LABORATORY 11 – CARDIOVASCULAR MEASUREMENTS

Purpose

This lab measured the effects of postural change and exercise on these cardiovascular parameters using several different types of equipment. A method of determining the physical fitness of an individual is demonstrated.

Procedure

11-A: Determination of blood pressure

Blood pressure (BP) generally refers to the pressure of blood that is applied to the arterial walls. Systolic, the highest, blood pressure results when the ventricles contract. Diastolic, the lowest, blood pressure results when the ventricles relax. Blood pressure is normally expressed as systole over diastole and in millimeters of mercury (e.g. 120 mmHg/ 80 mmHg). Pulse pressure is the difference between systolic and diastolic blood pressures. Hypertension, high blood pressure, may affect both systolic and diastolic measurements. Hypertension may result in vascular damage and is especially dangerous

when it affects diastolic blood pressure.

Blood pressure is measured with a sphygmomanometer. These devices are of three general types: aneroid sphygmomanometers measure pressure by displacing a spring, mercurial sphygmomanometers by displacing a column of mercury, and electronic sphygmomanometers by increasing electrical resistance.

Procedure

1. Wrap the pressure cuff of the sphygmomanometer snugly around the upper left arm of
your lab partner. Your lab partner should assume a relaxed, sitting or supine position.
2. Place the stethoscope securely over the brachial artery. Close the pressure valve and begin pumping up the rubber ball.
3. You will begin to hear the arterial pulse as you pass the diastolic pressure. Continue pumping until the pulse is not heard, approximately 10 mmHg above your partner's normal systolic pressure. The brachial artery is now totally occluded.
4. Slowly open the pressure valve and listen for the pulse sounds to reappear as the pressure drops. These are known as Korotkoff sounds.
5. The first sound heard signals the systolic BP. Record this value from the scale.
6. The sound will become louder as the pressure drops until it finally starts to become muffled. Record the pressure at which the sound vanishes. This signals the diastolic BP. Record your blood pressure as systole/diastole
7. Alternate with your lab partner and repeat these procedures.
8. Next, measure the BP of each of you immediately upon standing. (NOTE: be sure to have
your cuff inflated prior to standing, so that you can begin to release pressure immediately upon standing.)
9. Lastly, measure the BP three minutes after standing. Record these values for your use
and on the chalkboard.
10. Discuss the orthostatic response in terms of the receptors used and the effects of

postural change. Include any limitations to obtaining reliable results.

11-B: Demonstration of a measure of physical fitness

A general measure of physical fitness is the ability to resume a normal resting pulse rate shortly after a brief period of exercise. One is considered to be less fit if increased periods of time are required to regain the resting pulse rate. Fitness may be considered a function of the degree to which the cardiovascular system has been developed. Fitness may be measured in a number of standardized tests, however we will be measuring the changes in heart rate as it relates to activity and participant's age. We will monitor the change in pulse rate that occurs when a resting student exercises and, then, attempts to return to a resting pulse rate. We will compare these changes in heart rates between students who exercise regularly and students who do not, and determine the target heart rate range for exercise for these students.

Procedure

1. Select three students who exercise regularly and three students who do not. Each student will take his/her resting pulse rate for one minute and record this value.
2. Each student will then run the track twice at a fast but comfortable pace.
3. Immediately upon returning to the laboratory, each student will record his/her pulse after exercise.
4. Each student will take his/her pulse at one minute intervals until the resting pulse is reestablished. (NOTE: The best method to employ is to take the pulse rate for 15 seconds and multiply by 4.)
5. These results will be recorded on the chalkboard for discussion. Is there a difference between the exercisers and the non-exercisers? Which student(s) do you consider to be

in better physical condition? Why?

6. Determine the target heart rate range for each student (if the ages are available) and for yourself. The target heart rate range determines the heart rate that should be maintained for 20-30 minutes, at least 3 times per week for cardiovascular fitness. To determine your target heart rate range do the following calculations for the Karvonen formula (only use numbers rounded off to whole numbers):

a. 220 – your age = maximum heart rate (max HR)

b. Max HR – resting HR = HR reserve

(to find your resting heart rate, take your pulse before getting out of bed each morning for three days and then take the average)

c. target heart rate range =

(HR reserve x 60%) + resting HR = low target heart rate

(HR reserve x 80%) + resting HR = high target heart rate

Example: 20 year old with a resting heart rate of 65 beats per minute

220 – 20 = 200 (max HR)

200 – 65 = 135 (HR reserve)

(135 x 60%) + 65 = 81 + 65 =146

(135 x 80%) + 65 = 108 + 65 = 173

This student's target heart rate range would be 146 – 173 beats per minute.

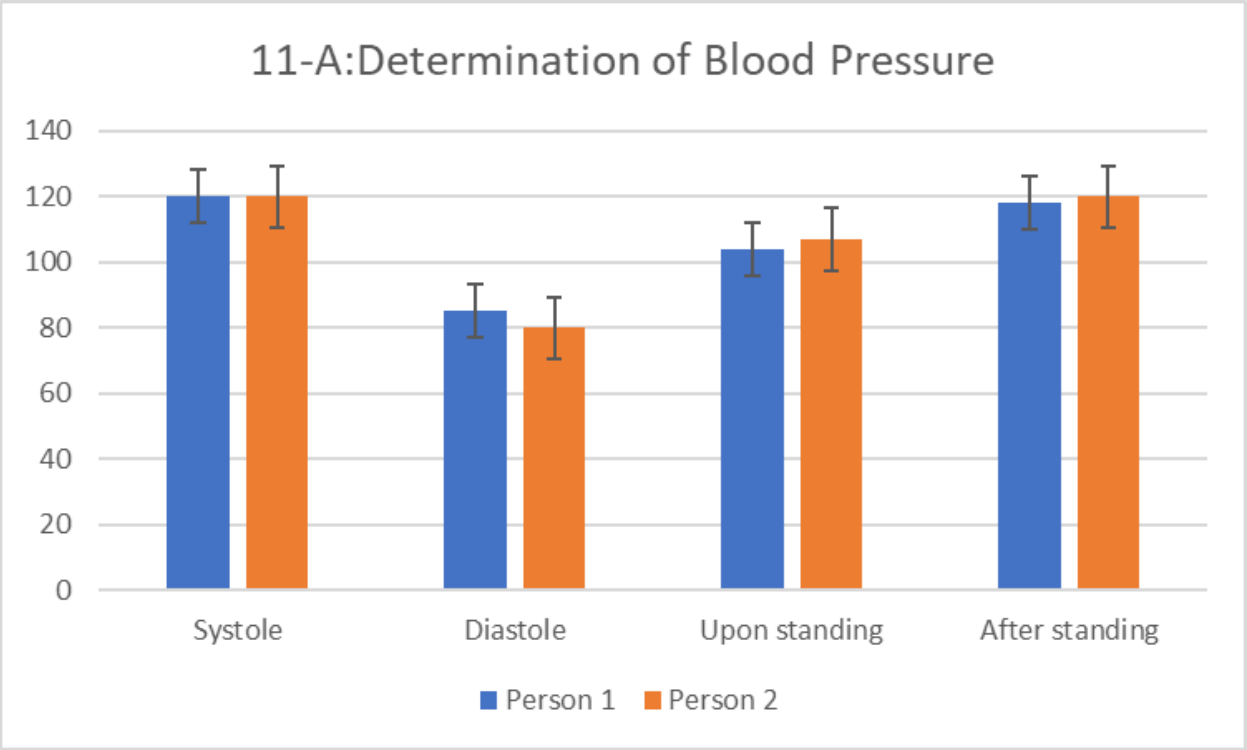
7. Include your calculations for your target heart rate in the results section of your report.

8. Evaluate the class results in terms of target heart rate and level of fitness for each individual.

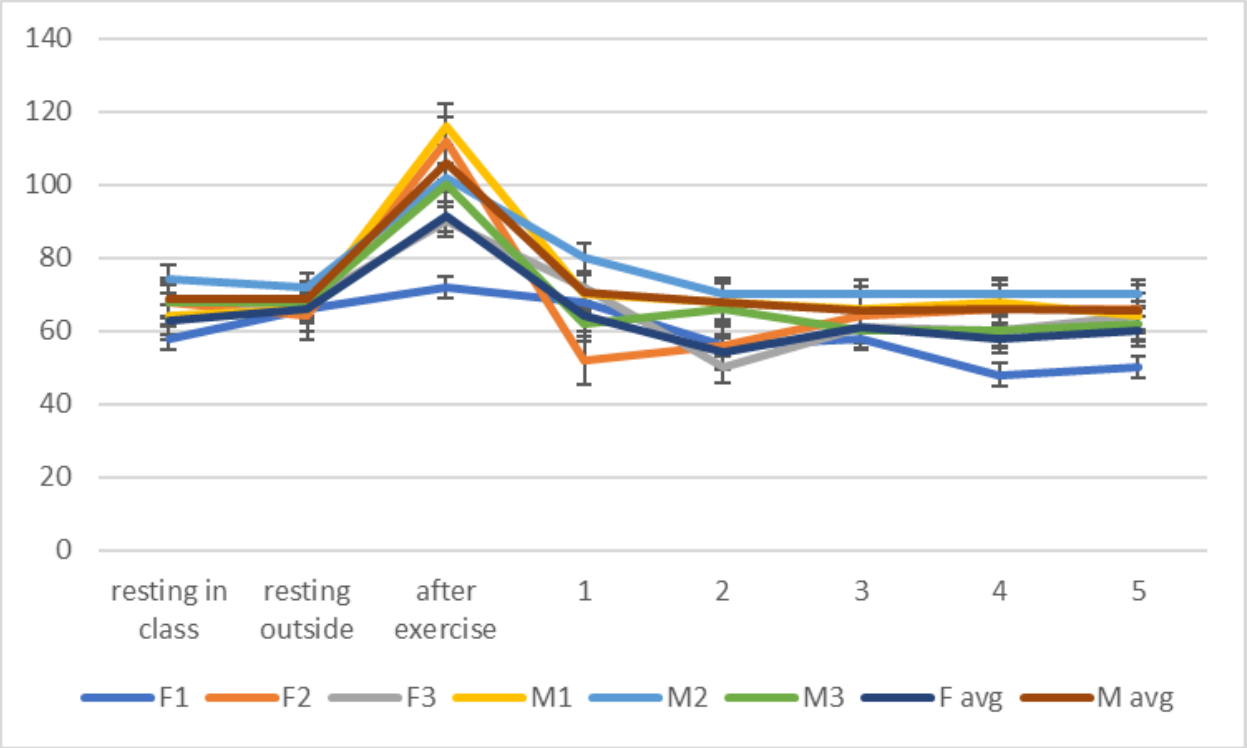
Results

11-A:Determination of Blood Pressure

11-A	Systole	Diastole	Upon standing	After standing
Person 1	120	85	104	118
Person 2	120	80	107	120



11-B:Determination of a measure of physical fitness



Discussion

In this lab, we measured both blood pressure by using a sphygmomanometer and the measure of physical fitness by determining heart rate after exercise. For blood pressure, it appeared that there is a higher blood pressure when you are in a systole state and a lower blood pressure when you're in a diastole state. With the physical fitness experiment. There were three girls and three guys that were chosen to exercise for a short amount of time and then check their heart rate each time after finding their heart rate while resting in class and resting outside. It was found that the males usually have higher heart rates than females. This is because men typically have larger hearts and have a greater stroke volume, higher levels of testosterone and higher hemoglobin levels. Fitness levels can also be a factor since individuals with higher fitness levels often exhibit lower resting heart rates and a more efficient cardiovascular response to

physical activity. While the results provide valuable insights, it's essential to recognize the limitations of our study, including a relatively small sample size and the influence of other lifestyle factors. Future research could explore these aspects more comprehensively to refine our understanding of the intricate interplay between physical fitness and blood pressure regulation. Overall, this study contributes to the growing body of knowledge promoting the adoption of a physically active lifestyle for the promotion of cardiovascular well-being.

Conclusion

In conclusion, our exploration of cardiovascular measurements provided valuable insights into the body's cardiovascular responses to varying levels of physical exertion. Understanding these physiological responses is critical not only for exercise physiology but also for clinical applications, helping to assess cardiovascular health and design targeted interventions. As with any study, there are limitations, including the scope of activities examined and individual variations. Future research could expand on these findings by exploring a broader range of exercise intensities and incorporating diverse participant demographics. Overall, this study contributes to the foundation of knowledge surrounding cardiovascular function and lays the groundwork for further inquiries into optimizing health and performance through a nuanced understanding of cardiovascular measurements.