Milk fatty acids content in buffalo fed different ryegrass diets

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Introduction

As consumers are becoming aware of the links between dietary fat, health maintenance, and disease prevention, there is an increasing need for clarification of the metabolic fate and bioactivity of dietary fatty acids (**FA**). When considering milk and dairy products, we are particularly concerned with the content of saturated and unsaturated FA, bioactive FA (e.g., conjugated linoleic acid and n-3 FA), and *trans* FA). The current interest in *trans* FA with regard to milk fat is 2-fold. In relation to human health, *trans* FA have been associated with increased risk of chronic diseases, including cardiovascular disease, systemic inflammation, and type-II diabetes.Withrespect to milk fat depression (**MFD**), an inverse association is typically observed between the milk fat content of *trans* 18:1 isomers and the extent of the reduction in milk fat yield or content.
Factors affecting the FA composition of milk fat include the extent of de novo lipid synthesis by the mammary gland, the supply of preformed FA arising from dietary lipid intake and ruminalbiohydrogenation of polyunsaturated FA (**PUFA)**.
To extend buffalo-based agriculture in dry areas, where maize cultivation is difficult, ryegrass was studied as potential animal food, due to its reduced water requirements.

Methods

Ten multiparous lactating Mediterranean buffaloes were fed two isoenergetic (0.92 MilkFU/kg DM) and isoproteic (P=15%) diets based both on ryegrass hay (DH) or ryegrass silage (DS).
Milk fatty acids content was scored on samples taken at 60 and 90 days in milking (DIM) extracted and methylated according to ISO/FDIS 14156-2001and ISO/15884-2002 procedures for milk and milk products in general. Fatty acids methyl-esters were analyzed by Gas liquid chromatography (Varian, USA) on a SP-2560 column (100 m x 0.25 mm ID, Supelco, USA) with split injection (80:1) and He as carrier gas at constant flow 1.2 ml min^{-1}. Detection and injection temperature were set at 250°C. Temperature profile of the oven was 60°C for 5 min, then increased by 14 deg C/min to 165°C and held for 1 min, then increased by 2 deg C min^{-1} to 225°C held for 20 min. Line pressure was maintained at 33.41. As standards FAME C37, C19 and CLA were used (Supelco, USA). SCFA (Short Chain Fatty Acid C4:C8), MCFA (Medium Chain Fatty Acid C10:C14), LCFA (Low Chain Fatty Acid >C: 18, oleic acid omitted) and ClrA (C18:2 *cis*-9, *trans*-11 isomer) content recorded as %/100 mg extracted fat. Data were analyzed by ANOVA and statistical difference was discussed at P≤0.01 level.

Results and discussion

Silage treatments did positively affect milk fat yields (group S: 5.70 Vs group H: 5.13kg/head/d) and mozzarella yield (group S:1.43 Vs group H:1.26 kg/head/d) as shown in Table 3. Urea levels higher in DH can explain the differenc in milk yield. In fact, urea level indicate asynchrony between carbohydrate fermentation and protein degradation . This could cause a decrease in diet digestibility and the better results obtained in DS could be due to a more efficient use of feed nitrogen .

Table 1. Dietcomposition (Kg)

	D H	D S
Concentrate	8,7	9
ryegrasshay	4	1,2
Alpha-alphahay	4	2,8
Strow	2	3,5
Soja	1	0,5
ryegrasssilage	-	12
Fat	-	0,15
$CaCo_3$	-	0,04
TOTAL	19,7	29,19

Table 2. Chemical composition and net energy of the diets (on DM basis)

	Diet H	Diet S
Crude proteine %	15.45	15.57
Ash %	6.25	7.17
Fat %	4.91	5.36
NDF %	40.1	38.41
ADF %	29.0	27.51
Crude fiber %	19.3	18.12
ADL %	5.89	4.86
Ca %	0.81	0.81
P %	0.41	0.40
Starch %	16.38	17.0
Milk Forage Units/kg	0.92	0.92
NSC %	33.30	33.50
NSC/CP %	2.15	2.15

Table 3. Milk yield and composition.

	DH	DS
Morning milking. (kg/head/d)	5.13B	5.70A
Fat(%)	7.53	7.78
Protein (%)	4.35	4.33
Lactose (%)	4.86	4.84
Somatic cells (n*10^3/ml)	148	212
Urea (mg/dl)	53.9a	51.4b
pH	6.63	6.62
Estimated *Mozzarella* cheese yield (kg/head/)	1.26 B	1.43 A

Uppercase: P≤0.01; lowercase: P≤0.1

Table 4. FAME profile according to diet and DIM (% on total fatty acid)

	DH			DS		
	DIM60	DIM90	MEAN	DIM60	DIM90	MEAN
SCFA	21,09	15,69	18,39	21,53	21,12	21,33
MCFA	46,27	38,70	42,48	44,49	44,29	44,39
LCFA	17,96	19,27	18,62 a	28,40	23,83	26,11 b
stearic ac.	12,47	15,58	14,02 a	22,00	17,89	19,95 b
linoleic ac	3,11	2,06	2,59 a	3,71	3,41	3,56 b
CLA 9c11t	0,65	0,53	0,59 A	0,76	0,75	0,76 B

Uppercase: P≤0.01; lowercase: P≤0.1 *; SCFA (short chain fatty acids C4:C8); MCFA (medium chain fatty acids C10:C14); LCFA (long chain fatty acids >C:18 except oleic)

Fatty acid content in milk did generally showed the tendency of being higher in DS but only LCFA , stearic acid, linoleic acid and CLA revealed a significant difference (table 4). As lactation progressed concentration of LCFA decreased in silage group only, confirming the tendency reported in literature in cows. Considering that LCFA are from the diet or body fat depots the time effect could be caused by change in nutrient intake and partitioning of energy between milk and body reserves. As lactation progresses, body fat mobilization is reduced and eventually body reserves increase leading to a less LCFA content.

Conclusion

Results suggest that feeding ryegrass to lactating buffaloes is a valid option in arid areas to avoid intensive crop irrigation and in particular the silage treatment has a positive effect on milk yield and quality

Acknowlegements

This work was supported by the Italian Ministry of Agriculture and Forestry (MiPAAF**) and the Italian Consiglio per la Ricerca e la Sperimentazione in Agricoltura' (CRA)**