Dietary strategies to optimize milk production and composition of dairy goats fed a high-concentrate diet

S Dion*[12], ME Brassard[2], J Levesque[3], DE Rico[3], R Gervais[2], PY Chouinard[12]

[1]Institute of Nutrition and Functional Foods, Université Laval, Québec, QC, Canada,
[2]Département des sciences animales, Université Laval, Québec, QC, Canada,
[3]Centre de recherche en sciences animales de Deschambault, QC, Canada.

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Introduction

In early lactation, dairy goats undergo changes in rumen fermentation that can impair milk fat synthesis, due mainly to high levels of dietary concentrates. Dietary fat supplementation could be an effective way to modulate milk performance and fatty acid composition.

Objective

To evaluate how dietary lipid supplements of different fatty acid compositions affect milk performance when early lactation dairy goats are fed a high-concentrate diet.

Material and Methods

30 early-lactating Alpine goats, housed in pens with Calan gate feeders were allocated to 1 of 10 blocks according to milk fat concentration and assigned randomly to 1 of 3 treatments:

- **CTRL)** TMR with a forage-to-concentrate ratio of 55:45
- **PALM)** CTRL + 2% by-product of palm oil (88% of 16:0)
- **FLAX)** CTRL + 7% extruded linseed (49% of *c*9, *c*12, *c*15 18:3)

A 23 ± 5 d pretreatment period was used as a covariate. Treatment effects were compared with the Tukey adjustment for multiple pairwise comparisons.

Ingredient and nutrient composition of experimental diets

Item, % of DM	Pretreatment	CTRL	PALM	FLAX
Ingredient				
Alfalfa silage	55.0	45.0	45.0	45.0
Ground barley	32.3	41.1	38.7	38.7
Cracked corn	3.9	3.9	3.9	3.9
Corn gluten meal	1.8	3.0	3.4	3.4
Flaxseed meal	2.9	2.9	2.9	-
Bran	2.1	2.1	2.1	-
Palmit 80[1]	-	-	2.0	-
Val 160[2]	-	-	-	7.0
Mineral-Vitamin mix[3]	2.0	2.0	2.0	2.0
Nutrient composition				
DM, % as fed	40.1	44.5	44.5	44.7
CP	17.0	17.0	16.6	16.7
NDF	27.4	25.4	25.5	25.1
Starch	17.9	20.1	19.4	18.7
NE_L, Mcal/kg of DM[4]	1.60	1.65	1.71	1.71
Total fatty acids (FA)	2.3	2.3	4.0	4.0
FA, g/100 g FA				
16:0	20.6	22.1	49.2	15.7
*c*9, *c*12 18:2	32.1	34.3	19.6	26.6
*c*9, *c*12, *c*15 18:3	28.3	25.8	14.3	37.6

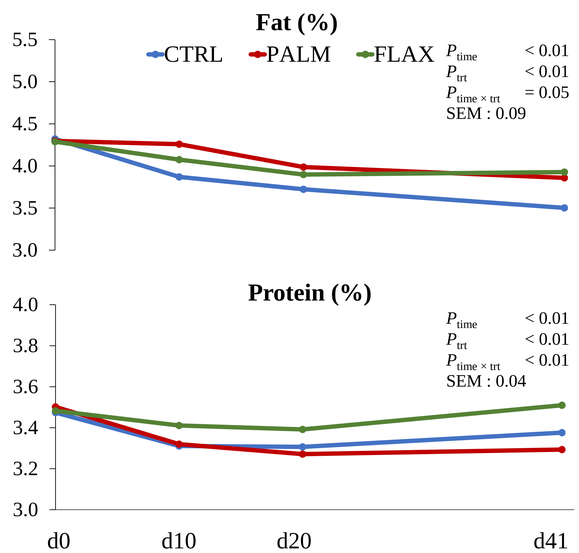
[1]Palmit 80® : a by-product of palm oil industry, as a source of 16:0 (88% of FA)
[2]Val 160™ : extruded linseed, as a source of *c*9, *c*12, *c*15 18:3 (49% of FA)
[3]Minéral Synchro 20-2T, La Coop, Montréal, Qc, Canada.
[4] Theoretical values of the SRNS formulation software (version 1.9.6, Tedeschi et al., 2010)

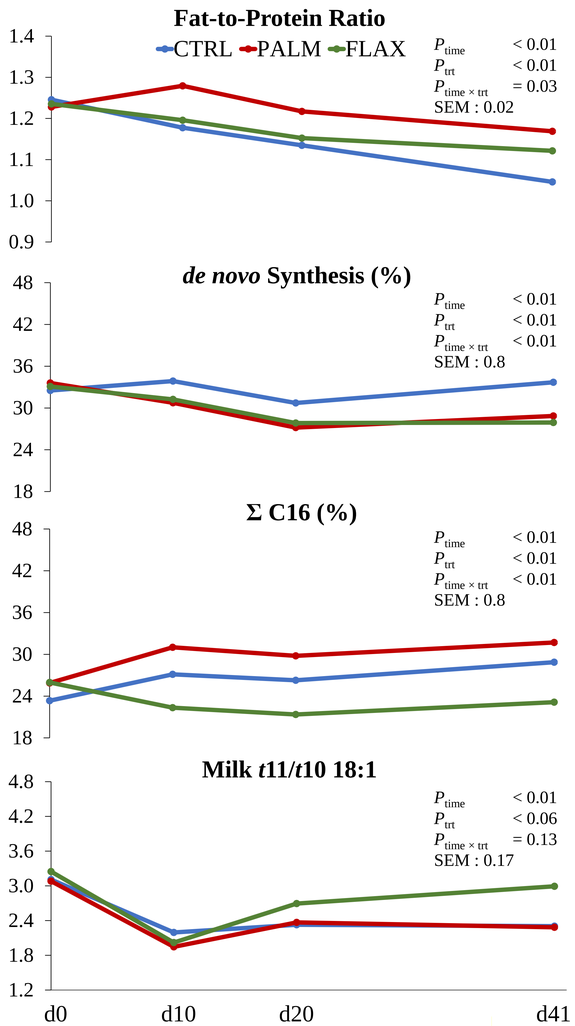
Results

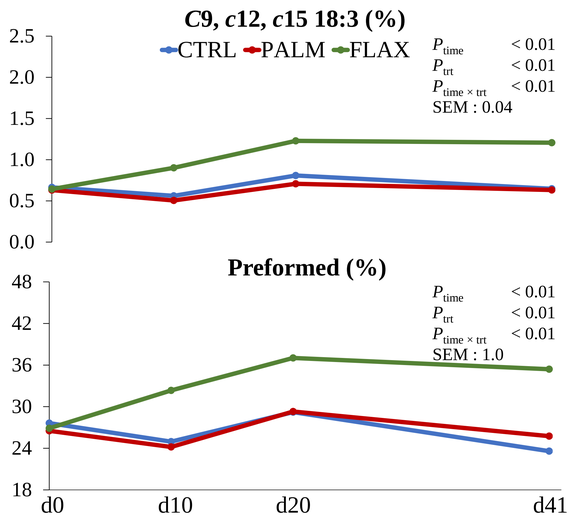
Body weight, dry matter intake (DMI) and milk performance

Parameter	CTRL	PALM	FLAX	SEM	P_{trt}[1]
Body weight, kg	61.1	59.4	60.3	0.7	0.23
DMI, kg/d	3.57	3.22	3.31	0.16	0.29
Milk Yield, kg/d					
Measured	4.85	5.05	4.56	0.27	0.23
Energy corrected (ECM)	4.45	4.82	4.42	0.22	0.21
Fat corrected (4 %) (FCM)	4.55	4.95	4.48	0.23	0.17
Feed efficiency, kg/kg					
Measured/DMI	1.39	1.54	1.40	0.07	0.29
ECM/DMI	1.27	1.48	1.36	0.07	0.14
FCM/DMI	1.31	1.51	1.38	0.07	0.14
Milk Composition					
Fat,					
%	3.60b	3.92a	3.90a	0.08	<0.01*
g/d	174	196	177	8	0.08
Protein					
%	3.33ab	3.29b	3.45a	0.04	0.01*
g/d	160	166	156	8	0.50
Lactose					
%	4.32	4.35	4.41	0.04	0.22
g/d	209	219	201	11	0.32
Fat-to-protein ratio	1.09b	1.19a	1.14ab	0.02	<0.01*
Urea, mg/dL	31.1	29.5	29.0	0.7	0.07

[1]$P_{time \times trt}$: * ≤ 0.05







Relative differences (%)

	PALM vs CTRL	FLAX vs CTRL
Intake		
*c*9, *c*12 18:2 (ω-6)	-12	+28
*c*9, *c*12, *c*15 18:3 (ω-3)	-7	+138
Total FA	+44	+65
Milk Secretion		
*c*9, *c*12 18:2 (ω-6)	+11	+15
*c*9, *c*12, *c*15 18:3 (ω-3)	-2	+77
Total ω-6 FA	+11	+15
Total ω-3 FA	-3	+56
Transfer Efficiency		
*c*9, *c*12 18:2 (ω-6)	+18	-15
*c*9, *c*12, *c*15 18:3 (ω-3)	+2	-27
Total ω-6 FA	+18	-15
Total ω-3 FA	+2	-36

Conclusion

Results indicates that feeding lipid supplements increases milk fat concentration and that milk fat composition is affected according to the FA profile of the lipid supplement.

Acknowledgments

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