Kentucky Equine Research®
World Leaders In Equine Nutrition

Advances in Equine Nutrition

Volume II

Edited by

J.D. Pagan

THE EFFECT OF LONG-TERM DIET RESTRICTION ON THYROXINE AND TRIIODOTHYRONINE CONCENTRATIONS AND METABOLIC RESPONSES IN HORSES FED AND FASTED PRIOR TO EXERCISE

D. POWELL, L. LAWRENCE, T. BREWSTER-BARNES, B. FITZGERALD, L. WARREN, S. ROKURODA, A. PARKER AND A. CRUM
University of Kentucky, Lexington, KY

The results of a previous experiment indicated that the source of the calories can have an effect on the metabolic responses of feed restricted exercising horses. Because thyroid hormone can have a positive response to feeding a meal and exercise has been suggested to help maintain thyroid hormone production during negative caloric balance, this study was conducted to determine if horses consuming a restricted diet with 70% of the calories coming from the concentrate source, were better able to maintain thyroid hormone concentrations during exercise when fed prior to exercise.

All horses were previously determined to have normal thyroid functional capacity via thyrotropin releasing hormone response testing. Initial body weights and condition scores were obtained on each horse prior to treatment assignment. Eight Thoroughbred geldings were randomly assigned to one of two treatments: treatment 1, a calorie restricted diet containing 70% of the caloric need from the roughage source [RHR]; treatment 2, a calorie restricted diet containing 70% of the caloric need from the concentrate source [RHC]. The diets were designed to be adequate in grams of crude protein, calcium and phosphorus for horses undergoing moderate work. The diets were adjusted weekly in order for each horse to maintain an approximate 1.0 kg body weight/d weight loss. The horses were exercise conditioned for 55 d prior to exercise testing. The conditioning program consisted of progressive increases in work bouts until by day 22, all horses were working 3 d/wk on a high speed treadmill set at a 6% grade for 28 min and 2 d/wk for 30 min at a strong trot in a 60' round pen. At the end of the conditioning period, each horse performed two step tests: one, following a 12 h fast and one, 2 h following a meal of 2.0 kg of concentrate (a time previously determined to give an adequate thyroid hormone response to feeding). The exercise test consisted of a step test at a 10% grade, where the speed was increased every 2 min beginning at 2 m/s and ending at fatigue, determined as the point at which the horse could not keep up with the speed of the treadmill. Blood samples were taken pre-exercise, at the end of each 2 min step change, and during a 10 min recovery. The samples were analyzed for T_4, T_3, glucose, insulin, free fatty acid (FFA) and lactate concentrations. Heart rates and time to fatigue were also recorded. The exercise tests were separated by a 6 or 7 d interval during which time all horses continued their conditioning program.

Initial and final condition scores were 5.5 and 4.75 for the RHR group and 5.2 and 4.5 for the RHC group, respectively. Both treatment groups lost 8% of their initial body weight by the end of the study. Fed horses receiving the RHR

dietary treatment had the greater T_4 response (time*diet*feeding state, P<.05) and a decline in glucose concentrations (time*diet*feeding state, P<.05). In response to fasting, horses receiving the RHR diet had a greater FFA response (time*diet*feeding state, P<.05) and numerically longer times to fatigue. Horses receiving the RHC dietary treatment tended to show an increase in T_3 concentrations during the step test (time*diet, P<.08) and tended to have lower heart rates when fasted (time*diet*feeding state, P<.1). Insulin concentrations declined during the step test when horses were fed (P<.05), but were not affected by diet. Plasma lactate concentrations increased (P<.01) in response to exercise, but were not affected by diet or feeding state.

These data suggest that exercise and calorie source may be important to hormonal regulation and energy metabolism in horses subjected to long-term restriction of calorie deficient diets.