Test the heart rate of a number of pupils while they were taking part in a `stepp...

Aims:

To arrange pupils who took part in the exercise in order of fitness level. I will look at who is the fittest and see why, and also see if there are different fitness levels between girls and boys within the group.

Method:

The information that I have been given is that eight pupils, four of each sex took part in a stepping activity, their height and weight were recorded, the heart rate of all pupils before the activity, the heart rate of all pupils at regular intervals during the activity and the heart rate of all pupils 10 and 20 minutes after the activity. The way in which the pupils who carried out the investigation took the measure of heart rate was in the following way; each pupil in turn was connected to a BBC heart rate monitor and then asked to step up and down for ten minutes. Their heart rate was taken every 2 minutes. The pupils were then asked to rest. Their heart rate was taken again 10 and 20 minutes after the exercise had been completed.

Background Information:

There are many measures of fitness. For example the volume of blood, this is very important. The red blood cells contain the haemoglobin that reacts with oxygen. There are about 5. 5 million red blood cells in each cubic cm of blood in a healthy adult. So the larger the volume of blood, the more oxygen is transported in a minute. So it is vital to have the requested amount of blood as that oxygenated blood which contains the oxyhaemoglobin, is that

one that transports the oxygen to the cells, in this case the muscles exerting the force will be in most need to oxygen.

Another thing that will affect the efficiency of the pupils in the exercise is how big the lungs are. If the lungs were big, they would have a large volume of air because the diaphragm and external intercostals muscles are larger and therefore create a larger volume when they contract; this is advantageous since they supply the increasing amount of oxygen to the blood passing through.

When a person exercises, the level of carbon dioxide in blood increases and this is toxic. This increase in the level of carbon dioxide in the blood is detected by the chemoreceptors, which send messages to the medulla oblongata, which in turn sends messages via the nerve fibers to the intercostals muscles, and diaphragm making them allow larger volumes of air in and because of that breathing rate increases. So the bigger the lungs, the more carbon dioxide they can take out from the carboxyhaemoglobin as they inhale.

Until this point its all aerobic respiration but when it gets to the point when the heart can't cope with the increasing demand for oxygen, the muscles will not get enough oxygen to react with glucose to create the energy to make adenosine triphosphate (ATP) which is then used as an `energy currency` to `pay` for these changes in a cell which require energy, the cells start to break down what it can from the glucose to create little energy without the presence of oxygen, this is called anaerobic respiration as it doesn't need

oxygen and doesn't produce carbon dioxide and water but instead Lactic acid.

So no matter how fast you breathe or how fast your heartbeats, your body cannot obtain enough oxygen from aerobic respiration to supply all its energy needs. So although your muscles will get the energy they need, this lactic acid will start to collect in the muscles, which changes the blood pH, which also makes your muscles ache. So at the end of the exercise, the heart would have reached its limit in some pupils. The limit is when the heart is pumping as fast as it can and all the oxygen in the arterioles is taken and most of carbon dioxide is given to the venules.

Within a minute, there will be too much of this acid that your muscles stop working altogether. So build up of lactic acid affects performance. You then will be breathing deeply after the exercise to repay the oxygen debt, which is the amount of oxygen needed to get rid of the acid.

The heart is a muscular organ, so the cardiac tissue develops more strength with increased use so therefore when someone exercises that will make the heart more efficient and increases its size. So when the muscle develops the heart will pump more blood in each beat. This means that the heart can beat less frequently and still pump the same amount of blood. So the stronger the heart the fitter the person is.

Now I am going to represent the information that I have been given in a series of graphs and charts so that I can analyze them and evaluate the procedure.

Analysis:

Graph number 1 shows the heart rate of all the pupils before, during and after the activity. A resting pulse is the pulse that you have when you are relaxing and not doing any exercise and doing your normal body functions. So when you compare the resting pulse of the pupils you notice a difference, this is because some pupils have stronger hearts. So low heart rate indicates strong cardiac muscles, which may be inferred that person is physically fit. Graph number 3 shows that the boy's average heart rate is higher than the girls; therefore I can assume that the heart muscle of the girls is stronger within this sample.

During the exercise phase all the pupils' heart rate goes up because there is a greater demand for energy, which is met when the heart supplies blood carrying oxygen and glucose necessary for respiration. Due to the strengths of the hearts, some of the pupils are only able to sustain the effort for only a short period of time and others for longer.

The heart rate goes down after the pupils stop exercising because there is a less demand for oxygen in the muscles, and so the heart is able to cope with that easily and therefore it doesn't need to beat as frequent.

You do realize that at the 10th minute the exercise is over, after the 10th minute, the graph shows the recovery time of all pupils. The recovery time is the time a pupil takes to recover from the end of the exercise to return back to the resting pulse. I have drawn a separate graph for the recovery time, as this time is an important sign of fitness. The shorter the time the fitter the person is because the person hasn't got much of oxygen to pay back to get

rid of the lactic acid. This shows that hisher heart copes well with the increasing demand for oxygen. From graph number 2 you can see that Anne and Daljit have the shortest recovery time, which is also identical i. e. 20 minutes, the longest recovery time is Jane's which was 30 minutes long. So she took a while to repay the oxygen debt, her heart is not strong as the others, because it needed to keep pumping frequently to get the required amount of oxygen to where its wanted.

Also the bar chart shows that the boy's recovery time is slightly higher than the girls' recovery time. The boys have an average of 19. 5 and the girls have an average of 21. 5. These averages are not accurate because we have not been given accurate information, as the pupils who took these measures, didn't take them at narrow time intervals. So looking at these averages in addition graph number 3 showing pulse rate of boys verses girls which tells us that girls in this group have stronger cardiac muscles than boys for this sample.

Summary:

I conclude that Anne is the fittest pupil for a number of reasons. Anne has the lowest resting pulse and during the exercise her pulse rate stays the lowest, which means that she has got strong cardiac muscles, she has a very fast recovery time, which shows she is fit, and she is also physically fit because she has strong leg muscles. For the same reasons I will place the others in order of fitness level being the fittest at the top:

1. Anne

2. Daljit

3. Rhona

4. Marj

5. Jane

6. Sean

7. Aaron

8. Stan

Evaluation:

I am going to evaluate the experiment in the following way: the aim of the experiment is to find out who is the fittest and if there was any difference in fitness levels between boys and girls, but this experiment only experiments the stamina, and fitness involves all the S-factors which are strength, speed, stamina and suppleness. So they must cover the other three aspects. For strength they could have done some press ups. For speed they could have done a race. For suppleness they could have told the pupils to stretch themselves as much as they can.

They also could have taken the pulse of the pupils at intervals of 2 all the way through the exercise till the pulse returns to the resting pulse instead of taking the pulse at intervals of 10 after the tenth minute. This way it would be easier to work the recovery time and the time would be more accurate. Also the sample size was not enough to support any conclusion that any sex

is fitter than the other, therefore I would use a sample of at least 30 pupils of each sex. They should have got some more background information about the pupils and theirhealthstatus.

They could have done the exercise twice so the results are more reliable. The pulses taken were accurate because they connected the pupils to a BBC heart rate monitor. While some of the pulse rates appear to be anomalous, we can be sure of their accuracy due to the way they were recorded. Our interpretation of these is skewed as we have only 2 other data points to consider. These are discrete measurements determined by a wide range of continuous variables. On basing our conclusions upon these points we have to remember the underlying determining variation and that these factors have an influence on pulse rate.