THE EFFECT OF DIFFERENT GRINDING AND THERMAL OR HYDROTHERMAL TREATMENT METHODS ON THE DIGESTIBILITY AND FEEDING VALUE OF 00-RAPESEED BY PIGS

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ABSTRACT

In digestibility trials with pigs the effects of mixed grinding, flaking, grinding with roller mill and treating with Micronizer, Jet Sploder and hydrothermal procedures at different temperatures on digestibility of rapeseed were studied. In addition the fat availability and protein solubility were determined. The particle size has a great influence on the digestibility of organic matter.

INTRODUCTION

After reducing the glucosinolate content of rapeseed by breeding, the fineness of grinding and the fiber content of rapeseed have a major influence on the feeding value. From Heidenreich and Löwe (1993) it was shown, that the grinding procedure and some thermal or hydrothermal treatment methods influence the availability of fat, the solubility of protein and the glucosinolate content of rapeseed. It seemed necessary to study how these in vitro dates correlate with in vivo results.

EXPERIMENTAL

Materials and Methods

Rapeseed, variety Lirajet, was treated with different grinding and thermal or hydrothermal procedures. Applied were 1. grinding with hammermill (1,5 mm sieve hole diameter), a mixture of rapeseed and barley (1:2,25) . 2. Flaking with a roller mill, grinding with a roller mill at different slit extents to get 3. coarse and 4. fine crushed rapeseed . Thermal treating with micronizer at 5. 105 °C + flaking and 6. at 125 °C + flaking 7. whole corn micronized , with a jet sploder at 8. 105 °C and 9. 125 °C (both flaked) . Hydrothermal treated at 10. 98 °C and 11. 105 °C. The thermal procedures had the aim to diminish the glucosinolate content.
It was studied the influence of the different methods on :
- content of crude nutrients

- the in vitro availability of fat, measured with a method, which was published by Carew et.al. (1961)
- the in vitro solubility of protein determined with a Lufa method, published by Naumann and Basler (1976).
- the total glucosinolate content, measured with HPLC
- the average particle size determined by sieve procedure (d_m mm)
- the digestibility of crude nutrients at pigs and the daily N-retention

The digestibility trials with pigs (60 - 70 kg live weight) were carried out by applying the difference procedure. In preperiod barley and premix were fed. In the collection period a part of barley was substituted by rapeseed. Following ration was fed: 1520 g barley, 680 g 00-rapeseed, 50 g premix .

Table 1 Rapeseed, ground and treated with different procedures analytical results

	Ingredients and other parameters							
	Dry matter	crude protein in dry matter	crude fat	crude fiber	particle size	protein in solubility	fat availability	glucosinolate (91%DM)
	g/kg feed	g/kg	g/kg	g/kg	mm	%	in %	µmo/g	
whole corn	930		207	442	195	-	-	-	7,8
mixed ground	898		173	168	79	0,62	21	78	-
flaked	935		200	404	72	0,65	37	82	7.8
roller mill:									
coarse	937		205	440	193	1,18	37	29	7,7
fine	939		204	437	125	0,47	38	89	6,4
micronizer + flaked									
105°C	960		208	450	66	0,74	31	89	7,9
125°C	968		204	437	67	0,73	17	93	6,7
125°C									
not flaked	966		209	440	68	-	18	60	5,8
jet sploder + flaked									
105°C	963		194	410	70	0,79	35	79	6,7
125°C	962		200	411	66	0,72	28	88	6,4
hydrothermal treated + flaked									
98°C	917		207	412	71	1,16	16	63	6,4
105°C	914		207	401	70	1,15	11	58	5,2

Results and Discussion

Most of the crude nutrients were not influenced by grinding or thermal procedures. Only the crude fiber content was diminished by fine grinding (Table 1). The in vitro availability of fat was correlated with particle size (r = -0,83). If the particle size rises above 1,0 mm the fat availability decreases. This trend was lowered, when the hydrothermal treated rapeseed was flaked. A close correlation (r = 0,85) was calculated between fat availability and fat digestibility by the pig. The hydrothermal treated rapeseed variants show only a small decrease in fat digestibility, when fat availability was lowered. The protein solubility, the protein digestibility by pigs and N-retention were decreased, when the thermal treatment temperature rose above 100 °C.

The whole seed without ginding is poorly digested by the pig. Nearly eighty percent of the organic matter were excreted, when the whole corn was fed. Grinding poor rapeseed with hammermill analogous to cereals is not practicable because the oil is pasting up the mill.

Table 2 Influence of grinding methods and thermal or hydrothermal treatments in connection with flaking on the digestibility of crude nutrients and the N-balance

	Digestibility % Organic matter	Crude protein	Crude fat	Crude fiber	NFE	N-retention g/d	N-retention percent of intake
seed not ground	21	30	7	2	47	13,1	30
mixed with barley crushed with hammer mill	76	82	70	58	91	17,9	81
flaked roller mill	78	83	83	76	55	19,1	83
coarse	65	79	55	50	77	18,4	78
fine micronizer	78	83	80	57	78	19,0	82
105 °C + flaked	79	85	81	49	78	18,0	86
125 °C + flaked	75	82	75	48	76	16,1	81
whole corn jet sploder	23	24	11	11	46	12,4	24
105 °C + flaked	80	86	79	54	82	21,7	84
125 °C + flaked	76	81	77	45	79	19,6	81
hydrothermal treatment							
98 °C + flaked	77	89	74	53	81	21,1	85
105 °C + flaked	78	88	73	47	85	22,0	88

Therefore mixgrinding with cereals frequently is applied in feed plants . Roller mills mainly are used in oil mills.The digestibility of organic matter was influenced by particle size (r = -0,76) and by fat availability (r= 0,72). The average particle size should not exceed 0,75 mm (exceptions are hydrothermal treated variants). The fat availability should not decrease below 75 %. The glucosinolate content was reduced by fine grinding or dry heating about 15 %. By hydrothermal treatment at 105 °C it was reduced to 50 %.

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