Exercise Protocol: Lactate Threshold

Appropriate Applications

There are multiple reasons why the lactate threshold might want to be determined. Identification of the lactate threshold is the best predictor of performance over a range of endurance distances. Furthermore, training causes a shift in the exercise intensity at which the lactate threshold occurs, thus this test can be used to monitor training /detraining progression. In addition, laboratory protocols may use an exercise intensity based that is relative to above or below the lactate threshold.

Test Description

Briefly, the subject will perform a series of incremental exercise bouts during which ~50 μL of blood from a finger stick is analyzed for lactate concentration at the end of each bout. As exercise intensity increases, blood lactate concentration increases in a curvilinear fashion, and the intent of this test is to identify the workload at which blood lactate concentration begins rising exponentially. A brief (5-10 minutes) warm-up and cool-down are performed before and after a test. The initial bout begins at a very low intensity, which progresses to a near-maximal intensity. Each bout is usually 3-5 minutes in length, and depending upon the exercise mode, may be continuous or discontinuous. During treadmill testing, subjects must be stopped in order to sample blood (a discontinuous protocol); with cycling protocols, however, blood can be sampled while a subject is exercising, thus the bouts could be continuous. The number of bouts varies, but usually 5-8 bouts are performed.

Blood is sampled from a finger stick that has been cleaned with an alcohol swab. After allowing the finger to dry, a fingertip is lanced and the blood collected in one or two 50 μL heparin-coated capillary tubes. The blood is transferred via a pipette to a lactate analyzer for determination of lactate concentration. Sterile gauze is applied to the fingertip, and the subject instructed to maintain pressure for several minutes. As multiple samples are required for this test, for subsequent samples, the fingertip is squeezed to determine whether blood can still be sampled from the same stick, and if so, reduces the number of finger sticks that must be performed. Otherwise, additional finger sticks are performed on another site of the same finger or a different finger depending upon the subject's preferences. Total blood drawn during this test is less than 0.5 mL.

Training/Supervision Needed

Graduate students in the M.S. program in Exercise Physiology take coursework and have lab experiences to prepare them for these assessments.

Risks

The risk of a cardiac event is lower than it would be for maximal testing, however, the exact risk is not known. Any exercise bout may produce light-headedness, fatigue, possibly nausea, and delayed-onset muscle soreness. These side effects are usually minimized in fit subjects. They are also minimized by having a gradual warm-up as well as cool-down (at least 5 minutes each) and by having the subject refrain from eating for at least 2-3 hours before their test.

Under normal conditions, there are minimal risks to the subject when performing finger sticks that include: bruising; light-headedness or dizziness due to fear of needles; and infection.

Risk Management

Lactate threshold assessments are conducted in the Exercise Physiology Laboratory (ENS 255) and Annex Exercise Physiology Laboratory (ENS 111) at SDSU and in the Fitness Lab at 9245 Sky Park Court. Subjects who meet specific study criteria and who do not report cardiovascular disease or its symptomology, as screened with the Physical Activity Readiness Questionnaire (PAR-Q), will undergo an incremental exercise test on a selected ergometer (treadmill, cycle, rowing machine, hand-crank cycle). Mild exercise is used to warm-up and cool-down before and after exercise, which minimizes the risk of injury or a cardiac event from the exercise.

Whenever blood is drawn, there is a small risk of bruising. Although infection is a risk with finger sticks, this is minimized by use of alcohol to cleanse the area for the blood draw. Latex gloves are worn by the technician at all times, and all contaminated materials are deposited in a biohazard container, in accordance with the bloodborne pathogens standard of OSHA. In the case of individuals with a latex allergy, the laboratories have non-latex gloves available for use.

Potential Benefits

If the intent of the test were to determine fitness level or predict endurance performance, this test would provide extremely valuable information to the subject. However, if the test were used to determine exercise intensity of another exercise protocol, results of this test would likely be of little interest to the subject.

Consent Content “What Will Happen in this Research” section

You will first perform a 5-minute standardized warm-up at a low intensity. Afterwards, you will perform several bouts of (treadmill or cycling) exercise, which increase in intensity. Each intensity will be 3-5 minutes in length; the entire test will contain five to eight stages. After each exercise bout, a small amount of blood will be sampled from a finger stick. Prior to the finger stick, the fingertip will be cleaned with an alcohol swab. The amount of blood drawn will be equivalent to only a few drops, and the total volume of blood taken will be less than a teaspoon.

Consent Content “What are the Risks or Discomforts Involved in the Research?” section

Procedures that require blood samples to be collected have the risk of soreness, bruising and/or swelling at the collection site. Prior to each finger stick, the area will be cleaned with an alcohol swab. After the stick, you will be instructed to maintain slight pressure on the area to minimize additional bleeding.