Cardiovascular Training

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Introduction

According to the American College of Sports Medicine, cardiovascular exercise is:

‘Any activity that increases heart rate and respiration while using large muscle groups repetitively and rhythmically.’

Classifications

- High impact − Both feet off the ground at some point eg, running, jogging, high impact aerobics class
- Low impact − One foot on the ground at all times eg, hiking, low impact aerobics class
- No impact − Bodyweight always supported by multiple points of contact with ground eg, swimming, cycling, cross-trainer

Exercise intensity

The term ‘exercise intensity’ refers to the effort someone is putting in to their training. It can be gauged a number of ways including direct and indirect measures:

Direct:

- RPE (/10 or Borg scale)
- HR (%Max)
- Lactate

Indirect

- Power output
- Pace

Exercise intensity

The intensity with which an athlete exercises, will change the mechanism of energy production in the body used during the training. This in turn, will alter the physiological adaptation effects post exercise

In general, it is recommended that athletes involved in cardiovascular-based sports train at all intensity levels, but with an emphasis on the specific intensity with which their sport is played. An analysis of the sport should therefore be undertaken so that prescribed exercise stimulates the energy systems that are used

Monitoring exercise intensity

Monitoring exercise intensity will help you to make specific progression in certain physiological changes. It will also help you to understand the loading (volume and intensity) of training that your client can complete.

Monitoring should occur by measuring using either indirect or direct measures as mentioned in the previous slide

Rate of Perceived Exertion (RPE)

RPE scale 0-10 is the easiest method of monitoring intensity. The numbers listed relate directly to how easy or difficult your client finds an activity

Though not a physiological measure, RPE can give accurate measures of effort once a client is accustomed to it

Scale	Definition	Use (depending upon client fitness)
0	Nothing at all	
0.5	Just noticeable	
1	Very light	
2		
3	Light	
4		Active recovery
5	Comfortable pace	Warmup, cool down,
6		Aerobic conditioning
7	Heavy	Anaerobic threshold conditioning
8		
9	Very heavy	Anaerobic power
10	Maximum effort	

Borg Scale

The Borg scale is possibly a more accurate version of the 1-10 RPE scale. Again, the numbers listed relate directly to how easy or difficult your client finds an activity

The Borg scale correlates well with heart rate – The start scale of 6, is close to most resting heart rates (@60bpm) whilst the finish scale of 20 is close to most maximum heart rates (@200bpm)

Scale	Definition	Use (depending upon client fitness)
6	No exertion	
7	Extremely light	
8		
9	Very light	
10		
11	Light	Active recovery, warmup, cooldown
12		
13	Somewhat hard	Aerobic conditioning
14		
15	Hard	Anaerbic threshold conditioning
16		
17	Very hard	
18		
19	Extremely hard	
20	Maximal exertion	

Heart rate training zones

Heartrate training zones are calculated by using the maximum heartrate (MHR) and resting heartrate (RHR) of the client, then calculating %'s

Different sports utilise different heartrate %'s due to the varying physiological requirements of each sport. Those listed in the table are typical examples

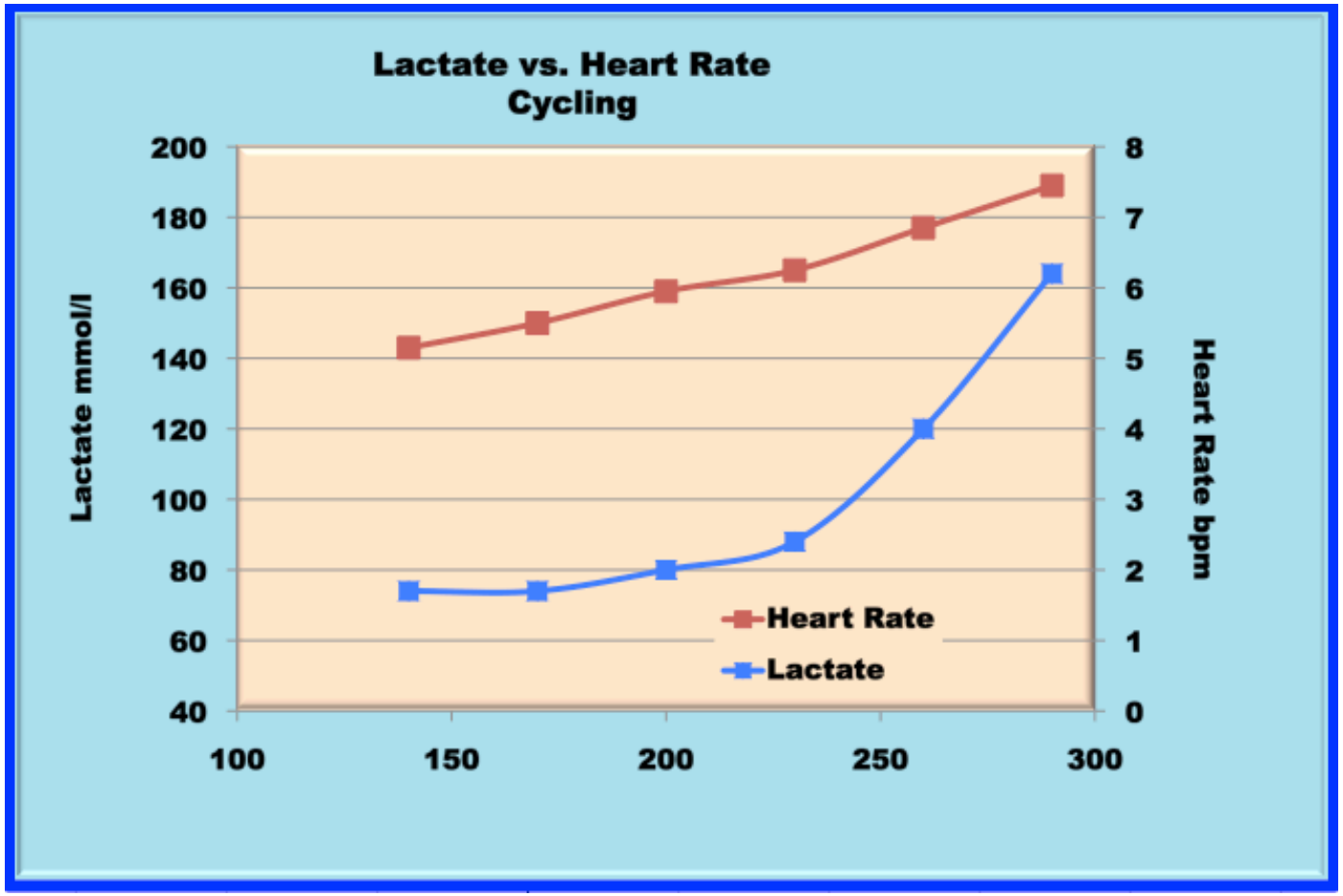
Heartrate does however vary on a daily basis and also during long distance events due to dehydration and 'cardiac drift'

% MHR	Definition	Use (depending upon client fitness)
60-70	Aerobic	Warmup, cooldown, active recovery, large volume work for fat utilisation
70-80	Low end anaerobic	A high proportion of training volume is at this intensity – cardiovascular adaptation changes
81-93	Upper anaerobic	Developing anaerobic threshold and ability to run at high intensity for long periods of time
94-100	Near maximal	Race/training pace for 1-10km

Lactate testing

Lactic acid is always produced in some quantity. As the intensity of exercise increases, so does blood lactate. At a certain point, (inflection point), blood lactate accumulates quicker than it can be removed. This is the start of the end for most athletes as muscles cannot function under high lactate levels. This point is termed ‘anaerobic threshold’ and is usually around 85% of MHR

As fitness increases, more lactate can be tolerated, meaning that power output can be higher at any given heartrate



Power measurement and monitoring

Exercise intensity can be monitored using power output. Measuring power is an indirect measure − not a physiological measurement. However it does show exactly what work is being done by the client.

For power monitoring to be valid, a maximum power test such as an FTP or CP test must first be completed (see ‘Fitness Tests’ and ‘Critical Power for Cycling’ lesson)

Effects of CV training

Short term

- Increased HR = More O_2 delivery
- Increased stroke volume
- Cardiac output may increase by 20-40 l/min
- Blood flow diverted to muscles requiring increased O_2 via vasoconstriction
- Vasodilation widens arteries and arterioles supplying the muscles
- Sphyncter valves open and close capillary beds in the muscles
- Increased coronary blood flow from approx 250cm^3 per minute to approx 1000cm^3
- After approximately 30 minutes, loss of water and electrolytes causes an upward ‘cardiac drift’ where the HR is slightly increased at any given intensity

Effects of CV training cont.

Long term

- RHR decreases (ave 52bpm trained / 72bpm untrained)
- Post exercise recovery time decreases
- Stroke volume increases due to stronger myocardium
- Increased cardiac output
- Improved blood supply to myocardium due to increased time for diastole as a result of reduced HR's at any given intensity
- Increased blood volume
- Increased red blood cell (RBC) count
- Increased Haemoglobin levels

Effects of CV training cont.

Long term

- Improved smooth muscle ‘tone’ in arteries – increasing ability to expand and contract to move blood
- Hypertophy of myocardium – especially the left ventricle
- Improved blood cholesterol profile
- Increased capillarisation in muscles and lungs allowing increased gaseus exchange
- Increased blood lactate tolerance
- Decreased risk of many diseases such as CHD and diabetes

Training methods - LISS

Low Intensity Steady State - Prolonged (> 30 mins) periods of time at a low intensity (approx 50%MHR)

Benefits:

- Increased exercise adherence
- Increased frequency of exercise
- Reduced metabolic stress
- Increased fat metabolisation (inc aerobic efficiency)
- Neuromuscular adaptation (better movement pattern)

Downsides:

- Low Kcal burn
- Fatigue
- Impaired immune function
- Increased training time
- Repetitive strain type injury

Example:

Long, low intensity run or bike ride

Training methods - Fartlek

Varying speeds and intensities at random

Benefits:

- Fun
- Increased exercise adherence
- Introduction to higher intensities
- Potential to lower training time compared to LISS

Downsides:

- Not controlled therefore less ‘measurability’
- Higher intensities not suited to all

Example:

‘Lamp-post’ running (sprinting and then walking between alternate lamp-posts)

Training methods – Interval (inc HIIT)

Timed work and rest periods allowing intensity to be maximised for any given period of time

Benefits:

- Measurable
- Shorter training duration
- Excess Post Exercise Oxygen Consumption (EPOC) causes increased metabolic rate post workout
- Increased kcal burn
- Can have specific effects on the raising of the ‘anaerobic threshold’

Downsides:

- Higher intensities not suited to all
- Require a detailed knowledge of your athlete in order to make as specific as possible

Example:

- Resisted shuttle runs, Tabata protocol bike sprints

Training guidelines

Cardiovascular exercise is very fatiguing for an athlete. Therefore the following guidelines should be taken into consideration when devising CV training programmes.

- Use the FITT and SPORT principles to programme your athlete's training
- Constantly monitor feedback from your athlete
- Be very aware of over-training
- Progress or regress training according to feedback and fitness test results