly need to get their physician's approval.**
- After exercising regularly for six months, some people might be able to exercise comfortably at up to 85% of their maximum heart rate, according to the AHA. However, the AHA notes that you don't have to exercise that hard (at 85%) to stay in condition.

Physiological Adaptations as Aerobic Capacity Increases

THE HEART

- Hypertrophy of the myocardium - heart becomes bigger and stronger
- Increase in stroke volume and maximum cardiac output - heart can hold more blood and pump more out. Resting and maximum stroke volume is therefore increased. Net effect - higher maximum cardiac output (resting cardiac output remains the same).
- Decrease in resting heart rate - resting cardiac output remains the same. As resting stroke volume has increased, resting heart rate therefore drops.
- **Heart is far more efficient at pumping blood round the body, helping to distribute more oxygen to the muscles.**

Physiological Adaptations

THE LUNGS

- Maximum pulmonary ventilation increases - due to an increase in frequency of breathing and tidal volume.
- Respiratory muscles become more efficient with training
- Lung volumes at rest increase (apart from tidal volume)
- Diffusion rates improve with training - increase in lung volume creates a greater surface area

Improved ventilation does not really have a direct effect on VO_2 (max) as an athlete is always capable of ventilating more than enough oxygen. It is linked more to the expiration of a greater volume of carbon dioxide.

Physiological Adaptations

THE BLOOD

- Blood volume will increase. Due to an increase in blood plasma and number of red blood cells. Therefore, more oxygen-carrying capacity.
- During sub-maximal exercise, blood acidity in trained athlete will be less acidic due to a more effective aerobic system.
- During maximal exercise, blood acidity in trained athlete will be more acidic as the athlete has a greater tolerance to lactic acid, more accumulates.

THE VASCULAR SYSTEM

- Increased elasticity of arterial walls, can withstand greater pressures.
- More capillaries, increasing rate of gaseous exchange

Physiological Adaptations

THE MUSCLES

- Hypertrophy occurs - muscles grow bigger
- More myoglobin, better transport within the muscle
- More mitochondria, greater rates of aerobic respiration
- Increased enzyme activity, more efficient aerobic system
- Muscle cell stores more glycogen and triglycerides

Physiological Adaptations

OVERALL BENEFITS

- **More efficient external respiration**
- **More efficient oxygen transport from lungs to cells**
- **More efficient use of oxygen within the cell**

Can lead to an increase in VO_2 (max) of up to 20%

In addition:

- **Tendons become stronger**
- **Ligaments are stretched, increasing flexibility**