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The Important Influence of Feed Form and Formulation on Glucose and Insulin Response to Meal Feeding: the Development of Purina® WellSolve L/S® Horse Feed

A SUMMARY OF NUTRITION RESEARCH CONDUCTED AT THE PURINA ANIMAL NUTRITION CENTER, EXAMINING THE EFFECTS OF DIFFERENT PHYSICAL FEED FORMS ON CONSUMPTION TIME AND GLUCOSE AND INSULIN RESPONSE TO FEEDING.¹

< INTRODUCTION >

Modern horse feed is available in multiple forms—from different sized pellets, to extruded nuggets, to grain mixes and mixtures of all of these forms. However, little research has investigated feeding identical nutritional formulas of feed but in different physical feed forms to determine how feed processing relates to consumption time and physiological response in the horse. This research was designed to test the hypothesis that feeding an identically formulated concentrate meal in 3 distinct feed forms (4 mm width pellet, 5 mm width extruded nugget, and 19 mm width oval pellet) would affect consumption rate of the meal, and in turn, influence resulting glucose and insulin responses. The ultimate goal was to develop a feed with the lowest glucose and insulin response to feeding, targeted for special needs horses with a sensitivity to soluble carbohydrates in the diet.

< MATERIALS AND METHODS >

The horses utilized for this study were six healthy, unfit, mature QH geldings. They were housed in 3 m x 3 m stalls overnight, with daily group turnout, and individually received 1-1.5% BW in grass hay to maintain a body condition score of 5-7. For concentrate feed, the horses were randomly assigned to receive one of three dietary treatments for 6 days and on day 7 an oral feed tolerance test was performed. Each day, horses were offered 3.6 kg of their assigned concentrate ration, split into an AM and PM feeding. Blood samples for glucose and insulin analysis were taken at time 0 and at 30 minute intervals for a total of 360 minutes after morning feeding on day 7. Consumption time was also recorded at each feeding. The concentrate rations were as follows: P=4 mm width typical pellet, E=5 mm width extruded nugget, or O=19 mm width oval pellet. All treatments contained the same Purina® WellSolve L/S® feed formulation, that was analyzed to contain an average of 6.2% starch and 3.25% simple sugars. All horses received all dietary treatments in a crossover fashion for a total experimental period of 21 days. Glucose and insulin data were analyzed using the Repeated Measures Mixed Procedure of SAS and all differences were considered significant at P<0.05.

¹Gordon, M.E., M.L. Jerina, R.H. Raub, K.E. Davison, and K.J. Young. 2008. The Effects of Feed Form on Consumption Time and Glucose and Insulin Response to a Concentrate Meal in Equine. *Journal of Equine Veterinary Science* 28(5): 289-294.

< RESULTS >

For consumption time, O took the longest time to consume, while P was consumed in the shortest time period ($P=0.03$, Table 1.) However, for glucose and insulin response, P elicited a lower ($P<0.01$) glucose concentration at 2.5 hours than O and elicited a lower ($P<0.03$) insulin concentration at 5.5 hours than E and O (Figures 1 and 2). In addition, the average responses for both the glucose and insulin concentrations through the 6 hour testing period were lower ($P<0.02$) for P versus O. Overall, the glucose and insulin responses for all the feed forms was very low, but the smallest responses were seen when horses ate the feed as a 4 mm pellet (P).

< IMPLICATIONS >

Feed processing can affect consumption time as well as the glucose and insulin responses to a meal. Our 4 mm pelleted feed form had the lowest overall glucose and insulin response to feeding compared to extruded nuggets and larger oval pellets. In addition, this feed form also had the shortest consumption time. It is important to note the very low glucose and insulin response to feeding that all three feed forms demonstrated in this research. This work assisted in confirming that Purina® WellSolve L/S® horse feed is suitable for special needs horses and that manufacturing the formula into a 4 mm pellet is additionally helpful.

TABLE 1

MEAN CONSUMPTION TIME IN RESPONSE TO 3 DIETARY TREATMENTS

	4 MM PELLET (P)	5 MM EXTRUDED (E)	15 MM OVAL PELLET (O)	POOLED STANDARD ERROR
MEAN CONSUMPTION TIME (MINUTES)	18.35 A	19.82 A,B	22.94 B	1.22

Note: Means without a common superscript letter differ at $P=0.03$

FIGURE 1

Mean plasma glucose in response to feeding dietary treatments, P (pellet), E (extruded) and O (oval).

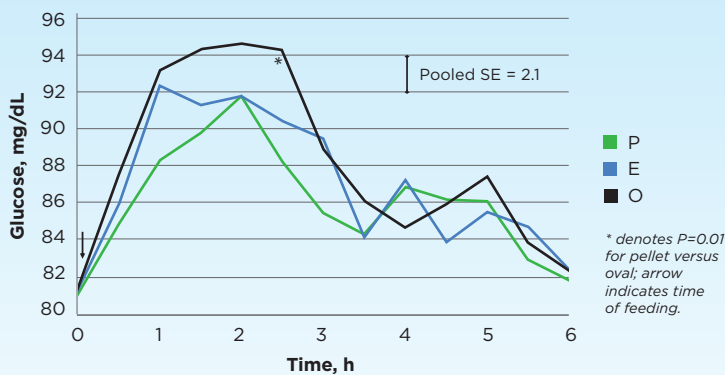
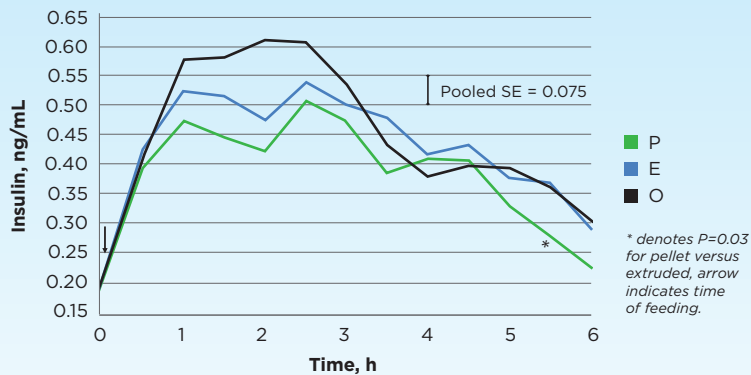


FIGURE 2

Mean serum insulin response to feeding dietary treatments, P (pellet), E (extruded) and O (oval).



P ration: 4 mm Pellet



E ration: 5 mm Extruded Nugget



O ration: 19 mm Oval Pellet



< FOR MORE INFORMATION > Contact your local Purina representative if you would like more information about this study.