# The Effect of Different Sexes and Varying Levels of Exercise on Heart Rate in Young Adults

# Introduction

Heart rate (bpm) measures how many beats the heart produces within a minute. The beat is produced when the left ventricle contracts, pumping oxygenated blood through the body. The standard resting heart rate for a healthy adult ranges from 60-100 bmp. This number can vary based on sex, age, heart condition, drug intake, and pregnancy (Voss et al., 2015).

Heart rate(bpm) connects to aerobic fitness. Resting and active heart rate are higher in more fit athletes (Schneider et al., 2018). Regular exercise can strengthen the heart and prevent cardiovascular issues. Even low amounts of high intensity exercise can strengthen the heart (Thijssen et al., 2022).

If exercise is a sign of fitness, then there will be a difference in the change in heart rate from people who get low levels of exercise to people who get high levels of exercise. People who get high levels of exercise will have less of an increase in heart rate after exercise than people who get low levels of exercise.

There is a slight difference between the heart rate of males and females however, the variation is often minimal. Healthy adult males often had a heart rate between 50 and 80bpm while females are between 53 and 82bpm (Quer et al., 2020).

If birth sex does not have much affect on heart rate then the average heart rate of males and females will be similar before and after exercise. Females will have a slightly higher resting and active heart rate then males but it will not be a large difference. The change in heart rate should be consistent for both sexes.

# Methods

A total of 47 students participated in this experiment, 35 females and 12 males with ages ranging from 17 to 22. Of the 35 females, 10 were listed as having high levels of physical activity, 11 as medium, and 14 as low. Of the 12 males, six were listed as having high levels of physical activity, one as medium, and five as low.

Resting heart rate was recorded by a pulse oximeter or by hand. The oximeter was placed on the index or middle finger and counted the beats. To measure heart rate by hand two fingers were placed on the cardioid artery, on the neck, or the radial artery, on the wrist, and beats were counted for one minute. Fifteen minutes of high intensity exercise was performed. Most common form of exercise was going up and down the stairs in Lillard (32 students) and running (5 students). Ten student preformed various other forms of exercise. Students noted their birth sex and their level of physical activity with their heart rate data. Change in heart rate was calculated from the data by subtracting resting heart rate from active heart rate.

# Results

Heart rate spiked immediately after activity and slowly decreased over time. For all groups it took an average of 6.4 minutes for heart rate to return to resting. People who got high levels of physical activity had the largest change in heart rate from resting to active. People who got low levels of activity have the least change in heart rate from resting to active. (Figure 1). Change in heart rate decreased at a linear rate to level of physical activity. People who got medium levels of physical activity had the most varied resting heart rates and a median average change in heart rate.

The average male resting heart rate was slightly higher than the average female resting heart rate. The average female active heart rate was slightly higher than the average male active heart rate. (Figure 2). Change in heart rate was similar for both genders with females having an average change of 44bpm and males having an average change of 42bpm.

**Figure 1 Change in heart rate of people with different levels of regular physical activity.** High activity: 45 or more minutes five or more days per week, dark blue. Medium activity: 45 or more minutes three to four days a week, blue. Low activity: 45 or more minutes two or less days a week, light blue. Sixteen people had high levels of physical activity. Average change in heart rate was 51.4bpm. Twelve people had medium levels of physical activity. Average change in heart rate ranged was 30.4bpm. Nineteen people got low levels of exercise. Average change in heart rate was 36.7bpm.

**Figure 2 Average Heart rate of males and females before and after exercise.** Blue represents females and orange represents males. There were a total of 35 females with an average resting heart rate of 70.8 bpm and an average active heart rate of 126.1 bpm. There were a total of 12 males with an average resting heart rate of 85.2bpm and an average active heart rate of 99.4bpm.

# Conclusions

The first hypothesis was not supported as people who got high levels of exercise had the largest change in heart rate and people who got low levels of excessive had the lowest change in heart rate. The prediction was backwards to the results. The differences in heart rate between all three groups were minimal. The second hypothesis was supported because there was very minimal difference between the change in heart rate of males and females. The predictions were slightly supported as there was minimal difference between the average heart rates of males and females however the average male resting heart rate was actually slightly higher than the average female resting heart rate.

A future hypothesis to test may be: If sex has a minimal impact on heart rate, then is it caused by hormonal differences in males and females. (Quer et al., 2022). It would also be interesting to use body mass index (BMI) Instead of relative level of physical activity since BMI can be a better indicator of health. The small differences the changing heart rate shows that there is not much impact on heart rate by fitness or biological sex so theoretically neither should have an impact on cardiovascular health.

A larger sample size may be beneficial for yielding better results If this experiment were to be repeated. Heart rate is also relative to oxygen intake which may have been a source of variation in this experiment. Results can also be skewed by short-term health improvements (Schneider et al., 2018). So noting how long people have consistently gotten recorded levels of exercise may impact results. Type of exercise should also be kept consistent, and time of exercise should be monitored.

# References

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