

THE DIGESTIBILITY OF POLISHED RICE, RICE POLLARD AND LUPIN GRAINS IN HORSES

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Summary

Diets containing oaten chaff plus soybean meal (OS) or OS plus cracked white rice, rice pollard or cracked lupin grains were fed to four horses in a latin square designed experiment. On the assumption that the addition of the cracked rice, rice pollard or the lupin grains did not influence the digestibility of the OS portion of the rations, the digestible energy content of the cracked rice, rice pollard and the lupin grains were calculated. The values obtained were 18.2, 15.6 and 17.7 MJ DE/kg DM respectively.

I. INTRODUCTION

The chemical composition, digestibility and digestible energy content of few ingredients that are included in prepared horse rations have been determined under Australian conditions. Commonly, nutrient content of ingredients are assumed to be similar to those presented in feed tables in overseas publications (e.g. NRC 1989). However, there are some ingredients that are included in Australian horse rations for which no data are available. Also, because of the way in which some ingredients are produced under Australian conditions, nutrient content data from overseas sources may not be accurate.

Average annual paddy rice production in Australia is around 800,000 tonnes and rice pollard and broken white rice are the primary milling by-products available for stockfeed. Lupin grain production in Australia now approaches one million tonnes and the grains are generally regarded as suitable for livestock following extensive research work with pigs, poultry and ruminants and a single report with horses (Sriskandarajah et al. 1988). It is not easy to estimate the level of use of these ingredients in horse diets, however, one company (Ricegrower's Co-operative, Leeton, NSW) manufactures 15,000 tonnes of horse feed containing over 70% rice milling by-products and up to 12.5% lupin grain per year.

While some data on digestibility coefficients for broken polished rice and rice pollard are available (McCarthy et al. 1989) none are for lupin grain. This experiment was conducted to provide further information on the nutritive value of these feeds for horses.

II. MATERIALS AND METHODS

Four adult geldings, of which three were Thoroughbreds and one a Quarter Horse, with a mean liveweight of 404 kg, were used in the experiment. They were fed four diets in a latin square design. The diets contained oaten chaff plus soybean meal (OS) or OS plus broken polished rice, rice pollard or cracked lupin grains; in each diet the ratio of oaten chaff to soybean meal was the same. The quantities of ingredients in the different diets are presented in Table 1. Each diet was fed to each horse for a two week preliminary period and then for a further week during which total output of faeces and urine were measured. The horses were restrained in individual metabolism stalls during the collection week except for half an hour each day when they were given mild exercise on a treadmill. Urine collecting harnesses were fitted to the horses and the urine produced each day was collected into 20 l containers to which had been added 100 ml concentrated hydrochloric acid. Faeces were voided onto plastic sheets placed behind the horses. Samples of the faeces and urine produced each day by each horse were obtained and stored at -20°C together with samples of the dietary ingredients.

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Table 1. The composition (kg DM/day) of the experimental rations.

Ingredient	Diet			
	OS	Broken rice	Rice pollard	Lupin grain
Oaten chaff	6.286	4.190	4.190	4.190
Soybean meal	0.347	0.234	0.234	0.234
Rice grain, cracked		1.750		
Rice pollard*			1.798	
Lupin grains, cracked				1.762
Ground limestone	0.053	0.228	0.180	0.150

* Rice pollard in this context refers to the total product from milling brown rice to polished white rice and contains the germ and polishings in addition to the outer bran layer; it contains no hull fractions.

The dry matter (DM) and organic matter (OM) content of the feed and faeces samples were determined by methods described by AOAC (1980) while nitrogen (N) content of these samples and the urine samples were obtained following Kjeldahl digestion. The gross energy (GE) content of the feed and faeces samples was determined with bomb calorimetry. Neutral detergent fibre (NDF) was estimated using the method of Van Soest and Wine (1967). Mineral contents of the feed ingredients were determined by nitric perchloric digestion (Baker and Smith 1974) followed by inductively coupled emission spectrometry (Dahlquist and Knoll 1978).

III. RESULTS

The composition of the components used to mix the experimental diets is presented in Table 2.

Table 2. The composition of basic ingredients used to mix the experimental diets.

	Oaten chaff	Soybean meal	Cracked rice	Rice pollard	Lupin grain
GE, MJ/kg DM	18.8	19.6	18.4	22.2	20.3
g/kg DM:					
OM	940	940	990	905	970
N	11.5	80.8	14	26.7	51.9
NDF	630	180	200	370	340
Ca	1.2	3.4	0.1	0.8	2.4
P	2.1	9.1	1.9	2.7	4.4
Mg	1.4	4.2	0.6	10.9	2.7
mg/kg DM:					
Cu	17	35	21	25	20
Fe	103	237	27	163	81
Mn	104	47	30	360	53
Zn	18	61	25	65	51

The GE contents of the soybean meal, rice pollard and the lupin grain were higher than that of oaten chaff or cracked rice reflecting the lower protein and/or oil content in these latter feeds. The NDF contents of the rice pollard and lupin grains indicate that both contained more fibre than the broken rice or soybean meal.

The results of the digestibility trial are presented in Table 3.

Table 3. The OM, N and NDF digestibilities, DE content and N balance values measured when diets containing oaten chaff and soybean meal (OS) or OS plus cracked rice, rice pollard or lupin grains were fed to horses. The calculated OM digestibility and DE content of the broken rice, rice pollard and lupin grains are also presented.

Measurement	Diet				SDM#
	OS	Broken rice	Rice pollard	Lupin grain	
OM dig.	0.53c	0.67a	0.60b	0.64ab	0.028
NDF dig.	0.39	0.48	0.44	0.47	0.049
N dig.	0.75b	0.75b	0.73b	0.84a	0.025
N bal., g/day	30.2	28.1	29.1	41.8	10.33
DE, MJ/kg DM	9.9b	12.3a	11.6a	12.1a	0.53
Calculated values for:		Dietary ingredient			
		Broken rice	Rice pollard	Lupin grain	
OM dig.		1.00	0.74	0.89	0.078
DE, MJ/kg DM		18.2	15.6	17.7	1.47

Values on the same line followed by a different letter are significantly different, P at least < 0.05.

SDM = standard deviation of the mean.

The OM digestibility and the DE content of the diets containing cracked rice, rice pollard and lupin grain were higher than the corresponding values recorded for the oaten chaff diet. The nitrogen digestibility was significantly higher in the diet containing lupins and there was a suggestion that this was associated with an elevated nitrogen balance. The NDF digestibility was not significantly influenced by diet.

By assuming that the digestibility of OM and GE of the oaten chaff and soybean meal portion of all four diets were constant and not influenced by the presence of broken rice, rice pollard or lupin grain in the diets, the OM digestibility and DE content of the broken rice, rice pollard and lupin grain were calculated by difference. These results are also presented in Table 3 and indicate that the rice was almost completely digestible and had a DE content of 18.2 MJ/kg DM. The DE content of the lupin grain was also high while that of the rice pollard was the lowest of the three.

IV. DISCUSSION

The DE value obtained in this experiment for broken rice was considerably higher than that reported by McCarthy et al. (1988) for the same product viz. 18.2 vs 13.3 MJ/kg DM, while that for rice pollard was similar. As stated by McCarthy et al. (1988) their low value for broken rice could have been associated with poor palatability and acceptance of the trial diets by the horses and by coprophagia. The DE content of lupin grain measured in the present experiment was high. It has a high crude protein content (325

g/kg DM; Table 2) and should be a suitable energy and protein source for horses. The highest N balance value was obtained when the diet containing lupins was fed. The conclusion that lupins are a suitable grain source for horses agrees with that of Sriskandarajah et al. (1988).

The N digestibility values recorded in this experiment (0.73 - 0.84; Table 3) are similar to those reported by Sriskandarajah et al. (1988) for diets containing wheaten chaff, oats and either soybean meal or lupins and for values reported by McInnes and McMeniman (1984) for diets containing oaten chaff, lucerne chaff, cracked maize and molasses.

V. REFERENCES

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