Effect of a Lactate-Guided Conditioning Program on Fitness Markers in the Equine Athlete

A.L. Fisher, H.M. Greene MS, R.J. Talmadge PhD, Y.S. Nout DVM, PhD
Equine Research Center
Department of Biological Sciences, College of Science
California State Polytechnic University, Pomona

Introduction
Blood lactate concentration ([LA]) is used to evaluate the level of fitness in the equine athlete and has also been used in conditioning programs. 1,2 Most equine conditioning programs are based on regular bouts of similar intensity exercise. Training programs that incorporate both high and low-intensity exercise are known to be effective at improving fitness in human athletes. 3 Here we explore the effect of a conditioning program, that includes two shorter higher-intensity bouts and one longer low-intensity bout/week, on athletic performance in the horse.

Serum concentrations of skeletal muscle enzymes are markers of the health and function of the muscular system, and measurement of creatine kinase (CK) and aspartate aminotransferase (AST) activity is routinely performed in athletic horses. 4 Persistent high concentrations of these enzymes in serum after exercise may be a sign of recent skeletal muscle injury or subclinical muscle disease, which in humans may manifest through the onset of symptoms such as prolonged fatigue. 5 Monitoring these enzymes in horses may be helpful for veterinarians and trainers to identify the appropriate level of training.

Objective of Study
The goal of the study was to determine if a lactate-guided conditioning program implementing twice-weekly short-duration high-intensity exercise bouts and once-weekly low-intensity longer-duration exercise bout effectively increases fitness and athletic performance in horses. In addition, the study provided an opportunity to assess and gain insight into the functioning of the muscular system during exercise training.

Materials and Methods

Study Design
- 6 adult Arabian horses (9.3±3.4 years)
- 12 week conditioning program
- Conditioned 3 times per week, on high-speed equine treadmill
- Standardized exercise test (SET) before conditioning and every 3 weeks

Standard Exercise Test (SET)
- Prior to SET, lameness exam performed by veterinarian
- Warm-up for 5 min at 1.5m/s and 5 min at 3.5m/s, 0% incline
- Post warm-up, horses were subjected to SET at an incline of 6% (Fig. 1)
- Incremental Step SET was performed:
  - 4 m/s for 5 min, followed by a 0.5 m/s increase every 5 min
  - SET stopped when [LA] reached ≥4mmol/L

Blood Collection and Analyses
- Blood collected via intravenous jugular catheter (Fig. 2)
- After the warm-up (Baseline, BL)
- End of each step in SET
- Post-exercise: at 15 min, 30 min, 2 hr, 4 hr, 24 hr
- 15 ml blood collected into syringe
- 0.7 ml of whole blood analyzed immediately via Lactate Plus lactate meter (Lplus)
- 4 ml into EDTA vacutainer for packed cell volume (PCV)
- 4 ml into sodium fluoride/potassium oxalate vacutainer for further analysis
- 6 ml into vacutainer serum separator tube for further analysis
- Plasma and serum stored at -80°C for enzymatic biochemical analysis using Lactate kit L7596-50 (Pointe Scientific), Creatine Kinase kit C7512-300 (Pointe Scientific), AST kit P7560-3000 (Pointe Scientific)

LA was graphed against speed and the velocity at which [LA] was 2.5mmol/L (VLA2.5) and the velocity at which [LA] was 4mmol/L (VLA4) were determined for each individual horse (Fig. 4)

Physiological Data
- Continuous heart rate (HR) data were collected using a Polar HR Monitor
- Rectal temperature before and after exercise was measured
- Horses were weighed once weekly

Conditioning
- 3x per week on a SATO I Equine Treadmill
- 2 consecutive days at VLA2.5 for 25 min at a 6% incline
- 1 day rest, followed by exercise at VLA4 for 45 min at 6% incline

Statistical Analysis
- Data between the SETs were compared using Repeated Measures ANOVA. Significance set at P<0.05 and values are expressed as means ± SE

Results: Conditioning Program

Increase in VLA2.5 and VLA4 Over the CP

Results: Physiological Parameters

Results: Biochemical Variables

Figure 1: Horse running on treadmill during SET
Figure 2: Blood collection through catheter
Figure 3: Plasma collection after centrifugation

Conclusions
- This lactate-guided conditioning program that implemented two shorter durations of high-intensity exercise and one longer low-intensity exercise is effective at increasing fitness and athletic performance in these horses
- Standard exercise tests are useful in determining VLA4
- Submaximal exercise can elevate serum CK and AST, although in these horses values remained within normal limits (CK: 100-470 IU/L; AST 185-375 IU/L). These changes appear to be attenuated with conditioning which might indicate muscle cell adaptation to training

References

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