

BMI and Heart Rate

Investigation Question: How does Body Mass Index affect heart rate with respect to exercise?

Null Hypothesis: Body Mass Index has no affect on heart rate with respect to exercise

Alternate Hypothesis: If the Body Mass Index increases, then there will be a higher increase in heart rate with respect to exercise.

Independent Variable: Body Mass Index (BMI)

Dependent Variable: Percent increase of heart rate

Constants: temperature, time of jumping jacks, BMI chart, time to count heart rate

Control: Resting heart rate values

Materials: stopwatch, 20 subjects, open space, calculator, Body Mass Index chart,

Procedure:

- 1) Have subject derive their BMI with respect to their height and weight on the provided chart. Record value
- 2) Take subject's resting heart rate by counting their pulse for 10 seconds, and then multiplying by 6 for the 60 seconds in a minute. Record value
- 3) Using a stopwatch, have the subject do jumping jacks for exactly one minute
- 4) After jumping jacks, immediately take subject's heart rate by counting pulse for exactly one minute
- 5) Record value in data table
- 6) Calculate % increase of heart rate using the formula provided below. Record value in data table
- 7) Repeat process for multiple trials (20 total)

Formula for calculating percent increase of heart rate:

$$\begin{array}{r} \text{(Heart rate after jumping jacks) - (resting heart rate)} \\ \text{\% Increase} = \frac{\quad\quad\quad}{100} \times \quad\quad\quad \\ \text{\hspace{10em} (resting heart rate)} \end{array}$$

Raw Data (+1 heart rate)

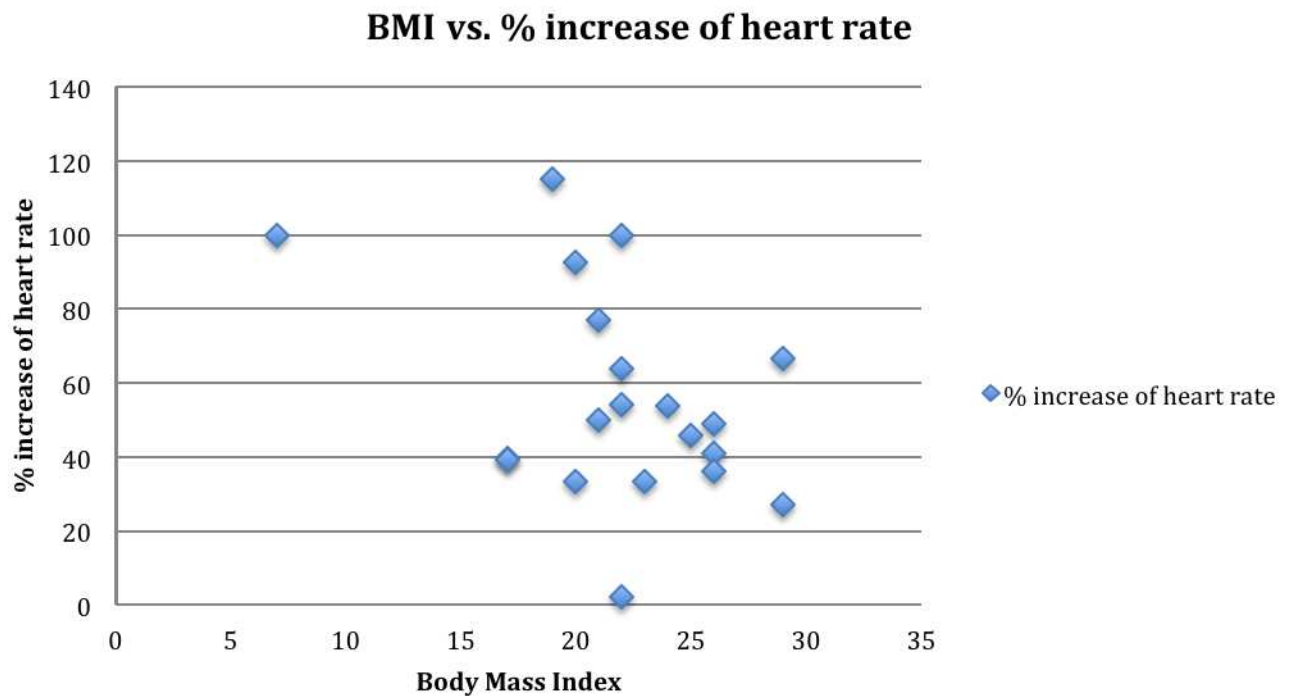
Trial	Body Mass Index	Resting Heart Rate	Heart Rate after jumping
1	20	66	127
2	19	60	129
3	22	72	118
4	26	66	93
5	21	84	126
6	29	84	140
7	24	78	120
8	22	96	98
9	22	70	140
10	21	70	124
11	17	78	109
12	23	66	88
13	20	90	120
14	26	84	125
15	29	102	140
16	25	96	140
17	27	60	120
18	26	114	155
19	22	96	148
20	17	102	142

Processed Data: (+.01%)

Trial	%Increase of heart rate
1	92.4
2	115
3	63.9
4	40.9
5	50.0
6	66.7
7	53.8
8	2.1
9	100
10	77.1
11	39.7
12	33.3
13	33.3
14	48.8
15	27.1
16	45.8
17	100
18	36.0
19	54.2
20	39.2

Body Mass Index Chart

WEIGHT lbs	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215
kgs	45.5	47.7	50.0	52.3	54.5	56.8	59.1	61.4	63.6	65.9	68.2	70.5	72.7	75.0	77.3	79.5	81.8	84.1	86.4	88.6	90.9	93.2	95.5	97.7
HEIGHT in/cm	Underweight				Healthy				Overweight				Obese				Extremely obese							
5'0" - 152.4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
5'1" - 154.9	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
5'2" - 157.4	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39
5'3" - 160.0	17	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38
5'4" - 162.5	17	18	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	31	32	33	34	35	36	37
5'5" - 165.1	16	17	18	19	20	20	21	22	23	24	25	25	26	27	28	29	30	30	31	32	33	34	35	36
5'6" - 167.6	16	17	17	18	19	20	21	21	22	23	24	25	25	26	27	28	29	29	30	31	32	33	34	35
5'7" - 170.1	15	16	17	18	18	19	20	21	22	22	23	24	25	25	26	27	28	29	29	30	31	32	33	34
5'8" - 172.7	15	16	16	17	18	19	19	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	32	33
5'9" - 175.2	14	15	16	17	17	18	19	20	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	32
5'10" - 177.8	14	15	15	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	28	28	29	30	31
5'11" - 180.3	14	14	15	16	16	17	18	18	19	20	21	21	22	23	23	24	25	25	26	27	28	28	29	30
6'0" - 182.8	13	14	14	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29
6'1" - 185.4	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28
6'2" - 187.9	12	13	14	14	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	25	25	26	27	28
6'3" - 190.5	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	27
6'4" - 193.0	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26



Conclusion:

From our processed data and graphs, it is clear that our results were in accordance with our null hypothesis; there is no correlation between BMI and heart rate. Before this experiment, we predicted that the higher the BMI, the higher the percent increase from resting heart rate to heart rate after exercise. After we finished collecting raw data from 20 subjects, we processed this data and calculated the percent increase of heart rate, and our results showed that there is no relationship between Body Mass Index and heart rate with respect to exercise. No statistical analysis was necessary due to the lack of correlation between the two variables. According to outside sources, there does in fact exist a correlation between BMI's and heart rates; higher BMI's signify unhealthiness and/or obesity, so the higher BMI's should have a higher percent increase of heart rate after exercise. This proves that there were many shortcomings in our lab, as outside

research indicates that our results should have matched our alternate hypothesis.

Evaluation/ Improvements:

The biggest reason this experiment failed to yield accurate/expected results was due to the fact that there were too many external variables that we could not control. For instance, there were many different factors affecting the subjects while we were testing them. The clothing that was worn was different for each individual and the amount of heat could have potentially interfered by increasing heart rates. Some of our subjects stated they had drunk coffee or red bull earlier in the day so due to the caffeine; their resting heart rates were abnormally high. The varying degrees of athleticism in our subject base could also skew the results for those who are often exposed to exercise experienced very minimal change in heart rate after exercise. Those who weren't fit, however, did. The speed each subject did the jumping jacks also varied between subjects, which could have lead to potentially faster heart rates in some subjects as they were doing more jumping jacks within the minute. This could be improved by setting a uniform pace for all subjects to do their jumping jacks in accordance to. The method of measuring the heart rates was also inaccurate and open to error, and some subjects were confused on how to count their own heartbeats. Other measurements, including the height and weight needed to acquire Body Mass Index numbers, were also estimated or exaggerated by some subjects. This threw off our BMI calculations, which in turn throws off our analysis of the correlation. If we were to redo this experiment, we would attempt to control all of these external factors that skewed our data. We would inform our subjects of the experiment beforehand as to minimize the number of variables that could affect heart rate (i.e. consumption of caffeine, uniform inappropriate clothing, etc.). This

will give us a more normal population to test. The method of calculating BMI would also be altered to a more accurate method by providing on the spot scales to measure height and weight. We should also alter the method for counting heart rates to a more uniform method. This could be done through the usage of heart monitors, which will provide more accurate heart rate calculations. Through better control of the external environment and outside forces, and the setting of more uniform guidelines for each subject would minimize abnormalities and inaccuracies in our data collection, which will give us better, more accurate results.