SUMMARY OF SESSION ON NUTRITIVE VALUE OF RAPESEED PRODUCTS

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Eleven countries participated in providing research results on nutritive value, these being Canada, Denmark, Finland, France, GDR, India, Italy, Poland, Sweden, United Kingdom and West Germany. Forty percent of the presentations were contributed by Poland, which deserves commendation for their effort in this regard. Canada followed with 18%, GDR with 16% and each of the other countries contributed from 2 to 7% of the reports.

Presentations on Nutritive Value of Rapeseed Products comprized ten paper and 38 poster presentations. Current areas of research interests among those countries engaged in rapeseed production are indicated by the following breakdown of reports. Concern about glucosinolate metabolism or detoxification was the theme of 25% of the reports, suggesting that glucosinolate content of rapeseed meal remains a major deterrent to its feeding value. Studies involving ruminants fed rapeseed meal, seed or forage were the concerns of 20% of the reports and 15% concerned swine feeding. Various aspects of protein quality and amino acid availability were involved in 10% of the reports and 10% also pertained to poultry nutrition. Approximately 8% of the reports were devoted to each of rapeseed oil and to rat and mink studies.

Let us now turn to the matter of highlighting what has emerged in terms of new developments affecting the nutritive value and use of rapeseed products. Presentations and reports have been grouped into interest categories which reveal a major interest in glucosinolate metabolism and detoxification in relation to the use of rapeseed meal. Other categories include protein quality and amino acids in meal, the feeding of meal and rape forage to various species of animals and finally, studies on rapeseed oil.

A major area of interest has been the elucidation of the effects of various isolated glucosinolates when administered to animals. In rat studies 10 different intact glucosinolates fed with and without myrosinase were evaluated in diets containing no other rape products for effects on energy and nitrogen balance and compared with double-low rapeseed meal. Further research was reported on the use of copper for detoxification of glucosinolates in rapeseed meal, including favorable results in pig feeding trials.

A second rat study defined 20 μM (per gram of RSM) alkylene glucosinolates (excluding indole clucosinolate) as the maximum tolerance in terms of thyroid enlargement when fed diets containing 10%

of protein from rapeseed meal. In a third rat study, low and high glucosinolate rapeseed meals were fed to supply similar levels of progoitrin. The results from feeding the low glucosinolate meal were less favorable in terms of thyroid and organ weights than with high glucosinolate meal. Supplemental myrosinase increased the effects.

A fourth rat experiment involved the administration of purified progoitrin and oxazolidinethione to conventional and germ-free rats.

In parallel studies in which in vitro degradation of progoitrin and oxazolidinethione in feces, cecum and colon contents from rats (conventional and germ-free) was examined, it was found that no degradation of glucosinolates occurred in contents from germ-free rats but from 19 to 55% degradation of progoitrin occurred in contents of conventional rats. Oxazolidinethione was not affected.

A report on chickens also underlined the importance of microflora in the gastrointestinal tract in relation to glucosinolate breakdown. It was reported that either supplemental dietary antibiotics or removal of the ceca resulted in increased recovery of glucosinolates in the feces. Less than 15% of the glucosinolate consumed was absorbed in the upper part of the digestive tract. A poster presentation contained information on the location and time of glucosinolate decomposition in the hen fed rapeseed meal without active myrosinase.

In pigs given rapeseed meal or potassium thiocyanate, both materials resulted in increased levels of SCN^- in the serum and the urine. Serum T_3 was depressed.

Several interesting reports pertained to rapeseed protein quality. The Polish double-low cultivar "Start" was fed as meal to pigs in digestibility and nitrogen balance studies with very favorable results. In another report amino acid digestibility coefficients determined by using both fecal and ileocecal re-entrant cannula methods provided comparative data on rapeseed meal, barley and combinations. Larger differences among amino acid digestibility coefficients were found using the ileocecal method than with the fecal method. It was concluded that digestion coefficients derived separately from barley and from rapeseed meal tests could be used to predict amino acid availability in various mixtures of barley and rapeseed meal.

In studies with rats fed either casein or protein concentrate from rape, it was found that following feeding the blood levels of amino acids showed the digestion rate of rapeseed protein was one-half that of casein for the first three hours after consumption, but the two were relatively similar thereafter. The amino acids lysine, arginine and cystine of rapeseed protein were absorbed more slowly than those amino acids from casein during the first three hours and this was to the advantage of rapeseed proteins. (These findings may help to explain the very high PER values reported earlier for rapeseed protein.)

One study showed that rats grew as well on low glucosinolate rapeseed meal as on soybean meal in wheat-based diets when fed to

provide similar amounts of digestible lysine. An experiment with rats conducted through four successive parities showed similar reproductive performance on diets supplemented with low glucosinolate rapeseed meal when compared with soybean meal.

The cell wall fibre of the cotyledon of rapeseed may be responsible for some reduction in the availability of zinc and in the metabolizable energy value of rapeseed meal.

Three experiments demonstrated successful use of low glucosinolate rapeseed meal in broiler chicken diets but with laying hens levels exceeding about 12% resulted in some reduction in percentage of fertilized eggs. Pheasants fed 36 to 38% dietary levels of rapeseed meal of either low or high glucosinolate content and especially along with 15% whole seeds showed reduced fertilization of eggs and embryo deaths.

Several experiments with growing and finishing pigs confirmed the superiority of low glucosinolate rapeseed meal compared with high glucosinolate meal. Good performance was obtained with weanling pigs fed low glucosinolate rapeseed meal in combination with other protein supplements, soybean meal, fish meal and dried skim milk. A large, four parity experiment compared low glucosinolate rapeseed meal with soybean meal and combinations. Rapeseed meal permitted reproductive performance by gilts and sows equal to that obtained with soybean meal. In one report it was shown that the digestibility of rapeseed meal is markedly affected by the age of pig to which it is fed and that neutral detergent fibre content of the diet affects the digestibility of both protein and energy and therefore of rapeseed meal included in the diet.

In studies with sheep, ewes fed straw diets containing 20% high glucosinolate rapeseed meal through two reproductive cycles had lambing percentages and milk yields equal to those ewes fed soybean meal to provide the same amount of protein. Thiocyanate found in the milk of ewes fed rapeseed meal had no apparent adverse effect. Fattening lambs fed 20 or 30% low glucosinolate rapeseed meal showed diet digestibility and growth performance equal to those of the control lambs. Rape fed as a green forage was found to be 86 to 89% digestible.

Rapeseed as an oil and protein source was found to be satisfactory in mink diets provided that double low rape products were used.

Three reports dealt with the nutritional utilization of high erucic acid oils. A study on mustard oil revealed that interesterification of the oil improved its digestibility and reduced its adverse effects on serum cholesterol and triglycerides. Other reports indicated that pectins and agar as dietary components may alter the blood and tissue composition of rats fed high erucic rapeseed oil.

In one study of the conversion of alpha linolenic acid to docosahexaenoic acid and the role of the latter fatty acid in the retina and cerebral cortex it was found in rats that canola oil can influence the fatty acid composition of the membrane phospholipids in neural tissues of animals.

Possibly the highlights of the nutritional presentations would include the following aspects:

- toxicity of individual glucosinolates and the role of intestinal and cecal microflora in glucosinolate degradation.
- amino acid availability in rapeseed protein, including sequence and rate of intestinal hydrolysis.
- effects of dietary fibre and age of pig on protein and energy digestibility.
- effects of dietary pectins and agar on rapeseed oil utilization in the body.
- effects of cotyledon cell wall matter on nutrient absorption.
- further demonstrations of the superiority of low glucosinolate rapeseed meal.