Kentucky Equine Research®
World Leaders In Equine Nutrition

Advances in Equine Nutrition

Volume I

Edited by

J.D. Pagan

THE EFFECT OF WARMING-UP ON RESPONSE TO EXERCISE

S. ROKURODA, L. LAWRENCE, A. PARKER, L. WARREN, D. POWELL AND A. CRUM
University of Kentucky, Lexington, Kentucky, USA

Warm up before exercise/competition is believed to prevent injury and improve performance. Few studies have examined the benefit of warm-up on horses, although various warm-up methods are used for competitive horses. This experiment examined physiological and metabolic effects of warm-up on Thoroughbred horses.

Four mature Thoroughbred geldings were used as the experimental units. During the two months prior to the initiation of the study, horses were exercised 4-5 times a week, with the combination of trot and canter on a high speed treadmill. Horses were individually housed in 3x4m box stalls and were fed twice a day at 8:00 am and 4:00 pm except on testing days when the morning meal was withheld. At the end of the conditioning phase horses were assigned to treatments in a two period cross-over design experiment. In the first period, two horses performed an 18 minute low intensity warm-up (LW) prior to completing a step-wise exercise test and two horses performed an 18 minute moderate intensity warm-up (MW) prior to the exercise test. In the second period the treatments were switched. LW consisted of 18 minutes of walk at 2m/s on a 0% grade treadmill, and MW consisted of 5 minutes at 2m/s on 0% grade, 4 minutes at 4m/s (0% grade), 3 min at 4m/s (10% grade), 3 minutes at 4m/s (0% grade), and 3 minutes at 2m/s (0% grade). Upon completion of the warm-up exercise, all horses performed a step-wise exercise test (2-7m/s) on a 10% grade with 2 minute intervals between each step. The exercise tests were separated by 7 days, and treatment order was balanced. The response variables were heart rate, skin and rectal temperatures, packed cell volume (PCV), plasma lactate, plasma free fatty acids (FFA), and plasma glucose.

During the 18 minute warm-up, there were time x treatment effects on heart rate, PCV, skin temperatures, rectal temperatures, and plasma lactate concentration ($p<0.05$), with MW producing higher values for all variables. Heart rate during the 12th minute of the warm-up averaged 141.5 bpm when the horses performed the MW compared to 53.8 bpm when they performed LW. Plasma FFA concentrations declined during the first 12 minutes of MW, but remained constant during the same period when horses performed the LW. MW produced higher heart rate, PCV and skin temperatures at the initiation of the step test, but there were no differences between the treatments for these variables at the end of the step test. Plasma lactate levels at the beginning of step-wise exercise test were not significantly different between the treatments. Plasma

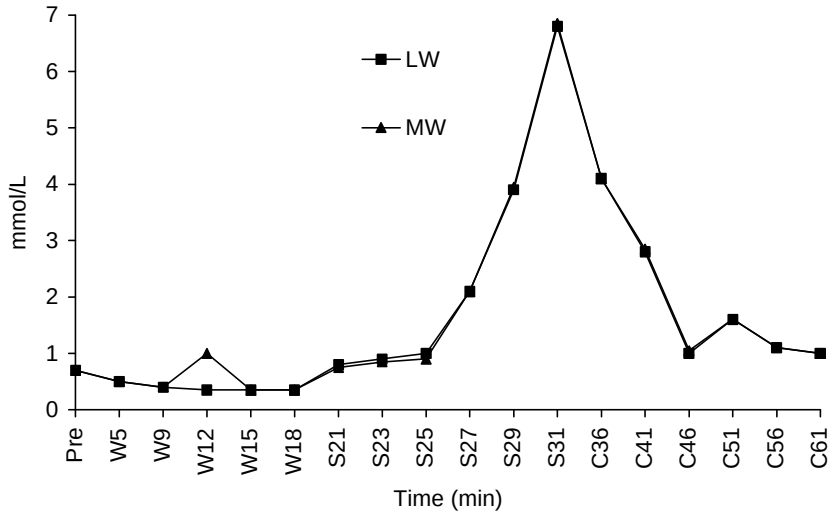

Figure 1. Effect of warm up intensity (low=LW; moderate=MW) on plasma lactate response during the warm-up (W5 - W18), step test (S21 - S31) and recovery (C36 - C61).

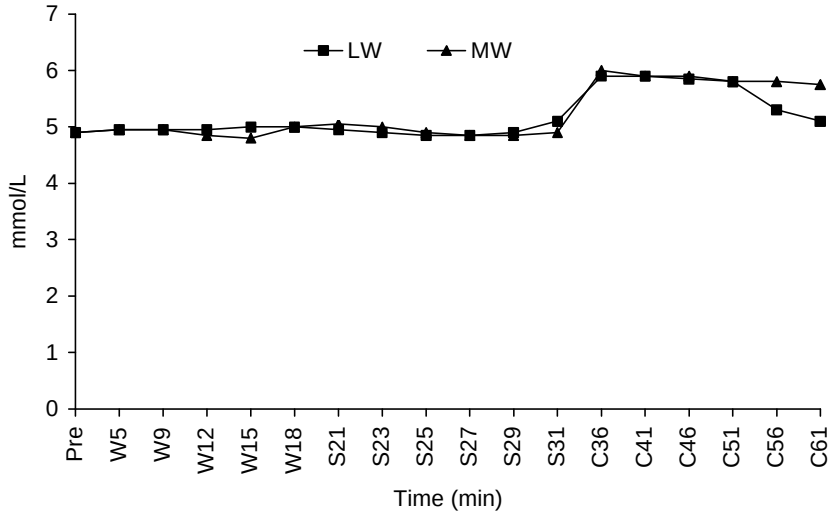

Figure 2. Effect of warm up intensity (low=LW; moderate=MW) on plasma glucose response during the warm-up (W5 - W18), step test (S21 - S31) and (C36 - C61). There was a time x treatment effect ($p<0.0002$) during the step test.

lactate increased ($p<0.05$) during the step test, but there were no treatment effects (Figure 1). During the step-wise exercise test, there was a time x treatment effect for plasma glucose (Figure 2). When horses completed the MW, they had lower plasma

glucose concentrations at the end of the step-wise test ($p<0.05$). There was no effect of warm-up intensity on changes in FFA nor TG during the step-wise exercise test. There were no effects of the warm-up intensity found on any variables during the recovery period.

Warm-up increases tissue temperature which is believed to facilitate metabolism and muscle contraction, increase cardiac output, and dilate capillary beds in muscle; thus increasing blood flow and oxygen availability. In this study the MW seemed to be the more ideal type of warm-up because it produced a higher temperature increase than in LW, without significant lactate build-up. In addition, higher heart rate and PCV occurred during MW as expected. Despite the differences in physiological and metabolic responses during warm-up, there were no differences in heart rate or lactate responses during the step-wise exercise test. Horses in this study were not maximally exercised, so it is possible that treatment differences would have become apparent with a more difficult test. Warm-up intensity did appear to influence blood glucose responses to the step test. At the end of the exercise test glucose level in MW became lower than in LW, while the response of plasma FFA to the step test was not affected by warm-up intensity. This was an unexpected result: the warm-up was expected to facilitate fat utilization, and thus conserve glucose. These results may indicate that the MW for this particular exercise test was not beneficial over LW.


Kentucky
Equine
Research®