

67

Influence of long-term furosemide use on weight loss in horses

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Furosemide is a diuretic commonly used to reduce the incidence of exercise induced pulmonary hemorrhage (EIPH) in racehorses. Elimination of fluid via renal clearance results in overall reduction of fluid in the body and subsequently a decrease in body weight (BW). Previous research in other species suggests long-term use can yield resistance to the diuretic effects, with decreases in weight loss post-administration used to gauge this resistance. In this study, furosemide use was evaluated over 7 weeks for effect on weight loss post-furosemide administration (at 2, 4, 8, 24, and 48 h). Horses were randomly assigned to either control (CON, $n = 5$) or treatment (FUR, $n = 6$). Once weekly, FUR horses were administered furosemide (IV) at 1 mg/kg BW, the dosage used in most racing jurisdictions. Feed and water were removed from all horses (both CON and FUR) for 4 h post-administration to simulate racetrack protocols for horses administered furosemide. Feed and water were immediately returned after weighing horses at 4h post administration. Data were analyzed using a mixed model ANOVA with repeated measures in SAS v9.0. There was no difference in starting BW between groups (CON: 521 kg \pm 30, FUR: 530 kg \pm 28, $P < 0.0001$). Body weight change was influenced by day by time ($P = 0.0001$), treatment by time ($P < 0.0001$), and day by treatment ($P < 0.0001$) interactions. Differences in BW loss occurred between groups at 2 h (CON: $-0.38 \pm 0.27\%$, FUR: $-2.2 \pm 0.25\%$, $P < 0.0001$), 4 h (CON: $-1.02 \pm 0.27\%$, FUR: $-3.29 \pm 0.25\%$, $P < 0.0001$), and 8 h (CON: $0.04 \pm 0.27\%$, FUR: $-1.21 \pm 0.25\%$, $P = 0.024$). There was no difference in BW loss between d 0 and d 49 in CON ($P = 1.00$), but horses administered furosemide (FUR) lost less BW on d 49 than d 0 ($-1.39 \pm 0.29\%$, $-2.56 \pm 0.29\%$, respectively; $P = 0.047$). This study demonstrated furosemide administration led to significant loss of BW compared with controls and dehydration persisted for up to 8h post-administration; yet, weekly administration of furosemide resulted in less BW loss after 7 weeks. This difference could be attributed to drug resistance. Because no long-term studies have been conducted in the horse, despite long-term use being commonplace, this appears to be the first documentation of furosemide resistance in horses. Resistance could suggest furosemide would become less effective as a treatment for EIPH or dosages may need to be adjusted to maintain efficacy. These findings warrant further investigation to establish the safety and efficacy of using frequent doses of furosemide over long periods.

Key Words: furosemide, weight loss

68

Impacts of DigestaWell NRG supplementation on post-exercise muscle soreness

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Exercise induced muscle soreness (MS) and fatigue reduces the usability of horses, and may be due to lactic acid accumulation and increased inflammation. Fenugreek and *yucca schidigera* may increase exercise recovery and reduce inflammatory responses in humans. Recently, horses consuming a dietary supplement of *yucca schidigera* and fenugreek, DigestaWell NRG (NRG), for 7d had less lactic acid accumulation post exercise. The objective of this study was to evaluate post exercise MS and pro-inflammatory cytokines in horses consuming NRG for 4wk. Twenty horses were assigned to either treatment (TRT; $n = 10$) receiving NRG (200g/d)

for 4 wk or unsupplemented controls (CON). All horses participated in a standard exercise test (SET) before the study (period 1) and again after 4wk (period 2). The SET consisted of 50min of exercise under saddle: 2.5min walk, 15min trot, 5min canter, and 2.5min walk, both directions while carrying 20% BWT. MS was evaluated 24hr before and after each SET by a blinded massage therapist on 20 sites per side using a subjective scoring system: 0 (no pain) to 2.5 (severe pain elicited), and the percent change from pre-SET was calculated for each SET. Blood was collected and plasma analyzed for lactate, interleukin 1b (IL1), and tumor necrosis factor- α (TNF) pre-SET, 10 and 30min, and 2, 6, and 24hr after the SET. Statistical analysis was performed in SAS using MIXED ANOVA with fixed effects of hr and treatment with repeated measures on hr within horse. Lactate and TNF were log-transformed and reported as geometric mean with a 95% CI. The percent increase in MS following exercise was not different for CON horses when comparing periods ($P = 0.9$), whereas TRT horses had a lower percent increase in MS in period 2 ($P = 0.013$). During period 1, TRT and CON horses had similar post exercise lactate ($P > 0.9$), and IL1 ($P > 0.2$). NRG reduced post exercise lactate (0.71[0.67–0.75] vs 0.60[0.57–0.63]mmol/L; $P = 0.029$) in TRT horses, when compared with CON. During period 2, IL1 was elevated post exercise at 30min, 2 and 6hr ($P < 0.05$) and tended to be higher at 24hr post exercise ($P = 0.059$), but was not different between TRT and CON horses ($P > 0.5$). Period 1 TNF for TRT and CON horses tended to differ ($P = 0.055$), and therefore, period 2 was compared with period 1 within TRT horses to test the effect of NRG. There was no response of TNF to exercise ($P > 0.5$), but period 1 was greater than period 2 ($P = 0.012$; 184 [179–189]) vs 173[168–178]pg/mL). These varying effects on post-exercise systemic inflammation should be explored further. The reduction in post-exercise lactic acid accumulation and TNF by NRG may explain the decrease in muscle soreness following supplementation.

Key Words: muscle soreness, exercise

Posters

69

Effects of standing martingale use on kinematics and conflict behavior in jumping horses

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The use of standing martingales is a commonly accepted practice among hunt seat riders. Despite the widespread use of the standing martingale by riders of all levels, no studies have been conducted to evaluate its effect on the biomechanics of horses ridden over fences. We hypothesized the use and adjustment of standing martingales would have an effect on the kinematics of jumping horses, and an improperly adjusted martingale would cause conflict behaviors in these horses. To test these hypotheses, 12 horses accustomed to jumping were videoed over a line of 2 jumps with 3 treatments in a replicated Latin-square design: no martingale (NM), a correctly adjusted standing martingale (CM), and a too-short standing martingale (SM). Rider remained the same across all treatments. Videos were analyzed using OnTrack Equine software (Lake Placid, NY) to evaluate kinematics of the jump and identify conflict behaviors. More specifically, still images were identified from the video to represent the last 2 approach strides, take-off, suspension over the jump, and landing, where measurements were then made using consistent anatomical locations, to represent poll position, neck position, upper body position, croup position, frontlimb position, leading