

# **HOW TRAINING AND FITNESS AFFECT THE HEART**



# **HEART RATE OR PULSE RATE**

**This is the number of times the heart beats per minute.**

**In a trained athlete it is likely to be less than an unfit person and it is therefore heart rate that is used to indicate a person's fitness level.**

# **HEART RATE OR PULSE RATE**

**This is the number of times the heart beats per minute.**

**Heart rate can vary considerably from person to person and even within the same athlete, but 72 beats per minute is often thought of as being average.**

The resting pulse rate can also be affected by:

1. Age
2. Gender
3. Size
4. Posture
5. Eating
6. Emotion
7. Body Temperature
8. Smoking

MAXIMUM PULSE RATE can be worked out  
by the formula:

$$220 - \text{Age}$$

Therefore for a 15 year old the maximum  
pulse rate would be:-

$$220 - 15$$

$$205$$

# **STROKE VOLUME**

This is the amount of blood pumped by the heart per beat.

At rest this may be 85 ml, but when exercising it could go up to 130 ml.

# CARDIAC OUTPUT

The amount of blood pumped by the heart in 1 minute.

This is governed by the heart rate and the stroke volume. The formula is:

Cardiac output

Stroke volume x Heart rate

# CARDIAC OUTPUT

For Example

If Stroke volume was 10 mls per beat and heart rate was 70 beats per minute

then

Cardiac Output would be

$$10 \times 70 = 700$$



# **Changes During Physical Exercise**

During physical exercise the body requires more oxygen in order to perform the additional work. As oxygen is supplied by the blood there must, therefore, be an increase in the blood supply. One of the ways in which this is carried out is by an increase in **CARDIAC OUTPUT** (i.e. both the heart rate and stroke volume increase as well).

# Changes During Physical Exercise

Look at the following examples:

	PERSON A	PERSON B
Heart Rate	180 per minute	65 per minute
Stroke volume	115 mls per beat	80 mls per beat
Cardiac Output	____ litres per min	____ litres per min

What is the CARDIAC OUTPUT for person A and person B

(Remember: There are 1000 millilitres in a Litre)

# Changes During Physical Exercise

Look at the following examples:

	PERSON A	PERSON B
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	EXERCISING	REST

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# Changes During Physical Exercise

These figures below give the rate of a person's heart beat before and during a period of intense exercise.

Time	Heart rate	Time	Heart rate
0	60	8	110
1	64	9	98
2	68 exercise	10	90
3	130	11	82
4	150	12	74
5	161	13	64
6	171	14	64
7	167	15	60

# Changes During Physical Exercise

What happens to the person's heart rate during the 15 minutes it was measured?

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# Changes During Physical Exercise

The heart beat increased when exercise began at the 2 minute mark and then began to decrease when exercise slowed at the 7 minute mark.

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**When a person trains regularly their stroke volume will increase.**

**On the other hand, the heart rate does not increase, it DECREASE, so the heart becomes more efficient.**

**Training increases the heart muscle in size, thickness and strength.**

# **How do we measure Cardiovascular Fitness?**

The best measure of cardiovascular fitness is called **MAXIMUM OXYGEN UPTAKE** or **VO2 MAX**.

This measures the ability of the heart, lungs and blood to transport oxygen to the muscles.

A frequently used test for this is the **Harvard Step Test**.

# THE HARVARD STEP TEST.



**You are awarded scores depending on the heart rate rise and recovery.**

Fitness Score

Duration of Exercise in Seconds



X 100

2 X Sum of Recovery Pulse rates

# Score Classification for Harvard Step Test

Fitness category	Score (boys/girls)
Very poor	below 55
Poor	56 - 64
Average	65 - 79
Good	80 - 89
Excellent	90 or above

# THE COOPER 12 MINUTE RUN WALK TEST



# Score Classification for Cooper Test

<b>Fitness Category</b>	<b>Distance covered in 12 min.</b>	
	<b>Boys</b>	<b>Girls</b>
Very poor	less than 1.2 miles	
Poor	1.20-1.23	1.02-1.19
Average	1.24-1.53	1.20-1.27
Good	1.54-1.84	1.28-1.42
Excellent	1.85 +	1.42 +

## **What is a working pulse rate?**

The working pulse rate is a measurement of pulse rate taken immediately after exercise.

This is an accurate guide to the intensity the heart has been working. A target range (Target zone) can be set for the heart rate to reach during exercise and this can be worked out using the following formula:



60 - 80% of Maximum Heart Rate

The target for a 15 year old is:

$$220 - 15 = 205$$

$$60\% \text{ of } 205 = 123$$

$$80\% \text{ of } 205 = 164$$

Therefore the target zone is

123 - 164 b.p.m