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BY-PRODUCTS FROM RAPESEED PROTEIN CONCENTRATE (RPC) PROCESSING AS FEEDSTUFFS II. RAPESEED HULLS TO GROWING HEIFERS

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Rapeseed (RS) hulls are an important by-product of RPC processing and therefore the return from hulls influences the process economy. Metabolic experiments with hulls on sheep, carried out in Sweden, indicate a content of metabolizable energy (ME) of 8-9 MJ per kg DM (den Braver, 1972; Petersson, 1975) which agrees well with the findings of Burton (1975). Hulls have been tested in production - like experiments with beef cattle and resulted in satisfactory performance (Chanet, 1974). In a pre-test of the current experiment Ahlström (1973) found that growing cattle of 100 kg body weight accepted 3 kg and of 300 kg 5 kg RS hulls. - The objective of the present experiment was to investigate the effects of high-level feeding of RS hulls (50 % hulls instead of cereals, Treatment 2) to growing dairy heifers with regard to acceptability of feed, performance of animals and toxic effects in comparison with a control concentrate mixture (Treatment 1). - Preliminary results were reported by Ahlström and Thomke (1976), which report also includes a description of the processing technique.

MATERIALS AND METHODS

The hulls were processed at AB Karlshamns Oljefabriker, Karlshamn. They were not heated. The chemical composition of the hulls originating from high glucosinolate (GLS) winter RS material varied during the course of the experiment. Especially the last of the three shipments deviated, which can be noticed from the proximate composition and the content of GLS (Table 1), indicating an inefficient separation of the hulls from the meats in the latter case. - In calculating the nutritive value of RS hulls the digestibility values given by Petersson (1975) have been used.

The experiment was conducted at Alnarp Experimental Station with 28 individually fed growing heifers (Swedish Frisian Breed, with an initial age of 6-12 months and a weight of 200-300 kg) divided into two equivalent groups. It lasted 16 weeks. The first two weeks of the experiment comprised a pre-period. About 80 % of the energy intake originated from the concentrate mixtures (Table 2) and the remaining 20 % from hay. The feeding level (NRC, 1971) chosen was expected to result in average daily weight gains of about 800 g. The daily amount of hay corresponded to 0.5 % of individual weights. The concentrate mixtures were fed according to the animals´ weight, i.e. at the same calculated energy level, 3.5 - 5.7 kg per day of Treatment 1 and 3.8 - 6.2 kg of Treatment 2 mixtures. Vitamins and minerals were supplemented.

RESULTS

Since the chemical composition of Treatment 2 mixture showed a significant change during the final weeks the results are presented separately for weeks 3-14 and 15-16 (Table 2). Despite the very high level of hulls and its extreme bulky character the animals accepted the feed amounts offered. Feed refusals were very small. Differences in refusals between treatments were not recognized. The daily feed intakes for weeks 3-14 were 62.8 and 58.6 MJ ME in Treatments 1 and 2, respectively. The performance results in this period were very alike with average daily weight gains of 932 and

TABLE 1

CHEMICAL COMPOSITION IN PER CENT OF DM AND NUTRIENT CONTENT OF RAPESEED HULLS USED DURING DIFFERENT PERIODS OF THE EXPERIMENT

	Rapeseed hulls used during week 3-14	15-16
No. of samples	3	1
Crude protein	16.4 (16.0-16.7)	17.6
Ether extract	11.1 (9.1-13.8)	20.0
Crude fibre	35.7 (30.1-40.5)	28.6
Ash	5.5 (5.5- 5.8)	5.3
ME, MJ/kg DM	8.6 (8.0- 9.3)	10.9
Dig. crude protein, g/kg DM	69 (66 -71)	74
Glucosinolates, g/kg DM, total	12.3 (11.3-13.0)	15.8
Isothiocyanates (ITC), g/kg DM	0.4 (0.3- 0.5)	0.7
Oxazolidinethiones (OZT), g/kg DM	3.3 (3.1- 3.5)	4.0
Myrosinase activity, μmol/min/g DM	0.55(0.15-0.90)	0.55

TABLE 2

COMPOSITION OF CONCENTRATE FEED MIXTURES AND PERFORMANCE RESULTS

	Treatment 1 Week		Treatment 2 Week	
	3-14	15-16	3-14	15-16
Composition of concentrates in per cent				
Roller-milled barley oats (1:1)	84	84	34	34
Rapeseed hulls	-	-	50	50
Molassed dried beet pulp	10	10	10	10
SBOM and cottonseed expeller (1:1)	6	6	6	6
Results				
No. of animals	14	14	14	14
Initial weight, kg	247	325	244	321
Final weight, kg	325	337	321	330
Average daily weight gain, g	932	830	920	586
" " standard error, g	18	79	26	99
Average daily feed intake				
Concentrate	4.72	5.15	5.10	5.43
Hay	1.50	1.71	1.47	1.71
ME, MJ/day	62.9	70.0	58.7	69.6
ME, MJ/kg weight gain	67.5	84.2	64.1	118.6

920 g and feed conversion ratios of 67.4 and 64.1 MJ/kg weight gain for Treatments 1 and 2, respectively.

The results for weeks 15-16 given in Table 2 clearly demonstrate that Treatment 2 during this period resulted in inferior performance (30-40 %) despite an equal daily ME intake. This is interpreted as being an effect of the change in the composition of the hulls used at the end of the experiment. - The consumption of hulls resulted in strong faeces, which may be a practical advantage.

There were no differences in health or in conception rates within 6 months after the experiment between respective treatment groups, except an increase of nostril discharge from the Treatment 2 animals during weeks 7-16. This was probably caused by the higher content of ITC in the hulls. During weeks 13-14 the intake of ITC + OZT was 0.14 g/MJ ME or 0.12 g/kg metabolic body weight (m.b.w; $W^{0.75}$). The corresponding values during the final weeks were 0.16 and 0.15 g.

DISCUSSION

The animals accepted RS hulls without significantly decreasing their ME intake, which might indicate a reasonable palatability. The feeding level used in this experiment was slightly higher than normally used under practical conditions for heifers in Sweden. Our experiment did not reveal whether a further increase in the amounts of concentrate would have created differences in feed intakes.

Calculations of feed conversion ratios between treatments for weeks 3-14 reveal a higher ME value (20 %) for RS hulls than that given for sheep by Petersson (1975). An explanation of this difference in ME value might be a higher energy concentration in the present experiment than in the earlier experiments with sheep. However, the magnitude of the difference calculated is somewhat uncertain. The present results support the ME value of hulls being somewhat higher than 8.6 MJ/kg DM. Particular attention should be paid to the ether extract content of hulls, since the feeding value is greatly dependent on this nutrient (30 % of ME is derived from fat in the present material).

The daily weight gains and feed conversion ratios for weeks 15-16 illustrate that the content of ITC + OZT in the Treatment 2 ration developed a negative effect. From weeks 13-14 it increased from 0.14 to 0.16 g/MJ ME, or from 0.12 to 0.15 g/kg m.b.w. This relatively small increase seems to have caused adverse effects. However, part of the effect might be related to the time the material containing GLS was used. Swedish experiments with 10 % RSM (lacking myrosinase activity) in the concentrate to growing beef cattle showed this level to be safe (Ahlström, 1974:, Olsson, 1974). This RSM level corresponded to an amount of ITC + OZT of 0.11 g/MJ or 0.11 g/kg m.b.w. The level found in the present investigation to be acceptable (0.12 g/kg m.b.w.) corresponds well to the level found safe by the authors cited above. In defining maximum levels of GLS intake one should not overlook the presence of myrosinase activity and the fact that toxicity differences exist between cleavage products of GLS and that other products, even more toxic than ITC and OZT, may occur (Josefsson, 1975). OZT is reported to be more toxic than ITC (Bell and Belzile, 1965).

The present experiment has demonstrated that RS hulls are an ingredient of interest for growing cattle. The high level of hulls used in the present investigation does not seem to be actual from a practical point of view, which also means that there should be a margin of safety with regard to the content of GLS. A change to low-GLS material will further decrease the risks.

LITERATURE

Ahlström, B., 1973. (Acceptability tests with rapeseed hulls on growing cattle.) Report Dept. Animal Husbandry, Coll. Agric. Swed., Uppsala (Swedish)

Ahlström, B., 1974. (Dried DPW and RSM as protein feedstuffs for beef cattle.) Ibid. (Swedish)

Ahlström, B. and S. Thomke, 1976. (Hulls to heifers.) Report No. 43. Ibid. (Swedish)

Bell, J.M. and R.J. Belzile, 1965. Goitrogenic properties. Rapeseed meal for livestock and poultry - a rev. Can. Dept. Agric. Publ. 1257, Ottawa, 45-60.

den Braver, E., 1972. (Nutritive value of rapeseed hulls.) Report Dept. Nutrition Physiol., Coll. Agric. Swed., Uppsala (Swedish)

Burton, J.H., 1975. Nutrient availability in rapeseed hulls for ruminants. Proc. Nutr. Conf. for Feed Manuf., April 22-3, 1975, Toronto, Ont., 83-86.

Chanet, M., 1974. Utilisation dans l'alimentation animale des tourteaux de colza. Etudes visant a en ameliorer la valeur nutritionelle. Proc. 4 Intern. Rapskongr. Giessen, 4.-8. Juni 1974, 393.

Josefsson, E., 1975. Influence of glucosinolates and high-molecular factors on the nutritional value of low-glucosinolate rapeseed meal. J. Sci. Fd Agric. 26, 1299.

Olsson, I., 1974. (Rapeseed meal to beef cattle.) Husdjur No. 3, 14 (Swedish)

Pettersson, H., 1975. (Nutritive value of different rapeseed by-products to sheep.) Report No. 28, Dept. Nutrition Physiol., Coll. Agric. Swed., Uppsala (Swedish)