Stronger toasted rapeseed meals contain less glucosinolates, however, the *in vitro* protein quality is changed

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The glucosinolate concentration of solvent extracted rapeseed meal (RSM) depends on the glucosinolate content of the used seed batch and on the processing, particularly the temperature and the residence time in the toaster. Higher temperatures and a longer residence time in the toaster inactivate glucosinolates. In the oilmills, the bi-layered decks of the dryers (toasters) carrying the steamed (desolventized) meal are heated up to 130 ° C, with 20 to 60 min residence time (Münch 2005).

In a study, RSM from 10 oilmills differed very strongly in its glucosinolate content (SCHUMANN, 2005). In the present investigation, a stronger toasting was hypothesized for the RSM with lower glucosinolate content with the consequence of a protein damage which should be evidenced.

In RSM with differences of the glucosinolate content the concentration of the lysine as reference amino acid should be determined and its availability as possible measures of the degree of protein damage. Beside the amino acid analysis the homoarginine (HA) method was used to determine the available lysine. It bases on the guanidizing of the free epsilon amino group of the lysine to HA by a thiourea compound. Heat damaged lysine with blocked epsilon amino groups can not be guanidized and therefore it is determined unchanged as lysine and not as HA.

The ruminant produces high quality protein with all essential amino acids by the rumen microbes which is digested in the stomach and small intestine liberating all amino acids including the lysine. However, the amount of microbial protein seems to be not sufficient to meet the protein requirement of highly yielding cows, i.e. more than 35 litre milk per day. There is the possibility of an increased portion of the feed protein escaping the microbial degradation in the rumen and being available as direct feed amino acid source in the stomach/duodenum. More heat could change the portion of protein which passes the rumen and therefore the duodenally utilizable protein (uCP) and rumen undegradable protein (UDP) should also be investigated (for explanation see GfE, 2001).

Methods

Two types of RSM from two oilmills, with 10 samples each, either with lower GSL content of 2.4 ± 0.8 mmol/kg dry matter (DM or with higher GSL content of 13.8 ± 2.8 mmol/kg DM, were analysed (Tab 1). The different glucosinolate content of the two rapeseed batches indicates the different processing conditions with stronger meal toasting in oil mill A versus a weaker toasting in oil mill J.

Table 1 Glucosinolate concentration of rapeseed and rapeseed meals in the oil mills A and J (Schumann, 2005)

Oil mills Samples (number)	A	J
	mmol/kg dry matter	
Rapeseed	14,6 ± 5,9 (141)	15,3 ± 3,9 (153)
Rapeseed meal [1)]	2,5 ± 1,9 (80)	14,4 ± 3,2 (41)
Whereof for the present investigation	2,4 ± 0,8 (10)	13,8 ± 2,8 (10)

1) the glucosinolate content was analysed with the HPLC method according to EU (1990)
2)

The crude protein was determined as N (multiplied by the factor 6.25) according to the Kjeldahl method; for the amino acid analysis an amino analyser (Biochrom 20 from Pharmacia) was used (Bassler and Buchholz 1986).The detection of the available lysine via the HA method was described by Mauron and Bujard (1964). The method of determination of the uCP and that of the UDP according to the modified Hohenheim gas test is given by Steingass et al., 2001.

The results are given as arithmetic mean and standard deviation. The means were compared by STUDENTs` t test.

Results and discussion

The RSM with the lower glucosinolate content contained significantly less lysine, by 9 %, compared to the RSM with the higher glucosinolate content, although crude protein content was similar. In case of standardizing at 100 g crude protein the difference between the lysine concentrations rise to more than 10 %. The availability of the lysine measured by the guanidation of lysine with p-methyl isothiourea to HA differed significantly by 4.5 percent units, i.e. 6 % relatively. A lower

content and lower availability of the lysine in the stronger toasted RSM (indicated by the lower glucosinolate content) resulted in 2.5 g /kg meal less available lysine, i.e. 12 % less available lysine on meal basis and 15 % on basis of 100 g crude protein compared to the weaker toasted RSM (indicated by the higher glucosinolate content).

Regarding the protein measures for the ruminant the stronger toasted RSM contained 11 % more uCP and 20 % more UDP than the weaker toasted RSM. In both cases the significant difference means less microbial degradation of rapeseed protein in the rumen. More of such heat protected feed protein could be available in the duodenum as direct feed amino acid source complementary to the microbes` protein, suggesting that duodenal amino acid availability is less reduced than ruminal protein degradation.

Table 2: Protein quality of rapeseed meals from two oilmills (10 samples per meal)

Toasting	mmol/kg dry	Stronger			Weaker		
Glucosinolates	matter, DM	2.4 ± 0.8			13.8 ± 2.8		
Crude protein, CP	g/kg DM	394	±	12	387	±	9
Lysine	g/kg DM	20.3	±	0.8 [b]	22.2	±	0.8 [a]
Lysine	g/100 g CP	5.15	±	0.13 [b]	5.74	±	0.16 [a]
Available lysine	%	75.1	±	3.2 [b]	79.6	±	2.0 [a]
Available lysine	g/kg DM	15.2	±	0.8 [b]	17.7	±	0.7 [a]
Available lysine	g/100 g CP	3.86	±	0.18 [b]	4.56	±	0.16 [a]
Utilizable protein, uCP	g/kg DM	331	±	16 [a]	298	±	6 [b]
Undegradable protein, UDP	g/kg DM	230	±	20 [a]	192	±	10 [b]

[a,b] Means of the same line with different superscripts are significantly different.

Conclusion

A strong toasting of RSM in the oil mill increases the utilizable protein for the ruminant, however, it lowers the available lysine and thus the protein quality with regard to pig and poultry. Thus, RSM with lower glucosinolate content due to processing should be preferred for the ruminant feeding, however, for pigs and poultry a supply of extra lysine is required in such a strongly heated meal. Aiming the lowering of glucosinolate content of rapeseed the strategy of the plant breeding still has to have priority over certain measures in the processing. Further investigations in ruminants are necessary to define the reliable degree of feed protein protection in the rumen with a possibly high availability in the stomach and duodenum, respectively.

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