Resting & Exercise Measures of Cardiovascular Function (20 points)

Introduction

Heart rate (HR) is an easy way to measure an individual's cardiac function and estimate fitness level. The more efficient the cardiovascular system is the lower the HR will be and the greater the stroke volume (amount of blood ejected by the heart with each beat). HR increases proportionally with the workload (up to maximum levels where HR plateaus – "steady state"). In terms of exercise prescription, it is critical to understand that a linear relationship exists between HR and exercise intensity.

Statement of the Objectives

1. To determine maximal HR and calculate HR intensity zones
2. To practice palpation measures of HR.
3. To become familiar with HR responses to two different bouts of aerobic exercise.
4. To understand the influence of various physiological and environmental factors.
5. Understand the concept of 'steady state' and its application to common exercise tasks.

Methods

- This lab will be conducted in a group (Instructor will make final decision) and you will have to utilize the Student Recreation Center to complete this lab. At least 50% of your group MUST serve as subjects for this laboratory experience.
- All exercises can be done on any cardiovascular exercise machine (treadmill, elliptical, upright bike, etc.) that has a metal electro pad. These devices record HR. You are responsible for recording **ALL** your data during your exercise intensity workloads. (Can record data however you like)
- Before exercising, determine you're resting HR (see page 3). Choose which subject will be going first. Position subject on exercise machine and record HR by placing hands on the metal electro pad before initializing exercise. The low workload intensity will be performed first by the subject. Instruct the subject to begin exercise. Each exercising workload should last 10-minutes in length. Be sure to record the device used and other pertinent data (for example: Treadmill exercise low workload 3.5 miles/hour)

- Every minute, measure the subjects HR by use of the metal electro pad. Have your partner record your HR on your personal data sheet. At the end of the 10-minute exercise period, stop exercise. Subject should perform a 5-10 minute cool down exercise. Measure recovery HR by use of the metal electro pad for each minute of the post-exercise period. Proceed to the next condition (high power output) when HR is ± 10-15 beats/min from resting HR.

Calculating your Heart Rate

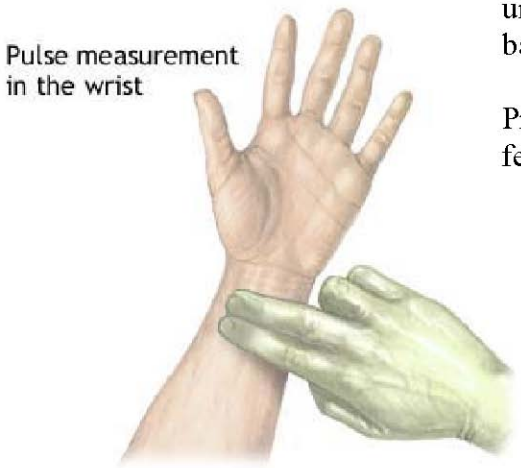
Taking your carotid pulse

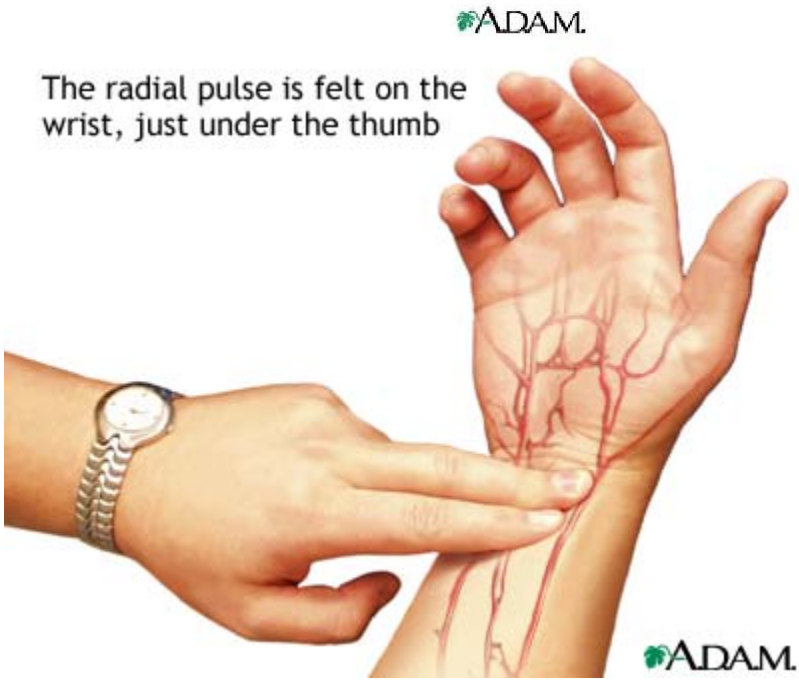
The carotid arteries take oxygenated blood from the heart to the brain. The pulse from the carotids may be felt on either side of the front of the neck just below the angle of the jaw. This rhythmic "beat" is caused by varying volumes of blood being pushed out of the heart toward the extremities.

Wrist pulse/Radial pulse

To measure the pulse at the wrist, place the index and middle finger over the underside of the opposite wrist, below the base of the thumb.

Press firmly with flat fingers until you feel the pulse in the radial artery.





Arteries carry oxygenated blood away from the heart to the tissues of the body; veins carry blood depleted of oxygen from the same tissues back to the heart. The arteries are the vessels with the "pulse", a rhythmic pushing of the blood in the heart followed by a refilling of the heart chamber. To determine heart rate, one feels the beats at a pulse point like the inside of the wrist for **15 seconds**, and **multiplies this number by 4**. This is the per-minute total.

***My Resting HR = ____ beats in 15 seconds x 4 = _____ Resting HR ***

Your exercise HR range

Estimate your maximum HR.

Take 220 - age = _____ (this is your maximum)
(Standard deviation for this equation is 10-12 beats per min)

Determine your lower-limit (50%) exercise HR by multiplying your maximum heart rate by 0.5

Age HR_{max} _____ x 0.5 = _____ beats/min

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Determine your upper-limit (90%) exercise HR by multiplying your maximum heart rate by 0.9

Age HR_{max} _____ x 0.9 = _____ beats/min

Your exercise HR range is between your upper & lower limits.

For most people, exercising at the lower end of the exercise HR range for a longer time is better than exercising at the higher end of the range for a shorter time. Exercising at the lower intensity will improve your overall fitness. Medications for high blood pressure may affect your HR during exercise. Consult your physician to determine your own ideal HR.
www.acsm.org

Calculate these HR Training Intensities

Age HR_{max} _____ x 0.6 = _____ beats/min
Age HR_{max} _____ x 0.65 = _____ beats/min
Age HR_{max} _____ x 0.7 = _____ beats/min
Age HR_{max} _____ x 0.75 = _____ beats/min
Age HR_{max} _____ x 0.8 = _____ beats/min
Age HR_{max} _____ x 0.85 = _____ beats/min

Do you see a pattern here?

Now,

Calculate the following HR Training Intensities

Light (35% to 59% of HR_{max}) = _____beats/min to _____beats/min

Moderate (60% to 75% of HR_{max}) = _____beats/min to_____beats/min

Heavy (75 - 89% of HR_{max}) = _____beats/min to _____beats/min

Very Heavy (≥90% of Age predicted HR_{max}) = _____beats/min

Below is what needs to be included within your lab report.

Due Date: Tuesday October 1, 2013 at the beginning of class.

Results

Graphs

1) Plot HR vs. Time for the Low workload.
2) Plot HR vs. Time for the High workload. Please be creative.

Explain: What was the subjects HR intensity for each exercise workload (low vs. high)?

Discussion Questions

Did the physiological responses reach a steady state during the low intensity or high intensity workload during cardiovascular exercise? If not, which power output did not reach a steady state? What are some reasons why this may have occurred? Hint: define 'steady state!'

Which energy fuel substrate is being utilized during rest and during each test condition? Why?

Which method to determine your HR (palpation or metal electro pad) displays a more accurate result? If they are different, what may be the cause of this? Explain.

How might certain environmental variables affect your HR response during exercise at either intensity? Explain.

References:

American College of Sports Medicine (2010). ACSM's guidelines for exercise testing and prescription: 6th Ed. Lippincott Williams & Wilkin: Philadelphia.

Brooks, G.A., Fahey, T.D., White, T.P., Baldwin, K.M. (2000) Exercise Physiology: Human Bioenergetics and Its Applications: 3rd Ed. McGraw-Hill: New York.

Powers, S.K. & Howley, E.T. (2009). Exercise Physiology: 7th Edition. WCB McGraw-Hill: Boston, MA.

LABORATORY REPORT FORMAT
Total Points = 20

TITLE PAGE

- Name of Laboratory
- Team Name and members

INTRODUCTION (2 pts)

- Statement of purpose (expanded somewhat from the handout)
- Relevance of the lab in regards to health/fitness (1/2 page maximum)

METHODS (6 pts)

- Describe the experimental protocol used; emphasize deviations from what was printed on the handout; expand on some procedures, which are not fully explained on the handout.

RESULTS (6 pts)

- See previous page.
- Visual interpretation of the collected data is very important, line-graph, bar chart, scatter-plot, etc. See Microsoft Excel.
- Not tables of data; just summaries of those tables with means $\pm$ SD (if asked for) – this applies to the condition when there are subjects involved; if only 1 is involved include all the data in the results section, otherwise in appendix at the end of the lab report.
- It is appropriate to comment on the data in this section (e.g. the graph shows that the HR increased over time…)

DISCUSSION (6 pts)

- Questions from the previous page can be listed and answered in this section.
- References are provided to "guide" the discussion and in most cases try to relate the lab findings to literature findings this is the purpose of the DISCUSSION section ➔ use the references provided, or find your own. Also use your textbook! BUT make sure that you cite all references

REFERENCES (as needed)

APPENDIX (if applicable)

- Tables of raw data

NOTES: All laboratory reports should be organized and neat! This will be strictly enforced! Laboratory reports should be typed using 12-point font and double-spaced.