# BY-PRODUCTS FROM RAPESEED PROTEIN CONCENTRATE (RPC) PROCESSING AS FEEDSTUFFS III. BY-PRODUCT MIXTURE TO GROWING, UNCASTRATED MALE CATTLE

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Processing RPC includes aqueous extraction in order to remove undesirable substances such as carbohydrates and glucosinolates (GLS). Hence, the aqueous extract contains nutrients and antinutritive compounds. On account of economic considerations, among others, it must be made use of. The potential of aqueous extract from the RPC-process described by Anjou and Fecske (1974) as a feed ingredient has not yet been investigated. - The by-product mixture investigated here originated from the evaporated aqueous extract (EAE) which was mixed with the other two by-products (hulls and fines) of RPC processing. The relation between these by-products in the mixture was the same as that resulting from the process, i.e. 33 % hulls, 21 % fines and 46 % EAE on a DM basis. - The objective of the present experiment was to investigate the possibility of using the by-product mixture (BPM) as a feed ingredient to growing, uncastrated male beef cattle by comparing a concentrate feed mixture containing 8 % of BPM with a control of commercial type.

## MATERIALS AND METHODS

The by-product mixture, based on high-GLS winter rapeseed (Br. napus), was produced by AB Karlshamns Oljefabriker, Karlshamn. The aqueous extract originated from test runs at its pilot plant and was evaporated to a DM of about 50 % prior to mixing with hulls and fines and heat-drying. The fines had been defatted by screw pressing. The chemical composition of BPM is given in Table 1. The content of ITC + OZT of BPM was 19.1 g/kg. The myrosinase activity was 0. The GLS-content in BPM was of the same order as in fines. The chemical composition of individual ingredients of BPM is given for comparison. BPM (of the same batch used in our experiment), hulls and fines had earlier been evaluated in metabolic experiments on sheep (Petersson, 1975). The nutritive value of BPM from this investigation was used in the present work.

Prior to this experiment the palatibility of the BPM was tested on growing cattle to define an appropriate level. A substantial increase beyond the level chosen (8 %) clearly indicated a limiting effect on feed intake. The respective compositions of the two concentrate mixtures (Treatments 1 and 2) used are given in Table 2.

The experiment was conducted at the Alnarp Experimental Station on a total of 29 individually fed, growing bull beef calves (Swedish Frisian Breed) divided into two equal treatment groups with respect to weight, age and ancestry. The average initial weight was 119 kg. As a basic amount of forage the animals got 0.5 kg hay per head and day. The animals had nearly free access to their respective concentrate mixtures. Vitamin and mineral supplements were given. Blood samples were collected on two occasions during the experiment. The haematological status was determined by the Dept. of Clinical Biochemistry, Swedish University of Agricultural Sciences. - The animals were slaughtered at a live weight of about 240 kg. The respective thyroid glands were removed and weighed, carcass quality was assessed according to the commercial routines used in Sweden. - The statistical evaluation was done by co-variance analyses of performance results

TABLE 1

CHEMICAL COMPOSITION IN PER CENT OF DM OF INDIVIDUAL BY-PRODUCTS AND THE BY-PRODUCT MIXTURE (BPM) AND NUTRIENT CONTENT

| | BPM | Rapeseed hulls[a] | Fines[a] | EAE[a] |
|---|---|---|---|---|
| Chemical composition | | | | |
| Crude protein | 25.6 | 16.7 | 39.0 | 26.4 |
| Ether extract | 5.2 | 9.4 | 8.5 | 0.7 |
| Crude fibre | 15.7 | 36.4 | 11.7 | 2.9 |
| NFE | 45.0 | 31.6 | 34.2 | 58.7 |
| Ash | 8.5 | 5.9 | 6.6 | 11.3 |
| Gross energy, MJ/g DM | 19.9 | 21.1 | 20.9 | 18.5 |
| Glucosinolates, total, g/kg DM | 69.2 | 12.3 | 63.1 | 113[b] |
| Isothiocyanates (ITC), g/kg DM | 5.6 | 0.4 | 4.8 | 10[b] |
| Oxazolidinethiones (OZT), g/kg DM | 14.9 | 3.3 | 15.1 | 23[b] |
| Myrosinase activity, μmol/min/g DM | 0.0 | 0.55 | 0.16 | 0 |
| Nutrient content[a] | | | | |
| ME, MJ/kg DM | 11.1 | 8.6 | 13.4 | 12.1 |
| Dig. crude protein, g/kg DM | 180 | 69 | 326 | 196 |

a According to Petersson (1975) except GLS
b Calculated from BPM, RS hulls and fines

and by variance analyses of clinical data.

## RESULTS

The respective daily intakes of concentrate mixtures as well as the energy of the two treatment groups were very similar indicating that the inclusion of 8 % of BPM had no significant adverse effect on feed acceptability (Table 2). Furthermore the respective performance results measured as average daily weight gains and feed conversion ratios did not differ significantly from each other. The calculated intake of ITC + OZT was 0.13 g/MJ ME or 0.14 g/kg metabolic body weight ($W^{0.75}$; W = 180 kg). Carcass quality assessment gave very similar treatment results.

Clinical evaluation of blood parameters showed normal ranges of variation apart from significantly higher $SCN^-$-values ($P<0.001$) in Treatment 2 animals (Table 2). The average weights of thyroid glands, 15.1 and 20.1 g for control- and BPM-animals, respectively, did also differ significantly ($P<0.01$).

## DISCUSSION

The former experiments in this series (Ahlström, 1978; Ahlström and Thomke, 1978) have shown hulls and fines to be feedstuffs which can be fed successfully to cattle in appreciable amounts. From the pre-experimental acceptability test it was quite clear that the amount of BPM had to be limited. The performance results do not indicate any goitrogenecity of feeding 8 % BPM, but the increase in thyroid weight and $SCN^-$-level show a goitrogenic effect of BPM. In a few earlier experiments RSM feeding has been shown to be goitrogenic to cattle (Iwarsson, 1973; Iwarsson and Ekman, 1974; Iwarsson et al., 1973; Geay and Béranger, 1975).

TABLE 2

COMPOSITION AND NUTRIENT CONTENT OF CONCENTRATE FEED MIXTURES AND PERFORMANCE RESULTS

| | Treatment 1 | Treatment 2 | |
|---|---|---|---|
| Composition of feed mixtures in per cent | | | |
| By-product mixture (BPM) | - | 8.0 | |
| Roller-milled barley-oats (1:1) | 66.0 | 61.0 | |
| SBOM and cottonseed expeller (1:1) | 14.0 | 11.0 | |
| Molassed dried beet pulp | 20 | 20 | |
| Results | | | |
| No. of animals | 15 | 14 | |
| Initial weight, kg | 119.7 | 118.6 | |
| Final weight, kg | 244.7 | 241.3 | |
| Average daily corr. weight gain[a], g | 1359 | 1326 | |
| Dressing percentage | 48.2 | 48.4 | |
| Feed intake | | | |
| Concentrate feed mixture, kg/day | 4.35 | 4.25 | |
| Hay, kg/day | 0.43 | 0.48 | |
| ME, MJ/day | 52.3 | 51.2 | |
| ME MJ/kg weight gain | 38.5 | 38.6 | |
| Thyroid glands weight, g | 15.1 | 20.1 | ($P < 0.01$) |
| Carcass grading, no. of carcasses | | | |
| High choice | 4 | 6 | |
| Choice | 10 | 8 | |
| Medium choice | 1 | - | |
| Blood analyses | | | |
| Haemoglobin, g/100 ml | 11.3 | 11.6 | ($P=0.082$) |
| Serum urea-N, mg/100 ml | 7.3 | 6.7 | |
| tot. protein, g/100 ml | 6.1 | 6.2 | |
| albumin, g/100 ml | 3.6 | 3.5 | |
| PBI, µg/100 ml | 6.5 | 6.0 | |
| $SCN^-$, mg/100 ml | 0.13 | 1.27 | ($P < 0.001$) |
| cholesterol, mg/100 ml | 74.0 | 82.5 | |
| Zn, µg/100 ml | 141.4 | 135.9 | |

a Corr. to differences in dressing percentage

According to the metabolic experiment of Petersson (1975) the ME value of BPM has been calculated to be 11.1 MJ/kg DM. The present results do not allow any exact criticism of this value because of the limited amount of BPM used in the experimental feed mixture, but the feed efficiencies were very alike. The ME value calculated for EAE is less than that for barley (8 %), a partial cause of this inferiority being its relatively high ash content.

In the present experiment the amount of ITC + OZT was 0.14 g/kg metabolic weight, which is very close to the value found unacceptable to growing heifers (Ahlström and Thomke, 1978). The hulls used in the former experiment showed myrosinase activity, whereas the BPM lacked this activity as a result of heat-drying, which is supposed to be a reason for the difference in performance as between the experiments.

In conclusion, it has been demonstrated that 8 % BPM can be included in a concentrate mixture for intensively raised beef cattle.

LITERATURE

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