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Effects of concentrate level and starch degradability on milk yield and fatty acid (FA) composition in goats receiving a diet supplemented with sunflower oil.

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Lipid composition is one of the most important components of the technological and nutritional qualities of goat milk that could be extensively modified by nutritional factors such as lipid supplementation. The effect of lipid added to the diet on milk FA composition depends on their level and form of presentation (seed or oil) in interaction with the forage:concentrate ratio and the nature of forage and concentrate (Chilliard *et al.*, 2003).

In this experiment, dietary treatments were chosen to investigate the effects of different forage:concentrate ratios and different degradable starch in concentrate with a lipid supplement rich in C18:2 (n-6) on milk yield and FA composition. The 2 starch-rich feedstuffs were chosen in order to modify ruminal physico-chemical conditions to allow different patterns of CLA and *trans*-C18:1 (including *trans*-11) isomers into milk.

Animals and diets

Fourteen mid-lactating goats were used indoor in 3 X 3 Latin Square design, 3 diets supplemented with 130 g/d of sunflower oil (SO; i.e. 5.8% of diet DM) and differing in their concentrate level: 0.8 kg/d (**F-SO**) vs 1.4 kg/d and, for the latter, by the ruminal degradability of the starchy (DS) concentrate, either corn grain (**SlowDS-SO**) or flattened wheat (**RapidDS-SO**) delivered at 1 kg/d.

Results

High concentrate diets increased ($P < 0.05$) total dry matter intake (+205 g/d), increased milk (+525 g/d), protein (+19 g/d) and lactose (+27 g/d) yields, had no effect on fat yield and decreased milk fat content (-3.8 g/kg).

Diets **SDS-SO** and **RDS-SO** compared to **F-SO**, increased ($P < 0.05$) 8:0 to 14:0 and *trans*-10 18:1, decreased *cis*-9 18:1, *trans*-6+7+8, *trans*-9 and *trans*-11 18:1 isomers, *cis*-9, *trans*-11-CLA and the sum of *trans*-FA (18:1 and 18:2) percentages.

RDS-SO, compared to **SDS-SO**, increased ($P < 0.05$) milk lactose content, increased 6:0 to 16:0, *trans*-10 18:1 and 18:2 (n-6), decreased 18:0, *trans*-11 and *trans*-12 18:1 isomers, *cis*-9 18:1, *cis*-9,*trans*-11 CLA and the sum of C18 FA percentages.

The atherogenicity index (C12+4C14+C16/sum of unsaturated FA) was increased by 33% and 62% for **SDS-SO** and **RDS-SO** diets, respectively, compared to **F-SO**. No effect of the level of concentrate and nature of starch was observed on the desaturation ratios for 14:0, 16:0 and 18:0, except the *cis*-9,*trans*-11 18:2/*trans*-11 18:1 that increased with **RDS-SO** compared to **SDS-SO** (results not shown).

Sampling and analysis

- Milk yield (3d/wk),
- Milk samples collected on the last week of each experimental period on d 18 and 19 (4 milking) for fat and protein content analysis (AOAC, 1997),
- 2 milk samples (a.m. and p.m. milkings) collected on d19 of each experimental period for FA determination on a combined sample.

Dairy performances

	F-SO	SDS-SO	RDS-SO
Milk yield (kg/d)	2.75 ^a	3.21 ^b	3.34 ^b
Fat yield (g/d)	101 ^a	107 ^a	109 ^a
Protein yield (g/d)	93 ^a	110 ^b	115 ^b
Fat content (g/kg)	36.76 ^a	33.31 ^b	32.57 ^b
Lactose content (g/kg)	46.87 ^a	46.86 ^a	47.76 ^b

Means (n=14) with different letters differ ($P < 0.05$)

Milk FA composition

(% total fatty acid)	F-SO	SDS-SO	RDS-SO
Major FA:			
8+10+12+14+16	35.33 ^a	40.73 ^b	45.93 ^c
18:0	15.71 ^a	15.02 ^a	12.32 ^b
18:1 <i>cis</i> -9	25.74 ^a	22.75 ^b	19.84 ^c
18:2 (n-6)	2.22 ^a	2.19 ^a	2.60 ^b
Biohydrogenation products:			
18:1 <i>trans</i> -10	0.88 ^a	1.03 ^a	2.17 ^b
18:1 <i>trans</i> -11	3.23 ^a	1.98 ^b	0.96 ^c
Other 18:1 <i>trans</i>	1.90 ^a	1.76 ^{ab}	1.58 ^b
CLA <i>cis</i> -9, <i>trans</i> -11	1.73 ^a	1.01 ^b	0.57 ^c
Σ (18:1+18:2) <i>trans</i>	8.28 ^a	6.27 ^b	5.70 ^b

Means (n=14) with different letters differ ($P < 0.05$)

We report that increasing starchy concentrate level in the diet of lactating goats (i) increases the *trans*-10 at the expense of the *trans*-11 ruminal biohydrogenation pathway as observed in milk, (ii) decreases milk *cis*-9,*trans*-11 CLA and (iii) increases the milk level of medium- at the expense of long-chain FA. These effects are more pronounced with **RDS-SO** than with **SDS-SO** diet.

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References

AOAC, 1997. Association of Official Analytical Chemists, Gaithersburg, MD
Chilliard Y *et al.* 2003. J. Dairy Sci. 86, 1751-1770.