

Calculating Training Intensity

Heart rate changes during exercise are a physiological response that is directly influenced by the intensity of exercise. Therefore, measuring heart rate during exercise is a good indicator of the intensity of the exercise being performed.

Exercise Intensity

Measuring Heart Rate

Heart rate is the number of heart beats per minute (BPM) and is measured using the following two methods:

1) Manually by counting a pulse

This method is better for measuring resting heart rate as it is easier to perform when the athlete is sat down and not exercising.

It involves counting the pulse at either the radial (wrist) or the carotid (neck) arteries by using pressure applied by the index and middle fingers.

This method can be less accurate than an automatic heart rate monitor as human error may occur when counting the pulse. Therefore, it is beneficial to practise this method.



2) Automatically by using a heart rate monitor

This method is better for measuring exercise heart rate as it usually involves attaching an automatic heart rate monitor which can be worn during exercise.

An automatic heart rate monitor is usually worn across the chest but other types can be attached to the index finger.

This method allows an accurate reading of heart rate, which is often displayed on a watch also worn by the athlete.



Training Zones
In order to train at the correct intensity athletes use their heart rate to calculate their training zone. The recommended training zone for cardiovascular health and fitness is 60-85% maximum heart rate

Maximum Heart Rate
Maximum heart rate (HRmax) is calculated based upon age using the following equation:
 $HR_{max} = 220 - \text{age (years)}$

Calculating Training Zones

Ben is a 17-year-old long-distance runner. In order to ensure his training is within the recommended zone for cardiovascular health and fitness he decides to wear a heart rate monitor while exercising.

Q) What is Ben's 60-85% HRmax?

HRmax
 $= 220 - \text{age (years)}$
Therefore:
Ben's HRmax
 $= 220 - 17$
 $= 203 \text{ bpm}$

Optimal training intensity = 60 to 85% of HRmax.
Therefore:

Ben's optimal training intensity =
• $203 \times 0.6 (60\%) = 122 \text{ bpm}$
• $203 \times 0.85 (85\%) = 173 \text{ bpm}$

The range of heart rates Ben should try to maintain = $122 - 173 \text{ bpm}$

Rating of Perceived Exertion (RPE) Scale

The Borg rating of perceived exertion (RPE) scale is a scale used to measure exercise intensity. The scale increases from 6 (no exertion at all) to 20 (maximal exertion) and is given to an athlete for them to grade their perceived exertion during exercise. The athlete rates their overall exertion based upon factors such as fatigue, breathlessness and strain. An example of a Borg RPE scale is shown below:

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
No exertion						Very light			Somewhat hard			Hard (heavy)			Maximal exertion



The Relationship between RPE and Heart Rate

Although heart rate is often a more accurate way of measuring exercise intensity we might not always have an automatic heart rate monitor available. Instead of directly measuring heart rate it is possible to predict the heart rate of an athlete during exercise by using their RPE. It makes sense that there is a relationship between RPE and heart rate as both are influenced by exercise intensity.

The relationship between predicted heart rate and RPE is represented by the following equation:

$$\text{Rating of Perceived Exertion (RPE)} \times 10 = \text{Heart Rate (bpm)}$$