Exercise Investigation

Which activity, between Aerobics or Power Walking,
has a bigger impact on the percentage of heart rate increase ,
among 15 and 16 year old girls with similar fitness ,
with the average heart rate of 60 to 80 ?

INTRODUCTION

The main focus of the lab this time was to find the relationship between exercise and cardiovascular activity. The research question I chose to focus was "Which activity, between aerobics or power walking, has a bigger impact on the percentage of heart rate increase among 15 and 16 year old girls, with the average heart rate of 60 to 80?" I thought that this experiment would be interesting since it did not require any special equipments and I c ould not really predict the result s easily. The hypothesis I came up with at the beginning was that "If the type of sports affects the increase of heart rate, then power walking will increase the heart rate more than aerobics since it requires more dynamic movement relatively. " For aerobics, you mostly stay at one spot and have many rests in between the different exercises. On the other hand, when power walking, you have to move the skeletal muscles constantly. As the image below shows, oxygen is needed to provide energy to these muscles. Therefore, the heart will have to contract more powerfully and faster in order to move oxygen around. It is also important to note that skeletal muscle has the largest increase in the percentage of total blood flow than any other organs after exercise. Thus, power walking that has more movement in these muscles than aerobics will have a larger impact on the heart.

Cellular Respiration

$$C_6H_{12}O_6 + 6\,O_2 \longrightarrow 6\,CO_2 + 6\,H_2O + \text{Energy}$$

Image 1: Formula of Cellular Respiration

"Cellular Respiration." *Welcome to Cherokee High School.* Web. 17 Nov. 2010. <http://chsweb.lr.k12.nj.us/mstanley/outlines/respiration/respiration.htm>.

PROCEDURE

The Variables

Table 1: The Independent and Dependent Variables

Independent Variable	How was it changed?
Different types of Exercise	By testing 5 people from Aerobics and Power Walking group.

Dependent Variable	How was it measured?
The percentage of increase in hear t beat	By making the subjects to measure their heart beat before and right after exercise for 60 seconds. This will be done twice per subject so that the result is more valid.

Table 2: The Controlled Variables

Controlled Variable	Reason	Method
Length of exercising time.	The longer you exercise, your heart rate will increase more since there are more movements and more energy is needed.	Both activities are done for limited amount of time. 30 minutes in the case.
Physical condition of the subjects before exercise	The subjects might not work hard if they are tired and the contraction of the heart may not be as effective as usual.	All subjects should have had breakfast that morning and had enough amount of sleep the night before.
Fitness of the subjects	The ones that exercise more often will have endurance, meaning that their heart rate will not increase too much.	Choose people with the average heart rate which is from 60-80 per minute. Experienced athletes tend to have lower heart rate since they have endurance and their heart gets use to exercising. Therefore, people with similar heart rate will have similar fitness skills.
Gender of the subjects	According to the gender, the heart rate may be affected.	Test only on female subjects.

Equipment

-Stop watch to measure the 60 seconds

-Paper and pen to record the results

Procedure

1. Choose 5 people from each exercise group that matches the controlled

variables.

2. Measure 60 seconds with your stop watch while your subject measures their resting hear beat.
3. The subjects will exercise for 30 minutes.
4. Measure 60 seconds with your stop watch while your subject measures their heart beat right after exercising.
5. Steps 3 and 4 will have to be repeated once more for each exercise to obtain the sample size replicates.
6. Process the data so that it shows the percentage of heart rate increase.
   Using this formula: (changed heart rate)/(resting heart rate) X 100

When the experiments

08/10/10: first experiment on aerobics group (V)

10/10/10: first experiment on power walking group (V)

17/10/20: second experiment on power walking group (V)

19/10/10: second experiment on aerobics group (V)

RAW DATA

Table 3: The Results

Power walking and its impact on the heart rate

Person	Resting Heart Rate (beat/60 seconds)	Heart Rate After Exercise (beat/60 seconds)	Heart Rate Changed (beat/60 seconds)
1 Y.A	79	111	111-79=32
		102	102-79=23
2 J.Y	72	93	93-72=21
		88	88-72=16
3 H.T	80	113	113-80=33
		124	124-80=44
4 S.K	80	112	112-80=32
		107	107-80=27
5 A.D	68	89	89-68=21
		97	97-68=31

Aerobics and its impact on the heart rate

Person	Resting Heart Rate	Heart Rate After Exercise	Heart Rate Changed

	(beat/60 seconds)	(beat/60 seconds)	(beat/60 seconds)
1 A.D	64	72 78	72-64=8 78-64=14
2 G.K	80	96 92	96-80=16 92-80=12
3 S.D	68	76 79	76-68=8 79-68=9
4 N.Z	60	67 65	67-60=7 65-60=5
5 J.D	64	80 77	80-64=16 77-64=13

PROCESSED DATA

Sample Calculation

Here, I will choose one data to show a sample calculation. Have a look at the first data, person with the initial Y.A, in power walking. Her resting heart beat was 79 and the heart rates after exercise were 111 and 102. As shown on table 3, you just simply minus the resting heart rate from the heart rate after exercise in order to find out how much have increased. Then you divide this by the resting heart rate and multiply it by 100 to figure out the percentage of increase. This is important since it will measure how much the heart raise was able to rise in proportion to the original heart rate.

Percentage of Heart Rate Increase

= { (Heart Rate After Exercise) -(Resting Heart Rate) } / (Resting Heart Rate) X 100

So in this case it would be (111-79)/79X100=40.51(2dp) and (102-79)/79X100=29.11 (2dp). Then you would have to find the average of these two numbers in order to find the mean percentage of increase in heart rate for the person.

Mean Heart Rate Increase

= { (Percentage for first experiment)+Percentage for second experiment) } / 2

And that would be (40.51+29.11)/2=34.81. Then this kind of average of the increase in heart rate will have to be found for everyone. You can get the same results by also finding the average increase of heart rate first and then dividing that by the resting heart rate in order to find the percentage. However, I chose my way, because I

wanted to see the percentage for each time the activity was done so that I can analyze the data more thoroughly and find out some errors, if any, in the end of the experiment. Here is the table that shows the re sult of the calculations:

Table 4: Processed Data

Average Percentage of Heart Rate increase in Power Walking			
Person	**Percentage of Heart Rate increase 1**	**Percentage of Heart Rate increase 2**	**Average Percentage of Heart Rate increase**
1 Y.A	40.51	29.11	34.81
2 J.Y	29.17	22.22	25.70
3 H.T	41.25	55.00	48.16
4 S.K	40.00	33.75	36.88
5 A.D	30.88	45.59	38.24
Average Percentage of Heart Rate increase in Aerobics			
Person	**Percentage of Heart Rate increase 1**	**Percentage of Heart Rate increase 2**	**Average Percentage of Heart Rate increase**
1 A.D	12.50	21.88	17.19
2 G.K	20.00	15.00	17.50
3 S.D	11.76	13.24	12.50
4 N.Z	11.67	8.33	10.00
5 J.D	25.00	20.31	22.66

Then in the end we will have to find the mean and the standard deviation of each type of sport. This is done in order to prove whether the experiment is valid or not. For instance, if the standard deviation is high, it would mean that the data is diverse which is unreliable. Also, with standard deviation, we can compare the similarity of the two data.

Me[illegible]

= (Addition of all the average Percentage of Heart Rate increase) / (Number of Data)

So for power walking i t is: (34.81+25.70+48.16+36.88+38.24)/5= 36.76(2dp)

And for aerobics it is: (17.19+17.50+12.50+10.00+22.66)/5=15.97(2dp)

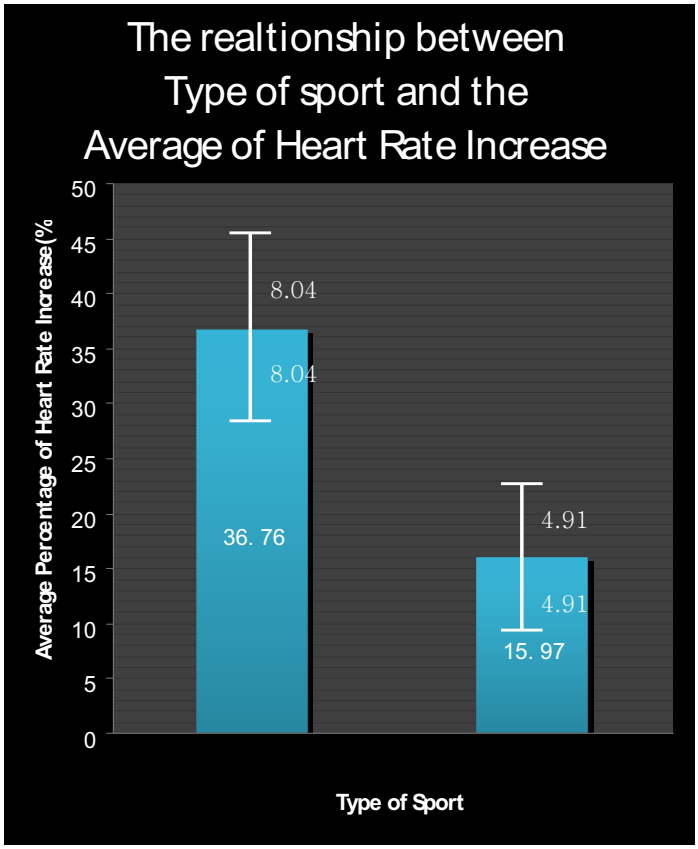
Below is the summary table of the dependent and independent variables:

Table 5: Summary Table

Power Walking	
Type of Sport	**Average of the Percentage of Increase in Heart Rate (%)**
Power Walking	36.76
Aerobics	15.97

The standard deviations for both of them are found by using the calculator. For power walking it is 8.04(2dp) and aerobics is 4.91(2dp)

Graph 1: The Relationship between Type of Sport and the Average of Heart Rate Increase



CONCLUSION

By looking at the graph, you can clearly see that power walking increases the heart rate more than twice compared to aerobics. And the error bars do not meet each other which exhibit that there is a large difference between the two data. Thus, my hypothesis was correct. Before I did not finish my experiment , I was actually not very sure about the results. Aerobics exercises "burn fat faster than any other type of exercise" and is "a type of physical exercise that integrates rhythmic aerobic exercise with stretching and strength training routines with the objective of improving all elements of fitness (flexibility, muscular strength, and cardio -vascular fitness)"[1] This means that, although power walking has more regular active movements, aerobics may need as much oxygen since it burns a lot of fat and it is also known to impulse the heart and circulatory system of the body. Yet, the result clearly indicated that power walking increased the heart rate much more. This is because power walking is a constant movement of the skeletal muscles. As mentioned earlier, skeletal muscles are the source of power for all skeletal movement in the body and " these cells are supplied with oxygen and nutrients, such as glucose or fatty acids, through the capillaries that extend directly into the muscle."[2] Compared to aerobics where there are some rest between the different exercises the muscles have to move continually which would require more energy and the movements are relatively more strenuous as well. Also, we have to take into account that the skeletal muscles are one of the organs that has the highest increase in blood flow after exercise.

EVALUATION

I believe that the research this time was valid and reasonable in the end. There were five subjects and they were all tes ted twice which made the result more reliable. And looking back at table 4 on page 5 and 6, the results are quite realistic and there are no anomalous data. However, there were some parts where improvements could have been made.

The major random errors I had was the measuring of the heart rate. I have asked my subjects to measure their heart rate after exercise. Although I did make sure that they knew how to measure it, I am not fully sure that it was accurate all the time. I was always there with a stop w atch to time them but maybe it would have been better if I took their pulse so that it is more certain.

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[1] *Aerobic*. Web. 18 Nov. 2010. <http://www.aerobic.org/>.

[2] "Skin and Muscle Blood Flow During Exercise - - World of Sports Science." *Internet FAQ Archives - Online Education - Faqs.org*. Web. 18 Nov. 2010. <http://www.faqs.org/sports-science/Sc-Sp/Skin-and-Muscle-Blood-Flow-During-Exercise.html>.

Additionally, there were some systematic errors as well. The basic outline of the experiment was quite successful but I think some of the controll ed variables were not accurate. For example, I have said that I will test with people who had break fast and enough amount of sleep but this may differ from people to people and there isn 't a fair method to measure this. When I reflect on the error bars, t he aerobic one is tolerable but the bar for power working is quite big. This basically means that the results of the subjects were diverse. I think it is because the walking paces of the people are very different. In aerobics, we all have to follow the ins tructor's movements so we put similar effort into the exercise. However, when we go power walking, some people have the tendency to walk slower than other people. The experiment would have been fairer if I had taken this to account and used people with sim ilar walking pace.

Overall, I think the experiment was a success. Since I chose a research question that I could not really guess the result, I learned a lot and it was enjoyable as well. If I have to suggest a related investigation with a different i ndependent variable, I would like to know more about how gender affects the heart rate when exercising, since it was the controlled variables that I was not sure about .