DISTILLERS DRIED GRAINS AS A FEED INGREDIENT FOR HORSE RATIONS: A PALATABILITY AND DIGESTIBILITY STUDY

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Summary

A series of preference tests and digestion trials were conducted to evaluate the suitability of distillers dried grains with solubles (DDG/S) as a feed ingredient for horses. First, six horse were used in a 6X6 Latin square design two choice preference trial to determine the effect that DDG/S have on the palatability of horse feed. Four pelleted diets were formulated to contain similar nutrient concentrations and either 0%, 5%, 10% or 20% DDG/S. During each period, two choice preference tests were conducted for six consecutive days.

The horses showed no preference between the pellets containing either 0%, 5%, or 10% DDG/S. The 20% DDG/S pellet was preferred over each of the other pellets by an average of 64% to 36%. The preference of the diets can be rated in the following order: 0% = 5% = 10% << 20%.

Following the preference trial, four horses were used in a 4 X 4 Latin square design digestion trial to evaluate the digestibility of the four diets. There was a trend towards decreased protein digestibility as the level of DDG/S was increased in the diet, but the difference was only statistically significant between the control and 20% DDG/S ($p=.08$). Dry matter digestibility was slightly depressed in the 5% and 10% DDG/S diets, but fat digestibility and TDN% were not different between treatments. DDG/S appears to be a suitable ingredient for horse feeds at a level of inclusion of 20%.

Key Words: horses, dried distillers grains, palatability, digestibility

Introduction

There are about 5.25 million horses in the USA today. Since many are fed commercially prepared feeds, horse feed represents a huge potential market to the American feed manufacturer. In spite of this, there is little available information about how to formulate and produce feeds which are acceptable to the horse and horse owner. When evaluating various ingredients for horse feeds, manufacturers must ask:

1. How palatable is ingredient X in horse feed?
2. Is ingredient X a good source of protein? fat? energy? minerals?
3. How much of ingredient X can I use?

For many ingredients (corn, oats, soybean meal, wheat midds) these questions can be answered fairly confidently. For distillers dried grains the answers to these questions are unknown. Therefore, a series of preference tests and digestion trials were conducted to evaluate the suitability of this ingredient for horses. These data should give feed manufacturers useful guidelines to follow for including DDG/S in their horse feed formulas.

Experimental Diets

A pelleted control diet (0% DDG/S) was formulated using ingredients and nutrient specifications representative of a common commercial horse feed (table 1). Three additional diets were formulated using either 5%, 10%, or 20% DDG/S. These diets were formulated to contain similar amounts of protein, fat, fiber and minerals (table 2).

TABLE 1. INGREDIENT COMPOSITION OF EXPERIMENTAL DIETS

	EXPERIMENTAL DIET			
Ingredient	0 % DDG/S	5 % DDG/S	10% DDG/S	20% DDG/S
distillers dried grains %	0	5.0	10.0	20.0
soybean meal %	10.5	7.8	5.2	0
soybean oil %	2.3	1.7	1.2	0
oats %	25.6	23.8	22.1	18.5
corn %	30.0	30.0	30.0	30.0
wheat middlings %	25.0	25.0	25.0	25.0
molasses %	3.5	3.5	3.5	3.5
mineral/vitamin premix %	2.5	2.5	2.5	2.5
limestone %	0.3	0.3	0.5	0.5
dicalcium phosphate %	0.3	0.3	0.1	0

Preference Tests

The palatability of the four experimental diets were compared in a series of two choice preference trials using six horses of varying ages representing four different breeds (Thoroughbred, Appaloosa, Paint, Quarter Horse). Throughout the experiment, the horses were maintained on a sweet feed and grass hay ration. The horses were fed twice daily in the morning and evening. Before the evening meal, each possible combination (six total) of experimental pellets was tested for six consecutive days in a Latin square design arrangement so that every horse tested every combination. A total of 36, five minute comparisons were made for each diet combination.

During each test, the horses were offered 900 grams of each feed in side by side buckets hung in the front of tie stalls. The horses were given 5 minutes to eat and the amount of each diet eaten recorded. Feed positions were switched at each feeding to eliminate a side preference. Immediately following each preference test, the horses were given their regular evening meal of sweet feed.

TABLE 2. NUTRIENT CONCENTRATION OF EXPERIMENTAL DIETS, HAY AND DDG/S (100 % DM BASIS)

Nutrient	Control	5% DDG/S	10% DDG/S	20% DDG/S	Hay	DDG/S
Dry Matter %	91.1	91.5	91.4	90.5	91.3	89.0
Crude Protein %	16.3	15.9	15.8	15.6	5.3	30.9
ADIN[1] % of total N	2.8	4.4	5.4	8.7	19.0	20.4
ADF[2] %	9.1	10.6	9.6	10.2	50.7	20.4
NDF[3] %	23.2	26.2	23.7	27.3	73.1	
Fat %	5.1	4.9	5.2	5.4	1.9	15.5
Calcium %	1.04	0.95	1.11	1.07	0.23	0.15
Phosphorus %	0.82	0.82	0.82	0.82	0.17	0.91
Magnesium %	0.28	0.28	0.29	0.30	0.09	0.37
Potassium %	0.96	0.90	0.90	0.89	1.48	1.21
Zinc (ppm)	195	191	186	185	25	75
Copper (ppm)	65	65	65	63	11	14
Manganese (ppm)	132	129	125	119	61	36
Ash %	7.2	6.8	6.9	6.8	5.7	

[1]nitrogen content in acid-detergent fiber
[2]acid-detergent fiber
[3]neutral-detergent fiber

Intake of each combination of diet choices was analyzed separately by analysis of covarience using horse, day, and side as covarients. Horses ate similar amounts of each diet in the 0% vs 5%, 5% vs 10%, and 5% vs 10% comparisons (table 3). The horses showed almost a two to one preference for the 20% DDG/S pellet when compared to either the 0%, 5%, or 10% DDG pellets. In each of these comparisons, the difference in intake between the 20% pellet and the other pellets was highly significant ($p < .001$). Hawkes et al (1985) reported that ponies showed a 3:1 preference for a diet containing 20% DDG when compared to a basal ration.

Total average intake from both buckets equaled 860 grams per five minute session or 172 grams per minute. There was no significant difference between any of the choice combinations in total average intake. These data suggest that inclusion of 5 % or 10 % DDG/S has no effect on the palatability of pelleted horse feed. Inclusion of 20 % DDG/S increases the palatability of horse feed. Therefore, feed manufacturers should feel confident that the addition of up to 20 % high quality DDG/S will not compromise the palatability of horse pellets. Of course, if poor quality, burned DDG/S is used, then feed preference may be completely different.

TABLE 3. COMPARISON OF INTAKES OF PELLETS CONTAINING DIFFERENT AMOUNTS OF DISTILLERS DRIED GRAINS WITH SOLUBLES

Comparison	average intake (g)	%
0 % DDG/S	464	52
5 % DDG/S	425	48
	889	
0 % DDG/S	433	51
10 % DDG/S	411	49
	844	
0 % DDG/S	300[a]	36
20% DDG/S	541[b]	64
	841	
5 % DDG/S	438	52
10 % DDG/S	397	48
	835	
5 % DDG/S	302[a]	34
20 % DDG/S	577[b]	66
	879	
10 % DDG/S	333[a]	38
20 % DDG/S	536[b]	62
	869	

[a,b]Values with unlike superscripts are different ($p < .001$)

Digestion Trials

Following the preference trial, four of the same horses (three Thoroughbreds and one Quarter Horse) were used in a 4 X 4 Latin square design digestion trial to evaluate the digestibility of the four diets. Each experimental period lasted four weeks. During each

period, the horses were fed their respective experimental rations for a three week acclimation period followed by a five day complete collection digestion trial. The experimental rations were fed to each horse along with timothy hay in a 1.25:1 hay to pellet ratio. Each horse received the same amount of feed during all four periods in two equal feedings at 12 hour intervals.

During the collection period, daily hay and pellet intake and total fecal output were measured. Subsamples of daily feed and feces were taken each day and frozen. These

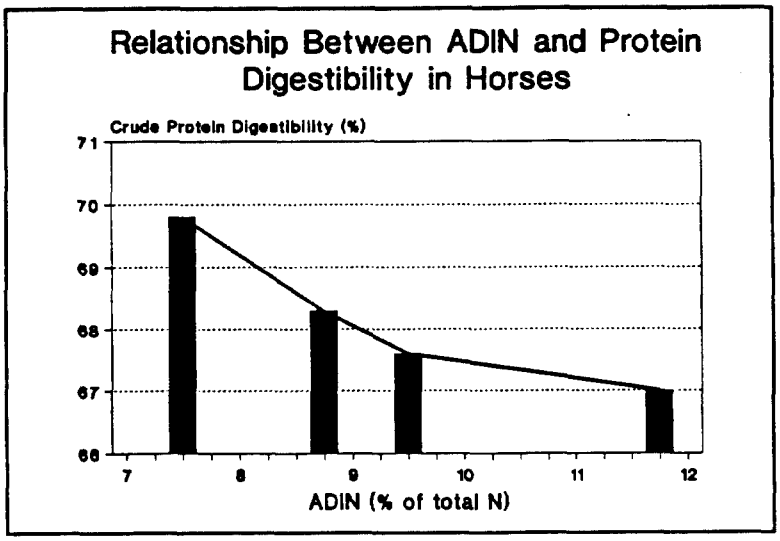
TABLE 4. APPARENT DIGESTIBILITIES OF EXPERIMENTAL DIETS

Nutrient	Control	5% DDG/S	10% DDG/S	20% DDG/S	S.E.[1]
Dry Matter	58.9[a]	57.7[b]	57.7[b]	58.7[ab]	.33
Crude Protein	69.8	68.3	67.6	67.0	.91
ADF[2]	35.4	34.9	33.4	35.3	.98
NDF[3]	42.7[a]	40.5[ab]	39.4[b]	42.8[a]	.73
Hemicellulose	55.1	49.9	49.8	54.9	2.28
Fat	75.2	73.0	75.0	75.4	.88
Calcium[4]	51.1	42.9	47.1	47.2	2.86
Phosphorus[4]	25.0	23.5	20.9	24.3	1.69
Magnesium	30.6	27.9	28.0	29.0	2.62
Potassium	65.2	64.4	61.5	62.6	1.49
Zinc	10.7	8.8	7.8	11.5	1.24
Copper	32.5[a]	30.5[ab]	27.2[b]	30.8[ab]	1.27
Manganese	10.6	7.0	4.7	9.5	2.08
Ash	29.7[a]	25.4[b]	24.6[b]	28.1[ab]	1.23
TDN[5]	46.7	47.3	46.9	46.0	.55

[1]standard error
[2]acid detergent fiber
[3]neutral detergent fiber
[4]estimated true digestibilities assuming endogenous losses of 20 mg/kg BW for calcium and 10 mg/kg BW for phosphorus
[5]total digestible nutrients
[a,b]Values within columns with unlike superscripts are different ($p < .05$)

subsamples were dried and composited for chemical analysis. Both hay and feces were analyzed for dry matter (DM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), crude fiber (CF), fat, calcium, phosphorus, magnesium, potassium, zinc, copper, manganese, and ash.

Digestibilities of the experimental diets are shown in table 4. Dry matter digestibility was slightly depressed in the diets containing 5% or 10% DDG/S as compared to the control or 20% DDG/S diets. In addition, NDF digestibility was lower in the 10% DDG/S diet than in the control or 20% DDG/S diet. There was a trend towards decreased protein digestibility as DDG/S increased in the diet, but the difference was only statistically significant between the control and 20% DDG/S ($p=.08$). It appears that the depression in protein digestibility observed with increasing DDG/S is related to the acid detergent insoluble nitrogen fraction (ADIN) of the DDG/S (figure).



The digestibility of fat, ADF, hemicellulose, calcium, phosphorus, magnesium, potassium, zinc and manganese in the four diets was not significantly different. The TDN content of the four diets was also not significantly different. Leonard et al (1975) fed diets containing either 0%, 5% or 10% DDG/S to mature horses. Dry matter and energy digestibility was not different between diets. Protein digestibility decreased linearly as DDG/S was added to the diets.

Conclusions

These data indicate that DDG/S can be added to horse diets at levels up to 20% without compromising palatability. The addition of 20% DDG/S to a horse feed may slightly depress protein digestibility and it remains to be determined how well young, growing horses can utilize DDG/S as a source of protein. Adult horses, however, utilize the energy and minerals in DDG/S quite well and DDG/S appears to be particularly attractive as a source of fat and phosphorus in horse diets.

Literature Cited

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