# The Impact of Birth Sex and Activity Level on Resting and Active Heart Rate

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pumped when no activity is being performed) and active (its pace during and after exercise) can indicator an individual's state of health. These diferent rates will be examined under multiple conditions in this lab.

The impact of birth sex and activity level on heart rate were the conditions examined during this lab. Starting with birth sex, after puberty, there is a 15-30% increase in heart mass in males, meaning that a male's heart is typically larger than a female's (National Heart, Lung, and Blood Institute, 2022). The average male adult heart rate is between 70 to 72 BPM, while the average for a female adult is 78 to 82 BPM (National Heart, Lung, and Blood Institute, 2022). This diference can be accounted for by the size discrepancy between male and female hearts. The smaller female heart pumps less blood with each beat when compared to a male's, meaning that it needs to beat at a faster rate to match the male heart's output. Both male and female hearts improve in strength with repeated moderate and vigorous activity (Prabhavathi et al., 2014). As a result, athletes typically have a lower resting heart rate (Prabhavathi et al., 2014). In other words, fewer beats are required to supply the same amount of blood as a non-athlete. A non-athlete therefore will have a fast heart rate to meet the same demands of the body.

## **Hypothesis and Predictions**

A person's exercise level will have an impact on heart rate before and after engaging in aerobic activity such as jumping jacks or running around. Those who have a high level of physical activity will have a lower heart rate than those with a moderate and low level of physical activity. This is because exercise strengthens the heart muscle, so more blood will be pumped per beat (Prabhavathi et al., 2014). Thus, fewer beats will be needed in a person who exercises frequently to meet the oxygen and nutrient demands of the body. I predict that if the heart rates of a group of people who exercise frequently (high exercise group), exercise moderately (medium exercise group), and do not exercise frequently (low exercise group), then the order of highest to lowest heart rate will be low exercise group, medium exercise group, and high exercise group. Exercise, therefore, has an inverse relationship with heart rate—more exercise means lower heart rate.

Birth sex will also have an impact on heart rate. Females will have a higher resting heart rate than males due to their hearts being smaller on average (National Heart, Lung, and Blood Institute, 2022). More beats will be needed to pump the same amount of blood as a male's heart. Since less blood will be pumped with each beat, I predict that if the resting heart rates of males and females are compared, then females will have a higher resting heart rate. Heart size, in other words, has an impact on heart rate, with a larger size equating to a slower heart rate.

### Methods

A pulse oximeter was used to record blood oxygen levels in SpO2 and heart rate in beats per minute (BPM). Heart rate was taken before starting the aerobic activity as the recording for resting heart rate, and was taken 0 minutes after completing the activity, right after completing the activity, 1 minute after, 3 minutes after, 5 minutes after, 10 minutes after, and fnally, 15 minutes after. However, before engaging in this activity, participants frst grouped themselves according to exercise levels and recorded their birth sex. The different groups for exercise level were high, meaning the person exercises at least 5 times a week for 45 minutes, medium, meaning the person exercises between 3 to 4 times a week for 45 minutes, and low, meaning the person exercises between 3 to 4 times a week for 45 minutes. Participants also chose a specific type of aerobic activity, some options, for example, being jumping jacks, running around, cycling, or pushups. Out of all 50 participants, 17 were male and 33 were female. 4 males recorded a low exercise level, 5 a medium, and 7 a high. Participants were college-aged students from 17 to 20 years old.

#### Results



**Figure 1.** Changes in heart rate in BPM over the course of 15 minutes. Resting heart rate refers to heart rate before exercise and 0 minutes is immediately following the exercise. The line graph shows that people with a high exercise level have a lower heart rate at almost all points before and after completing an exercise. The only point where the high exercise group did not have the lowest heart rate was at 1 minute after completing the exercise. Overall, the trend of the low exercise group having the highest heart rate, followed by the medium exercise group, and then the high exercise group was displayed in ,  $\rightarrow D$  f i j fa

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Average resting heart rate in males vs. females in BPM with group ings based on activity level. The bar graph shows that females with a low exercise level have a higher resting heart rate than males, but males with a medium exercise level have a higher resting heart rate than females with a medium exercise level. In the high exercise level group, females have a higher heart rate than males. Data relates to the second hypothesis and prediction.



Figure 3. Average resting heart rate in males vs. females in BPM without taking exercise levels into account. The bar graph shows that when average the resting heart rates of males and females across all exercise groups, females, on average, have a higher resting heart rate than males. Data relates to the second hypothesis and prediction.

### Discussion

The frst hypothesis