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Influence of oat β-glucan on postprandial glycemic and insulinemic responses to a meal or oral sugar

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Oats are a favored cereal grain in equine rations and are rich in β-glucan (BG). This soluble fiber has been linked to health benefits in humans, including lowered cholesterol and postprandial glucose and insulin. We hypothesized that oat BG would yield similar benefits in horses. Eight mature, clinically healthy Quarter Horses (mean ± SEM, 569 ± 2 kg) were used in a 4 X 4 Latin square design study to determine the effect of oat BG on glycemic and insulinemic responses. Horses were fed 4 diets differing in amount and source of BG for 22 d: cracked corn (low BG control), regular feed oats (moderate BG), a high-BG oat variety (high BG), or corn top-dressed with a concentrated oat BG powder (high BG). Both high BG diets provided 170 mg BG/kg BW/d. All diets were isocaloric. Horses also had free access to pasture forage and were fed a vitamin/mineral supplement. In each of 4 periods, 2 horses were fed each diet. Blood samples were obtained on d 0 and 21 for determination of serum total cholesterol. On d 21, glycemic and insulinemic responses to the assigned treatment diet were evaluated after an 8-h fast. Meal size was standardized to provide 0.8 g NSC/kg BW (an amount equal to the habitual meal size for both oat diets, but a lowered meal size for diets containing corn). On d 22, glycemic and insulinemic responses to an oral dose of sugar (corn syrup, 0.15 mL/kg BW) were evaluated after an 8-h fast. At the completion of each 22-d period, horses underwent a 13-d dietary washout (corn control diet), followed by reallocation of treatments. Data were compared using mixed model ANOVA with repeated measures. Serum cholesterol was not affected by diet and averaged 75.2 ± 1.6 mg/dL. Time to consume the meal differed between diets ($P < 0.0001$), averaging 13.4 and 7.5 min for diets containing oats and corn, respectively. Insulin response to a meal was affected by diet ($P < 0.0001$), time ($P < 0.0001$) and diet × time ($P < 0.0001$), where serum insulin was higher and remained elevated longer in response to meals containing oats (regular or high BG) compared with the 2 diets containing corn. In response to the oral sugar test, insulin was affected by time ($P < 0.0001$) and diet × time ($P = 0.027$), with a lower response in the 2 diets containing a high level of BG compared with the corn and regular oat diets. Diet did not affect glycemic responses to either the meal or the oral sugar test. Results of the meal test likely reflect differences in foregut starch availability between oats and corn. However, responses to the oral sugar test suggest that habituation to diets containing a high level of oat BG may reduce the magnitude of insulin response.

Key Words: horse, oral glucose test, insulin

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Comparative digestibility of dry matter, protein, and fiber between the horse and black rhinoceros

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Care of the critically endangered black rhinoceros ex situ requires understanding of physiological, environmental and genetic influences on health, all of which are poorly elucidated and challenging to study. Horses are thought to serve as the most appropriate domestic model of black rhinos for nutritional study based on their large developed hindgut and herbivorous diet. Six mature geldings (mean ± SE; 511 ± 9 kg) and 2 male black rhinos (1220 ± 77 kg) were used to compare macronutrient digestibility. We hypothesized that digestibility would be similar between species. Prior to starting the study, horses were transitioned from a hay-based diet to a wild herbivore pelleted ration (15.8% CP, 46.2% NDF, 8.0% ESC, 6.7% starch, 4.5% fat) over 28 d. During the study, horses were fed the pelleted diet at 2.25% BW (as-fed) divided into 3 meals/d. Horses were fitted with a collection harness and feces were collected for the last 5 d in each of 2, 10-d periods. A separate digestibility study was performed with black rhinos at Disney's Animal Kingdom. In an effort not to disrupt routine feeding practices, black rhinos were offered the same wild herbivore pellet used with horses (24% of diet DM), Coastal bermudagrass (18%) and timothy hays (39%), fresh elaeagnus browse (18%), and produce for training (1%). Feed intake was quantified over 2, 5-d periods, and all voided feces from each rhino were collected from the ground during the last 2–3 d in each period. Twenty-four hour fecal composites from individual animals were analyzed for nutrient content, and digestibility of dry matter (DMd), crude protein (CPd) and neutral detergent fiber (NDFd) were calculated on period averages. Data were compared using mixed model ANOVA with species and period as main effects. When scaled to body weight, daily DM ($P = 0.005$) and CP ($P < 0.0001$) intakes were higher in horses than rhinos, but NDF intake did not differ between species. Daily fecal output on a body weight basis was lower in horses than rhinos ($P = 0.005$). Within each species, DMd, CPd, and NDFd were similar between period replicates. Between species, DMd ($P < 0.0001$), CPd ($P < 0.0001$) and NDFd ($P < 0.0001$) were higher in horses compared with rhinos. Data indicate possible limitations to using horses as a digestive model for black rhinos despite morphological similarities between species. Differences could be attributed to differential absorptive mechanisms, dietary composition, and/or gut microbial populations. Proper selection of model species for study is integral to long-term viability and sustainability of exotic species.

Key Words: comparative nutrition, herbivore, hindgut fermenter

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Accounting for variation in phosphorus digestibility estimates

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Accurate digestibility values are essential for calculating appropriate daily requirements. A review of the literature shows a wide range of apparent P digestibility values in horses, ranging from −40 to 70%. Such large variations cannot be explained by differences in P intake alone. It was previously believed that inclusion of phytate-P in the diet could cause lowered P absorption, but recent studies have shown that horses can effectively liberate P from phytate. One reason for the variation among studies may be related to an interaction between intake and physiological status. Horses with low P requirements can potentially secrete excess absorbed P into the gastrointestinal tract to be excreted, leading to low estimates of P digestibility. Conversely, feeding low amounts P to animals with a high P requirement could reduce P recycling and lead to more accurate P digestibility values. The objective of this study was to examine