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Intake, feed efficiency and milk composition of cows fed flax meal

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Introduction and Objective

- Flax and linola (*Linum usitatissimum*) contain about 40% fat and 20% crude protein (CP; Petit, 2003).
- Flax is rich in omega 3 fatty acids (55% of total fatty acids).
- Flax is the richest source of the plant lignan secoisolariciresinol diglucoside (Prasad, 1997), a strong antioxidant.
- Flax comes from the blue-flowered plant crop grown mainly in the cool, northern climate of the western Canadian prairies.
- Canada is the world's leader in the production and export of flax, a position it has held since 1994.
- The objectives were to determine the effect of increasing levels of flax meal (FM) on dry matter (DM) intake (DMI), feed efficiency, and milk production and composition.

Materials & methods

- Eight lactating Holstein cows with a ruminal fistula were allotted to a replicated 4 x 4 Latin square design. Cows averaged 686 (SE 35) kg and 112 (SE 21) days in milk.
- Four (4) diets were fed for *ad libitum* intake: 0 (CON), 5% (5FM), 10% (10FM) and 15% FM (15FM) in the dietary dry matter (15FM).
- Four 21 d periods:
  - ✓ Feed intake and milk yield were measured daily and data averaged over the 7 d of the 3rd week.
  - ✓ Samples of diets taken once weekly and pooled within period.
  - ✓ On day 21, milk samples were taken from am and pm milkings and analyzed for fat, lactose, and protein by IR spectrophotometry
- Data were analyzed as to a replicated 4 x 4 Latin square design using PROC MIXED of SAS.

Results

✓ There was a linear effect of treatment (P=0.01) on DM intake as a result of higher intake with an increased level of FM in the diet.

✓ Concentration of FM in the diet had no effect on feed efficiency, milk production and composition and yield of milk components, with the exception of lactose proportion in milk that showed linear (P=0.10), quadratic (P=0.03) and cubic (P=0.09) effects with an increasing level of FM in the diet.

Table 1. Ingredient and chemical composition of the experimental diets

	CON	5FM	10FM	15FM
Ingredient, g/kg DM				
Grass silage	315	316	317	314
Corn silage	292	291	290	290
Ground maize grain	211	202	192	189
Soybean meal (48% CP)	108	74.5	41.4	20.4
Beet pulp	34.3	29.6	25.0	16.1
Calcium carbonate (35% Ca)	5.5	5.5	5.4	5.5
Flax meal	0	47.9	95.3	141.0
Protein supplement	17.4	17.4	17.9	8.5
Minerals and vitamins	16.4	16.3	16.3	15.5
Chemical				
DM, %	37.7	37.9	37.6	38.1
CP, % of DM	17.0	17.4	17.6	17.9
Ether extract, % of DM	2.44	2.41	2.34	2.41
NDF, % of DM	28.4	28.6	29.5	29.6
ADF, % of DM	18.3	18.5	19.2	19.3
NE_L, KJ/kg of DM	6.65	6.61	6.61	6.61

Table 2. Dry matter intake (DMI), milk yield and milk composition of Holstein cows fed no flax meal (CON), or 5 (5FM), 10 (10FM) and 15% (15FM) flax meal

	CON	5FM	10FM	15FM	SEM	Linear	Quadratic	Cubic
DMI (kg/d)	21.0	20.3	21.1	22.0	0.3	0.01	0.14	0.01
DMI (% of body weight)	3.03	3.03	3.17	3.27	0.07	0.01	0.50	0.08
Milk yield (kg/d)	35.5	36.5	36.0	36.0	0.8	0.76	0.54	0.60
Feed efficiency (kg milk/kg DM)	1.70	1.73	1.69	1.68	0.03	0.33	0.45	0.22
Milk composition (%)								
Fat	3.69	3.57	3.40	3.63	0.09	0.36	0.07	0.28
Protein	3.58	3.52	3.55	3.53	0.03	0.32	0.47	0.67
Lactose	4.49	4.60	4.57	4.56	0.02	0.10	0.03	0.09
Total solids	12.7	12.7	12.5	12.7	0.1	0.45	0.17	0.48
Yield of milk components (kg/d)								
Fat	1.32	1.27	1.24	1.29	0.03	0.40	0.14	0.35
Protein	1.28	1.25	1.29	1.25	0.03	0.76	0.93	0.98
Lactose	1.63	1.66	1.69	1.65	0.04	0.60	0.33	0.55
Total solids	4.58	4.53	4.58	4.54	0.09	0.85	0.93	0.92

Discussion

- ✓ Previous results indicated that FM can be fed at 15% of the dry matter in the diet of late-lactating dairy cows as indicated by no effect of FM level on feed intake, milk yield, and milk composition (Petit and Gagnon, 2009).
- ✓ FM supplementation can improve the oxidative status of Holstein cows as suggested by decreased TBARS production in ruminal fluid 2 h post-feeding and increased NFE2L2/Nrf2 mRNA abundance in mammary tissue (Schogor et al., Br. J. Nutr. In Press).

Conclusions

- Flax meal may be used in practice to replace other protein supplements in the diet without detrimental effect on DMI and milk production and composition.

References

Petit, H.V. 2003. J. Dairy Sci. 86:2637-2646; Petit and Gagnon, 2009. Anim. Feed Sci. Technol. 152:103-111; Prasad, K. 1997. Mol. Cell. Biochem. 168:117-121.

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