Comparison of Traditional Canola, *Low-Poly* Canola, and Rapeseed Meals as Modifiers of Bovine Milk Fatty Acid Profile

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NRC, 2001

Canola meal composition





Penn State Experiment

- Eight lactating dairy cows; 109 ± 15.1 days in milk at the beginning of the trial in a replicated 4 × 4 Latin square design trial
- □ Average milk yield: 49 ± 2.1 kg/d (108 lbs/d)
- □ One square, 4 cows, were ruminally cannulated
- □ Four, 17-d periods (12 d for adaptation)
- □ Treatments were canola/rape meals fed at around 12-13% of DM:
 - (1) traditional, solvent-extracted canola meal (CONTROL);
 - (2) traditional, mechanically-extracted canola meal (CANOLA);
 - (3) low-polyunsaturated, mechanically-extracted canola meal (LOWPOLY);
 - (4) low-glucosinolate, mechanically-extracted rapeseed meal (RAPESEED)
- Data analyzed using PROC MIXED; cow was random



Analyses from DairyOne

Chemical composition of the meals



CP, % of DM

% of DM	Control	Canola	LowPoly	Rape
Crude protein	43.0	32.8	45.2	34.3
NDF	33.3	28.3	25.7	34.1
NFC	20.3	21.1	13.7	12.1
NEL, Mcal/kg	1.74	2.32	2.37	2.35

Fatty acid composition of canola and rapeseed meals (g/100 g FA)

Meal	EE, %	16:0	18:0	18:1	18:2	18:3	20:1	22:1
CONTROL	3.1	6.5	1.4	63.1	25.8	2.7	ND	ND
CANOLA	16.1	5.1	1.9	60.0	20.3	9.0	1.2	0.1
LOWPOLY	13.7	3.6	2.5	76.1	10.1	3.5	1.5	0.1
RAPESEED	17.9	3.3	1.2	16.7	12.8	6.4	9.8	42.0

EE from DairyOne



Basal diet chemical composition

% of DM	Control	Canola	LowPoly	Rape
СР	16.0	14.9	16.6	15.1
NDF	31.1	31.3	31.0	32.1
Ether extract	3.9	5.5	5.2	5.7
NEL, Mcal/kg	1.48	1.55	1.56	1.57
NEL intake, Mcal/d	45.8	45.3	45.0	44.3
MP intake, g/d	3,393	3,013	3,269	2,926
MP balance, g/d	229	-29	221	-36



PENNSTATE



Rumen fermentation data

Item	Control	Canola	LowPoly	Rape	SEM	P =
рН	6.25b	6.34ab	6.36a	6.25b	0.059	0.041
VFA, mM	125.4	120.9	115.8	119.7	5.37	0.27
Acetate	74.7a	68.8b	65.6b	69.5b	2.28	0.006
Propionate	29.5	31.8	29.8	29.7	3.11	0.58
Butyrate	15.6	14.4	14.2	14.8	0.66	0.39
Ammonia, mM	6.3	5.1	6.3	6.5	0.67	0.41



Estimated microbial protein synthesis





Total tract apparent digestibility

Digestibility, %	Control	Canola	LowPoly	Rape	SEM	P =
DM	61.2ab	61.8ab	60.8b	62.5a	0.69	0.10
ОМ	62.9	63.2	62.5	63.9	0.71	0.17
Ν	59.7	59.8	62.4	60.2	0.90	0.21
NDF	36.0ab	36.0ab	34.5b	38.6a	1.64	0.033
ADF	27.7b	26.7b	26.3b	30.6a	1.37	0.026



Production effects

ltem	Control	Canola	LowPoly	Rape	SEM	P =
DMI, kg/d	30.9a	29.3b	28.9b	28.3b	0.81	0.001
Milk, kg/d	47.1 a	44.9b	46.7ab	45.0b	2.11	0.047
3.5% FCM, kg/d	41.7a	39.7b	41.0ab	40.8ab	2.24	0.11
3.5 FCM/DMI	1.35c	1.35bc	1.41ab	1.45a	0.057	0.021
Milk fat, %	2.81	2.80	2.75	2.94	0.201	0.54
Milk protein, %	2.98	3.00	2.95	2.93	0.053	0.32
MUN, mg/dl	13.3b	12.6b	14.7a	12.6b	0.87	<0.001



Manure gas emissions measurements





Manure ammonia emissions





Effects on milk FA composition



Chillard et al., 2009

Free, unsaturated FA may reduce intake and milk yield



Penn State experiment: milk fatty acids $-\Sigma C18:1$





Milk fatty acids – Σ saturated





Milk fatty acids – Σ MUFA





Milk fatty acids $-\Sigma transFA$





Milk fatty acids $-\Sigma CLA$





Conclusions

- □ High-oil canola and rapeseed meals:
- reduced DMI of high-producing dairy cows
 - This resulted in reduced milk yield, except LowPoly
 - LowPoly and rapeseed increased feed efficiency
- Ruminal acetate concentration was reduced by the experimental meals, but total tract fiber digestibility was not affected
- □ LowPoly increased manure ammonia emissions
- The experimental meals had a profound effect on milk fatty acid profile, reducing concentration of total saturated and increasing the sum of monounsaturated and *trans* fatty acids compared with the control

