57th Annual Meeting of the EAAP, September 17th-20th, 2006, Antalya, Turkey.
Session: H30.10

FRESH FORAGE IN DAIRY ASS'S DIET: EFFECT ON PLASMA FATTY ACID PROFILE

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Abstract
The effect on the plasma acidic composition in lactating asses fed with fresh forage was studied. Eight Martina Franca asses were divided into two groups of 4 each one, fed with 8 kg/head·day of meadow hay (CTR group) and 20 kg/head·day of fresh herbage and 3 kg/head·day of meadow hay (TRT group); all the animals received 2.5 kg/head·day of mixed feeds. The trial lasted for 63 days. On the feeds and plasma samples, fatty acids were analysed by GC-FID and the quality indices calculated. Data were subjected to ANCOVA. In fresh forage, considerable higher percentages for n-3 PUFAs (39.85 vs. 14.33g/100 g total fatty acids), especially for linolenic acid (14.13 vs. 39.53) were observed, whereas the n-6 PUFAs were similar in feedstuffs (meadow hay: 28.79%; fresh forage: 25.81% g total fatty acids). Consequently, in the TRT group, the plasma levels of both n-3 PUFAs (7.09% vs. 4.97%) and linolenic acid (5.76 vs. 3.47) were significantly (P<0.001) higher, and plasma n-6 PUFAs showed no significant (P=0.191) differences between treatment (TRT: 38.90% vs. CTR: 37.37%). As a non ruminant herbivore, donkey's plasma fatty acids profile reflects the unsaturated dietary pattern; moreover, the investigated quality indices were significantly (P<0.05) lower in the TRT group, being IA= 0.32 vs. 0.37 and IT=0.75 vs. 0.87.

Key words: Ass, fresh forage, blood, fatty acids.

Introduction
A general understanding of the influence of diet on milk production cannot be deduced from knowledge of other species. Horses as well as donkeys, being monogastric herbivorous animals, have specific mechanisms for regulating milk secretion, since nutrients absorption in equids precedes the ceco-colic fermentation (Doreau et al., 1992). However, specifically to asses, the literature reports few data to establish relationship between end-products of digestion and milk secretion. Considering that ass's milk is increasingly considered as an effective hypoallergenic food for infants (Muraro et al., 2002), studies on ass's feeding and milk composition are becoming more frequent. As a part of a larger study on the effects of the administration of different fiber sources (fresh forage vs. hay) on productive and nutritional response of dairy asses

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(Chiofalo et al., 2005), this study focus the attention on the plasmatic fatty acid composition of the asses.

Material and Methods

The research was carried out on 8 Martina Franca asses bred in an organic farm. The animals were divided into two groups of 4 each one, CTR and TRT, homogeneous for milk yield (1576 ± 560 mL/d), day of lactation (154 ± 56 days) and body weight (300 ± 35 kg). The asses, stabled with their foals in boxes provided with a large external paddock, received the daily ration (on average: dry matter intake = 9.5 kg/d, Crude Protein = 10% DM and Digestible Energy = 8.5 MJ/kg DM) consisting of 8 kg/head of meadow hay (Dry Matter = 90.6%, on a DM basis: 8.3% Crude Protein, 62.8% Neutral Detergent Fibre) for the CTR group, of 20 kg/head of meadow fresh herbage (Dry Matter = 21%, on a DM basis: 12.3% Crude Protein, 26.4% 49.4% Neutral Detergent Fibre) and 3 kg/head of meadow hay for the TRT group; all the animals received daily 2.5 kg/head of commercial concentrate (Dry Matter = 89.3%, on a DM basis: 15.6% Crude Protein, 36.2% Neutral Detergent Fibre). The chemical composition of feeds, sampled every 21 days, was determined using the official methods (A.O.A.C., 2000). The trial lasted for 63 days, preceded by a 15-day adaptation period which consisted of a gradual administration of the experimental diet to the asses of TRT group. During the trial the BCS of the animals was 3.1 (± 0.25), measured on a 0 - 5 scale (Martin-Rosset, 1990). Every 21 days, feeds were sampled and individual blood samples were withdrawn in Vacutainer® containing Na-EDTA. The fatty acid composition of the feed (Chiofalo et al., 2005) and individual plasma samples (Chiofalo et al., 2002) was determined by GC-FID; the atherogenic and thrombogenic indices were calculated using equations proposed by Ulbricht and Southgate (1991). The results, expressed as g/100 g fatty acids, were subjected to the statistical analysis ANCOVA (SAS, 2001), using the following model: $y_{ij} = \mu + a_i + b*x_{ij} + e_{ij}$; where a_i = effect of diet, x_{ij} = days of lactation.

Results and Discussion

Table 1 shows the acidic composition of the feedstuffs. The different PUFA values between meadow hay and fresh forage are considerable; particularly, the higher ω3-PUFA content of the fresh forage is due to the higher α-linolenic percentage in fresh forage (39.53 ± 3.75 g/100 g fatty acids) than that in hay (14.13 ± 2.72 g/100 g fatty acids).

Table 1. Fatty Acid class composition of feedstuffs (g/100 g fatty acids, Mean ± SD).

	Meadow Hay	Meadow Herbage	Concentrate
Saturated (SFA)	39.55±4.48	23.63±2.69	51.69±0.16
Monounsaturated (MUFA)	17.33±2.06	10.72±1.62	36.27±0.11
Polyunsaturated (PUFA)	43.12±4.55	65.66±4.31	12.04±0.04
n3-PUFA	14.33±2.69	39.85±4.00	0.52±0.03
n6-PUFA	28.79±4.61	25.81±0.30	11.53±0.01

In relation to the fresh forage administration, in the plasma of TRT group, the levels of both n-3 PUFAs (Table 2) were significantly ($P<0.001$) higher, and plasma n-6 PUFAs

showed no significant (Table 2) differences between treatment. As a non ruminant herbivore, donkey's plasma fatty acids profile reflects the unsaturated dietary pattern because of the absence of the fatty acid hydrogenation in the digestive tract before the absorption (Doreau *et al*., 2002). Indeed, α-linolenic acid, precursor of the anti-inflammatory eicosanoids, was significantly (P<0.0001) higher in TRT group (5.76± 0.28 g/100 g fatty acids) than that in the CTR group (3.47± 0.24 g/100 g fatty acids), according to results in Doreau et al. (2002) on mares fed herbage or hay.

Table 2 – Percentages of the acidic classes in the plasma (mean±SE).

	CTR	**TRT**	**SE**	***P***
Saturated (SFA)	39.70	39.74	0.68	0.9686
Monounsaturated (MUFA)	18.81	13.71	0.77	0.0005
Polyunsaturated (PUFA)	41.49	46.55	0.82	0.0010
n3-PUFA	4.97	7.09	0.23	<0.0001
n6-PUFA	37.37	38.90	0.71	0.1912

Table 3 shows the most significant ratios among the milk acid classes; the n3/n6 and the ratio were significantly higher in TRT group, according to the higher milk content of both n3-PUFA classes in this group. Consequently, the plasmatic Atherogenic and Thrombogenic indices (Table 3), that are correlated to pathological phenomena such as the formation of atheroma and/or thrombosis, therefore expression of animal welfare, resulted significantly lower in the TRT group.
Considering the role of fatty acids in metabolic processes, such as synthesis of prostaglandins (Kindahl, 1980), which influence the state of animal welfare, these data confirm the interest towards the fresh forage as "functional food" in equine nutrition.

Table 3 – Ratios and Quality indices in the plasma (mean±SE).

	CTR	**TRT**	**SE**	***P***
UFA/SFA	1.52	1.58	0.03	0.2527
n3/n6	0.13	0.18	0.009	0.0032
Atherogenic Index	0.38	0.32	0.01	0.0245
Thrombogenic Index	0.87	0.75	0.02	0.0018

Acknowledgement
Research supported by MIUR Cofin 2003. Authors thank the farm "Monte Baducco" (Salvarano di Quattro Castella, RE, Italy), for their cooperation.

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