supplementation on fatty acid profile and CLA content in dairy cow milk

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RIASSUNTO – Effetto dell'impiego del pascolo e dell'integrazione di soia sul profilo acidico e sul contenuto di CLA del latte bovino – *Tre gruppi di bovine hanno ricevuto rispettivamente una dieta unifeed con aggiunta di soia tostata (gruppo TS), o soia cruda (RS) o hanno utilizzato il pascolo con un'integrazione di concentrati e soia cruda (PRS). La quantità di soia somministrata nei tre gruppi era pari a 2,6 kg/d per capo. Dopo 84 giorni di prova, le vacche PRS hanno evidenziato un minor consumo di SS e un calo significativo nella produzione di latte rispetto al periodo di adattamento (-7,15, -5,47 e -1,68 kg per PRS, TS e RS; P<0,05). Le concentrazioni di grasso e proteina del latte non sono variate nelle tre tesi. Le bovine PRS hanno prodotto un latte con un minor contenuto di acidi grassi a corta-media catena ed una maggiore concentrazione di C18:0 e C18:1 rispetto a TS e RS. Il contenuto di CLA è risultato superiore nel latte prodotto dalle bovine PRS (0,96, 0,52 e 0,51% degli acidi grassi totali risp. per PRS, RS e TS). In conclusione, il profilo acidico e il contenuto di CLA nel latte sono stati influenzati in misura maggiore dall'impiego del pascolo rispetto al tipo di soia utilizzata.*

KEY WORDS: dairy cows, soybean, milk fatty acids, CLA.

INTRODUCTION – Conjugated linoleic acid (CLA) has been related to several beneficial effects on human and animal health (anticancerogens, antiatherogenics, *etc*.) The main dietary source of CLA for humans are foods derived from ruminants. In dairy products CLA content depends on ruminal bio-hydrogenation of the dietary unsaturated fats and it is also related to the Δ^9desaturase activity in the mammary gland. The CLA level of milk is affected by various factors, including diet composition, that seems to play an important role (Jensen, 2002). The aim of this study was to investigate the effect of toasted and raw soybean addition to a mixed diet and the combined effect of pasture and raw soybean on the yield, fatty acid profile and CLA content of dairy cow milk.

MATERIAL AND METHODS – Eighteen Friesian cows (primiparous and multiparous) in mid lactation (147±49 d) with a milk yield of 33±6 kg/d, were fed ad lib., after an adaptation period of 14 d, with one of three dietary treatments over 3 periods lasting 4 weeks each: TS (mixed diet+2.6 kg/d of toasted soybean), RS (mixed diet+2.6 kg/d of raw soybean), and PRS (pasture+concentrate+2.6 kg/d of raw soybean). The mixed diet (Forage to Concentrate ratio, F:C=50:50; 15% CP and 35% NDF on DM; 0.92 UFL/kg DM) contained: chopped corn (24.2%), barley meal (20.5%), alfalfa hay (20.5%), meadow hay (17.9%), dehydrated alfalfa hay (16.8%). The PRS group received in addition to pasture a fixed amount of chopped corn (3.5 kg/d), dehydrated alfalfa hay (2.4 kg/d), and raw soybean (estimated F:C=70:30; 13% CP and 39% NDF on DM; 0.86 UFL/kg DM). The DM intake of the TS and RS cows were measured daily, and a sample of pasture was collected weekly in order to estimate the DM intake in PRS. Milk yield was recorded daily, milk and blood samples were collected at the beginning and at the end of each experimental period. Analyses of milk fat, protein, urea (ASPA, 1995), fatty acid profile and CLA by gas-chromatographic method (Christie, 1982) were performed. The metabolic profile (total protein, urea, glucose, cholesterol, triglycerides, NEFA, Ca, P, Mg) on blood samples

(ASPA, 1999) were also carried out. All data were statistically analysed (GLM procedure) by SAS (1996).

RESULTS AND CONCLUSIONS – DM intake was similar for TS and RS groups and higher than PRS group (21.3 vs. 18.8 kg/d of DM for TS+RS and PRS resp.). No appreciable differences on metabolic profile among the dietary treatments were observed, except for the triglycerides value (0.19 *vs* 0.10 mmol/l respectively for PRS and TS+RS; P<0.05).

Table 1. Milk yield and quality.

		TS	RS	PRS	RSD
Milk yield*	kg/d	-5.47^{ab}	-1.68^{a}	-7.15^{b}	2.87
Fat	%	3.77	3.52	3.80	0.52
Fat	g/d	985B^{b}	929^{ABb}	687^{Aa}	163
Protein	%	3.15	3.30	3.06	0.17
Protein	g/d	821^{B}	888^{B}	547^{A}	95
Urea	mg/dl	29.63^{a}	29.65^{a}	36.15^{b}	3.93

A, B: P<0.01; a, b: P<0.05

**Difference between daily yield during the experimental period and the mean of the last 5 days of adaptation.*

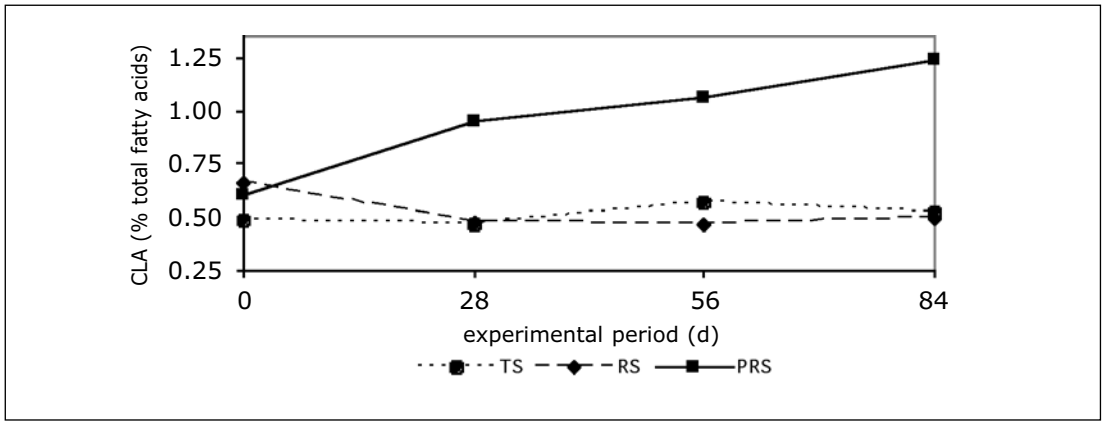
As expected, milk yield decreased significantly (P<0.05) in grazing cows than in the other groups (-7.15 *vs* -3.58 kg for PRS and TS+RS, resp.), but fat and protein content were unaffected by dietary treatment (Table 1). The highest milk urea value was recorded for PRS group, probably due to an imbalance between available carbohydrates and nitrogen at ruminal level (NRC, 2001). No significant differences in the fatty acid profile were observed between TS and RS groups. A significant lower value (P<0.01)of short-medium chain fatty acids (up to C14; Table 2) was recorded for grazing cows (14.34 *vs* 18.77% of total fatty acid for PRS and TS+RS group, resp.). According to Kelly *et al.* (1998), the C18:0 and C18:1 fatty acids were higher in the PRS cows (on average +23% than TS+RS). For the PRS group, CLA content was twice as high as the others (0.96 *vs* 0.52% of total fatty acids resp.) and increased linearly during the trial (Figure 1). These data are in agreement with those reported by White *et al.* (2001). In conclusion, this study indicated that the fatty acid profile and CLA content in milk is mainly affected by pasture than by the sources of soybean supplementation, and no differences seem to exists between toasted or raw soybean supplemented to mixed diets.

Table 2. Fatty acid composition in milk (% of the total fatty acid).

	TS	RS	PRS	RSD
C6:0 - 14:0	18.55^{B}	18.99^{B}	14.34^{A}	2.17
C14:1	0.69	0.60	0.65	0.24
C16:0	27.47^{B}	28.38^{B}	22.71^{A}	1.55
C16:1	1.97	2.10	1.83	0.27
C18:0	14.59^{A}	13.43^{A}	18.09^{B}	1.63
C18:1	26.68^{A}	25.81^{A}	33.61^{B}	2.05
C18:2	4.98^{B}	4.94^{B}	3.75^{A}	0.81
C18:3	0.95^{ab}	1.08^{b}	0.86^{a}	0.13
C20:0	0.16	0.33	0.17	0.67
C20:1	0.14	0.10	0.16	0.12
C20:3	0.14^{ab}	0.20^{b}	0.11^{a}	0.06
C20:4	0.29^{ab}	0.34^{b}	0.22^{a}	0.12
C22:0	0.08	0.07	0.07	0.03
CLA	0.51^{A}	0.52^{A}	0.96^{B}	0.17
Others	2.79^{ab}	3.12^{b}	2.46^{a}	0.36
Saturated/unsaturated	1.76^{B}	1.80^{B}	1.37^{A}	0.17

A, B: P<0.01; a, b: P<0.05

Figure 1. The CLA content (% of the total fatty acid) in milk.



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