DATA SET 2
EXPLORE 1C LESSON 18

Study 1

Lactate and H+ effluxes from human skeletal muscles during intense, dynamic exercise

Publish Date: March 1993
Journal: Journal of Physiology
Authors: Bangsbo J, Johansen L, Graham T, Saltin B.
Link: https://doi.org/10.1113%2Fjphysiol.1993.sp019546

Overview of the Study

The aim of the study was to examine changes in blood lactate and in lactate in skeletal muscles during varying intensities of exercise and during recovery. Lactate is a small molecule that, like glucose, can be a source of energy for muscle and other cells in the body. To study these changes, scientists recruited six male subjects in their young to mid-20s with similar fitness levels. All the subjects consistently worked out, but none of them trained for competition.

A one-legged exercise that isolated the quadriceps muscle was used for all exercise trials. All participants were able to practice and were familiar with the exercise before any trials started. Catheters for blood samples and temperature readings were placed where arterial blood entered the muscle and where the venous blood exited the muscle.

Participants were randomly assigned which leg would be used for all movement throughout the trial. After a light warmup, all participants completed the following exercise protocol: 10 minutes of moderate-intensity exercise with the active leg, 10 minute recovery period, seven bouts of 15-second high-intensity intervals with the active leg, five additional minutes of recovery, and finally, another ten minutes of moderate-intensity exercise with the active leg. Blood samples were collected every 2-10 minutes throughout the exercise protocol. Lactate in blood samples was measured using a fluorometric assay.

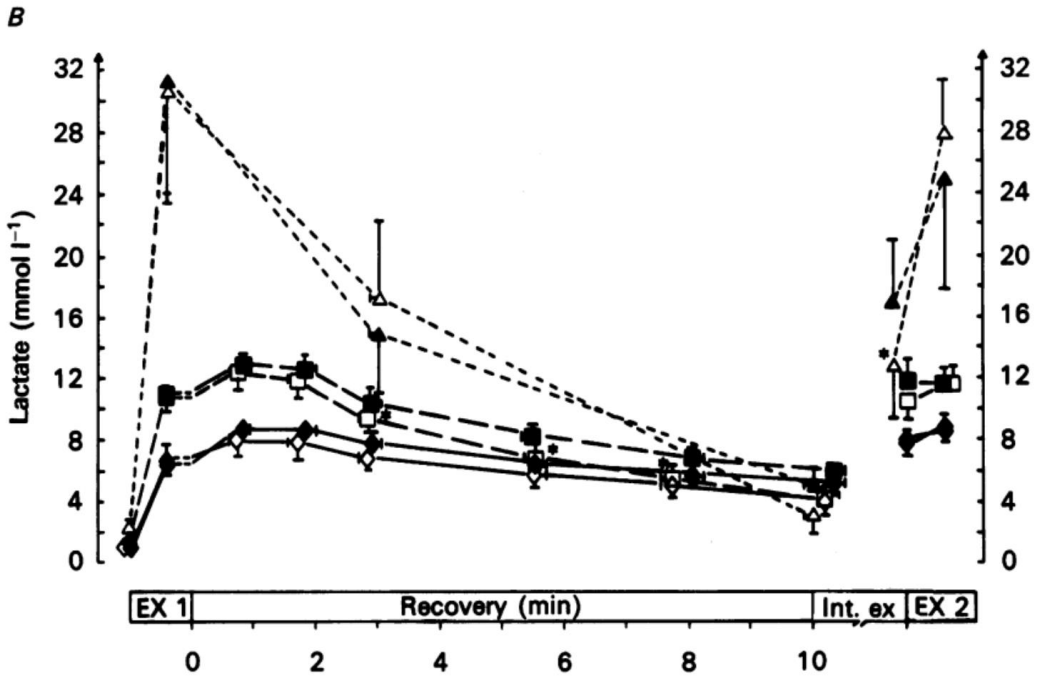

Figure 1 Lactate responses during exercise and recovery. (Int. ex., intermittent exercise). Femoral arterial (diamonds) and venous (squares) plasma lactate concentrations and intracellular muscle lactate concentrations (triangles). *Significant difference ($P<0.05$) between P-leg and A-leg**.**

Study 2

The effect of exercise intensity on skeletal muscle stress kinase and insulin protein signaling

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Journal: PLoS ONE
Authors: Parker L, Trewin A, Levinger I, Shaw CS, Stepto NK
Link: https://doi.org/10.1371/journal.pone.0171613

Overview of the Study

Scientists set out to determine how blood lactate levels changed over time in a sample of 8 "recreationally active" adults. They selected people with approximately the same fitness levels, weights, and BMIs. Two were female, and four were male.

On three separate occasions, participants reported to the laboratory in the morning after an overnight fast. A resting muscle biopsy and venous blood sample were taken prior to participants undergoing their randomized exercise protocol (SIE, HIIE, or CMIE). Immediately following the acute session of exercise, a muscle biopsy and venous blood sample were taken, and participants rested on a bed for three hours. A third muscle biopsy was taken 3 hours after exercise, and venous blood samples were taken in the middle of the exercise session, immediately after exercise, and 10 minutes, 30 minutes, 1 hour, 2 hours, and 3 hours after exercise.

Each participant completed three total workouts, including CMIE (continuous moderate-intensity exercise), HIIE (high-intensity interval exercise), and SIE (sprint interval exercise). The workouts were separated by about a week for recovery. Researchers collected blood samples prior to exercise on each workout day. Blood samples were also taken in the middle of the exercise session, immediately after, and 10 min, 30 min, 1 hour, 2 hours, and 3 hours after exercise. The levels of lactate were measured in each of the blood samples collected.

All exercise sessions were performed on a Velotron cycle ergometer. The SIE protocol consisted of 4 x 30-second all-out cycling sprints interspersed with 4.5-minute passive recovery periods. The HIIE protocol consisted of 5 x 4-minute cycling bouts at 75% of max effort, interspersed with 1-minute passive recovery periods. The CMIE protocol consisted of continuous cycling for 30 minutes at 50% of max effort, equating to the same total work performed (294 ± 23 kJ) in the HIIE protocol. Venous blood was collected from an antecubital vein via an intravenous cannula and analyzed immediately for lactate using an automated analysis system.

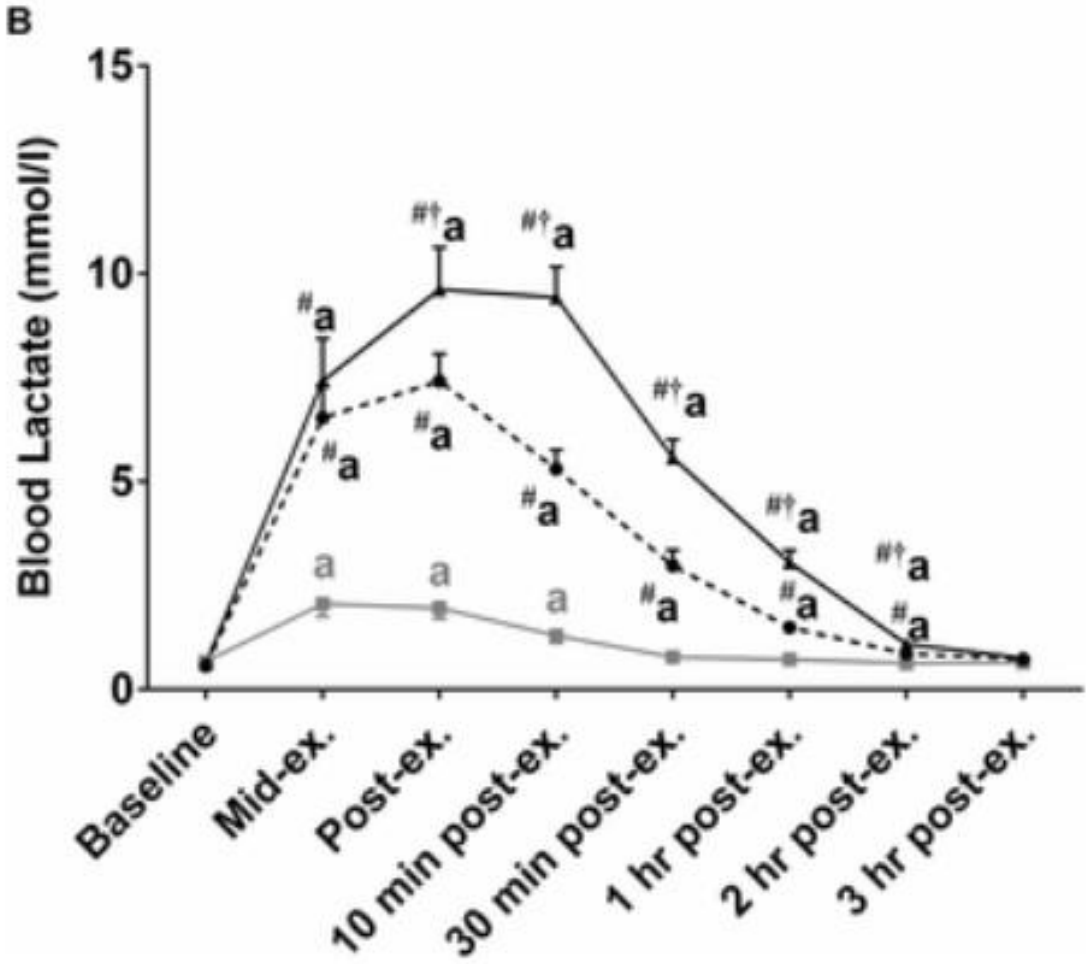

Figure 2: Blood lactate response to high-intensity interval exercise (HIIE, circles), sprint-interval exercise (SIE, triangles), and continuous moderate-intensity exercise (CMIE, squares). a = $p < 0.05$ compared to baseline. Significantly different ($p < 0.05$) at equivalent time point vs # = CMIE and † = HIIE