



RESEARCH ■ REVIEW >

RESEARCH >

Purina® Equine Senior® Horse Feed is Manufactured to a Specific Pellet Density Factor Allowing for Easier Chewing and the Development of a Mash

A SUMMARY OF RESEARCH CONDUCTED AT THE PURINA ANIMAL NUTRITION CENTER EVALUATING HOW MANUFACTURING PARAMETERS IMPACT CHEWING CHARACTERISTICS IN HORSES.^{1,2,3}

< BACKGROUND >

When developing a feed for horses, the obvious, and main driver of the formulation are the nutrient requirements that are being met. However, various other factors come into play including the ingredient specifications, final desired feed form, and of particular interest to Purina® Equine Senior® Horse Feed, the density of the pellet. Pellet density is a critical consideration for senior horse feed as we know that senior horses often have issues with dentition as they age and lose the ability to chew hardened pellets sufficiently. As such, it was necessary in the formulation of Purina® Equine Senior® Horse Feed to account for the density of a finished product. To do this, process researchers at Purina Animal Nutrition developed a proprietary algorithm called the “Ingredient Pelleting Factor” or IPF that is used to quantify the density and/or hardness of a pellet. The IPF considers a variety of factors for a specific ingredient including its nutritional composition and other unique characteristics and combines these data across all the ingredients in the formula to determine a formula’s specific IPF.

Once an ideal IPF was determined, those data were utilized to develop the Easy-soak™ technology that allows for Purina® Equine Senior® Horse Feed to easily turn into a mash when soaked as directed. Feeding senior horses a mash as opposed to dry pellets can help horses with inadequate dentition more easily consume their feed. To determine the most appropriate pellet density factor and to better understand how horses consume a mash, a series of trials were conducted to evaluate the chewing characteristics of mature horses consuming Purina® Equine Senior® Horse Feed at various IPF levels and as a mash vs. a dry pellet.

< MATERIALS AND METHODS >

Similar technology was utilized in separate trials to evaluate the chewing characteristics of horses. The BIOPAC®, BioNomadix® 2-channel EMG system was adapted to evaluate the muscle electrical activity associated with mastication in horses. This system utilized electromyography to analyze the electrical activities in the M. Masseter muscles along the sides of the horse’s jaw. Adhesive electrodes affixed to both the left and right side of the horses’ jaw collected electrical impulses that were recorded and analyzed utilizing proprietary software to determine chew rate, chew strength, and chew duration. All data was then analyzed for statistical significance.

¹ HR 296. The effect of dentition on chewing characteristics. Internal research. Purina Animal Nutrition Center. 2019.

² HR 203. Evaluation of the chewing characteristics of hard vs. soft pellets. Internal research. Purina Animal Nutrition Center. 2014.

³ HR 260. Evaluation of pellet diameter and chewing characteristics. Internal research. Purina Animal Nutrition Center. 2018.

Study 1: To determine the effect of pellet IPF on chewing characteristics in horses, four mature Quarter horses were utilized in a cross-over trial in which horses were offered two different versions of Purina® Equine Senior® Horse Feed formulated as either a more dense, higher IPF pellet or a less dense, lower IPF pellet. The nutritional and ingredient profiles of both treatments were identical. All horses consumed both treatments. Data were collected at both AM (0700) and PM (1500) feedings for 5 consecutive days per treatment per horse.

Study 2: A mix of mature and senior Quarter horse and Thoroughbred horses (n=8; average age=17.2 years) were utilized in a trial to evaluate the chewing characteristics of Purina® Equine Senior® Horse Feed. Prior to the start of the trial, all horses had not had any dental intervention for at least 1 year. Horses underwent an initial dental evaluation by a trained veterinarian to assign a dental score corresponding to the quality of their dentition. Horses were blocked by age and assigned to an initial diet of either Purina® Equine Senior® Horse Feed offered as a dry pellet (4 lb twice daily) or Purina® Equine Senior® Horse Feed offered as a mash. The mash was made by adding 3 quarts of warm (100°F) water to the 4-lb ration and allowing it to soak for 30 min prior to feeding. All concentrate was offered to horses in a 16-in diameter flat-bottom pan at ground level.

In both studies, horses were offered 1.5% BW of mixed grass hay daily split into two feedings following the concentrate consumption period. Data were collected for a 10-minute period during feeding and analyzed via ANOVA for chew amplitude, strength, length, and rate of chewing.

< RESULTS >

Horses readily consumed all rations with no instances of choke or esophageal obstruction. Data presented below are means ± SEM. All data were analyzed using custom-designed data analysis software. Briefly, each feeding was evaluated individually. Individual chews were identified as changes greater than 0.4 mV that persisted for a 0.2 second period. Once individual chews were identified, data were analyzed for the entire feeding period. **Figure 1** below shows the raw EMG data on top and the corresponding conversion to individual chew analysis below.

Study 1- Ingredient Pelleting Factor (IPF):

Higher IPF pellets required horses to chew harder, faster, and longer than lower IPF pellets. Chew strength for high IPF pellet was 0.02 mv/sec compared to 0.017 mV/sec for low IPF pellets (**Figure 2**; $P<0.05$). Horses chewed high IPF pellets at a rate of 1.81 chews/sec compared to 1.79 chews/sec for low IPF pellets (**Figure 3**; $P<0.05$). Chew duration was impacted by pellet IPF with higher IPF pellets eliciting a longer chew at 0.222 sec compared to 0.212 seconds for lower IPF pellets (**Figure 4**; $P<0.05$).

Study 2- Mash vs. Dry Pellets:

Horses produced a longer chew when consuming dry Purina® Equine Senior® horse feed compared to when it was a mash (**Figure 5**; $P<0.05$). Additionally, horses required a stronger chew to consume the dry pellet vs. the mash (**Figure 6**; $P<0.05$). The maximum chew amplitude, or strongest overall chew came when horses were consuming the dry pellet as opposed to the mash (**Figure 7**; $P<0.05$). The overall rate of chewing, calculated as chews per second was numerically higher for horses consuming Purina® Equine Senior® Horse Feed as a traditional dry pellet vs. a mash, but was not significantly different, possibly due to the low numbers of horses on the trial and high variability (**Figure 8**; $P>0.05$).

< CONCLUSIONS AND IMPLICATIONS >

Chewing is an important process in equine digestion. Improper mastication has been linked to inadequate saliva production, failure to reduce particle size sufficiently, and ultimately choke. Feeding horses with aberrant dentition should be focused on producing the optimal chewing characteristics for the feed being offered. The objective of the first trial was to determine the optimal IPF for the manufacturing of Purina® Equine Senior® Horse Feed through the analysis of chewing parameters. These results helped to inform upon the current formulated IPF of Purina® Equine Senior® Horse Feed. In the second study, this formula was utilized to evaluate the chewing characteristics in horses consuming Purina® Equine Senior® as a mash vs. as a dry pellet. The softer, lower IPF pellet resulted in a softer, slower, and shorter chewing pattern than the harder, higher IPF pellet, similar to the results seen when comparing the consumption of the mash vs. the dry pellet. For senior horses, this less rigorous chewing requirement may enable them to more successfully consume their feed.

FIGURE 1

Sample of data collected utilizing the BIOPAC®, BioNomadix® 2-channel EMG system. The red line shows the raw EMG data while the blue line shows the transformed data that is utilized for analysis.

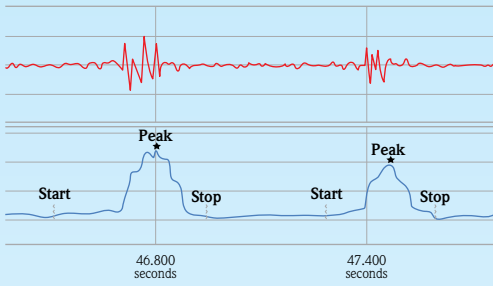


FIGURE 2

Chew strength of horses consuming Purina® Equine Senior® as either a high IPF pellet or a low IPF pellet.

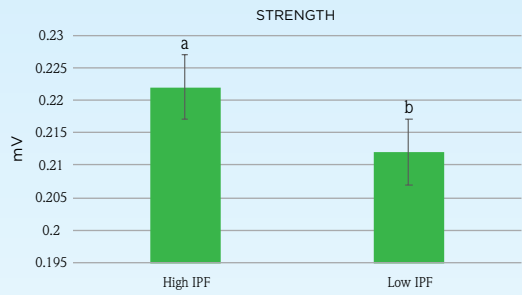


FIGURE 3

Chew rate of horses consuming Purina® Equine Senior® as either a high IPF pellet or a low IPF pellet.

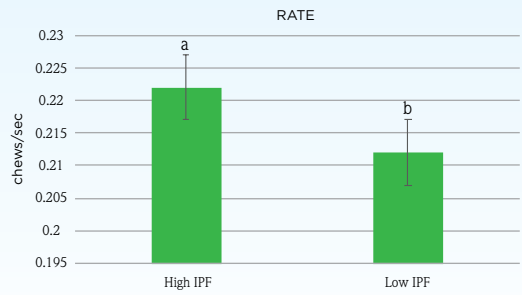


FIGURE 4

Chew duration of horses consuming Purina® Equine Senior® as either a high IPF pellet or a low IPF pellet.

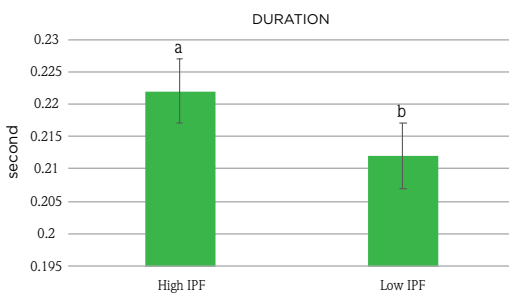


FIGURE 5

Chew length for horses consuming Purina® Equine Senior® as a dry pellet compared to a mash.

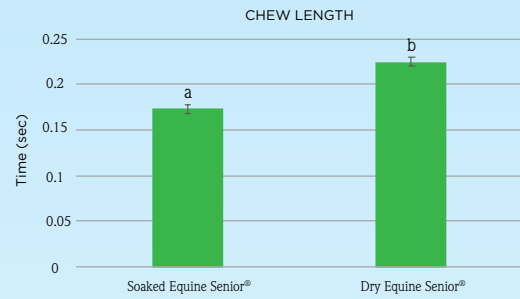


FIGURE 6

Chew strength for horses consuming Purina® Equine Senior® as a dry pellet compared to a mash.

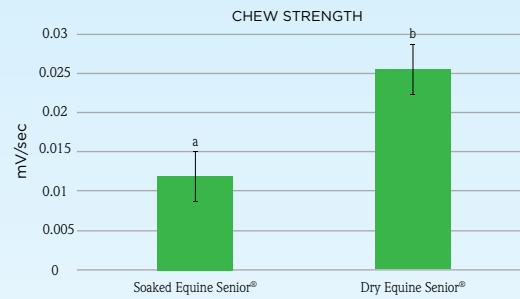


FIGURE 7

Maximum chew amplitude for horses consuming Purina® Equine Senior® as a dry pellet compared to a mash.

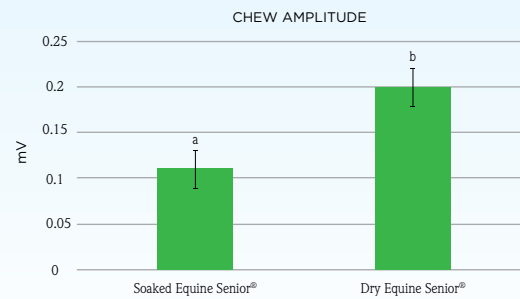
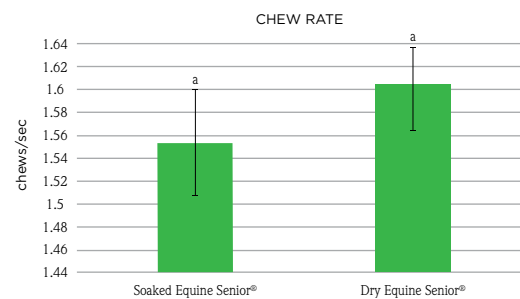


FIGURE 8

Chew rate of horses consuming Purina® Equine Senior® as a dry pellet compared to a mash.



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