ESSENTIAL FATTY ACIDS (EFA) IN HAFLINGER AND THOROUGHBREED MARE'S MILK

GLI ACIDI GRASSI ESSENZIALI (EFA) NEL LATTE DI FATTRICI DI RAZZA AVELIGNESE E PUROSANGUE INGLESE

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SUMMARY

Mare milk EFA amounts from Thoroughbreed and Haflinger mares from different lactation period in the first 4 months were evaluated. In Thoroughbreed's milk samples linoleic acid was 22.77% on total fatty acids in colostrum, with a significative decrease at 10 (16.94%), 20 (15.15%) and 30 days (15.06%) increasing at 60 (17.82%); α-linolenic significantly increased from 4.56% on total FA in colostrum samples, until 8.20% at 30 days, 9.11% at 60 days and 10.58% in 90 days milk samples. LA/ALA ratio decreased from 4.99 in presuckle samples until 1.63 in 3rd month's. In Haflinger mare's milk LA amounts were 10.35% on total fatty acids at 30 days, about 1/3 less than corresponding Thoroughbreed samples amounts, with not significative decrease at 105 (8.59%). Alpha-linolenic acid amounts increased between 5.46% at 30 days and 6.01% at 60, until 6.50% at 105. LA/ALA ratio decreased between 1.84 in 30 days samples until 1.29 in 105 days ones. In spite of Thoroughbreed samples, where unsaturated FA prevailed over saturated (sat/unsat 0.57-0.94), in Haflinger samples sat/unsat FA ratio ranged between 1.16-1.39.

Key words: mare milk, Thoroughbreed, Haflinger, essential fatty acids.

RIASSUNTO

La ricerca ha preso in esame i contenuti in acidi grassi essenziali (EFA) del latte di fattrici Purosangue Inglese ed Avelignese a tempi diversi di lattazione durante i primi 4 mesi. Il contenuto medio di acido linoleico nei campioni di colostro provenienti dai soggetti PSI è risultato pari a 22,77% (sul totale degli acidi grassi), ha presentato un significativo decremento nei prelievi effettuati a 10 giorni di lattazione (16,94%), a 20 (15,15%), a 30 (15,06%), aumentando nei campioni di latte raccolti a 60 giorni (17,82%). L'acido α-linolenico ha evidenziato una costante e significativa tendenza all'aumento, passando da valori di 4,56% nei campioni colostrali a 8,20% in quelli rela-

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tivi al primo mese, 9,11% a 60 giorni e 10,58% al terzo mese. Il rapporto LA/ALA ha subìto un progressivo decremento da 4,99 nei campioni presuckle a 1,63 nei campioni relativi al terzo mese. Nei campioni di latte delle fattrici di razza Avelignese il contenuto in acido linoleico è risultato pari a 10,35% (circa 1/3 in meno del valore individuato nei corrispondenti campioni raccolti dalle cavalle PSI) ed ha evidenziato un progressivo decremento fino a raggiungere un valore di 8,59% nei campioni di 105 giorni. L'acido α-linolenico si è innalzato da valori di 5,46% nelle campionature del primo mese a 6,01% in quelle del secondo ed a 6,50% a 105 giorni. Il rapporto LA/ALA è diminuito da 1,84 nei campioni di 30 giorni a 1,29 a 105. A differenza dei campioni di soggetti PSI nei quali prevalevano gli acidi grassi insaturi (sat/insat 0,57-0,94), negli Avelignesi tale rapporto è risultato a favore dei saturi (sat/insat 1,16-1,39).

Parole chiave: latte equino, Purosangue inglese, Avelignese, acidi grassi essenziali.

INTRODUCTION

Many Authors emphasize the role of dietary fat as a factor influencing human health, particularly in cardiovascular diseases. The quality of health would really be improved not only by a general reduction in fat dietary intake, but with a change in saturated/unsaturated fatty acids ratio, if more favourable to the second ones (Noble, 1999). Mare's milk seem to contain α-linolenic (ALA) and linoleic (LA) acids amounts, usually called EFA (essential fatty acids) and respectively progenitors of ω-3 and ω-6, higher than in cow's milk (Csapò et al., 1995). The question if infants may benefit from LCPUFA-unsupplemented formulae with higher α-linolenic acid content is always open and recent studies demonstrate that preterm infants are able to form AA and DHA, even if this synthesis seems extremely low (Giovannini et al., 1998). Mare's milk fat composition, in addition to the protein fraction characteristics, suggests that this product is more similar to human milk than cow's (Godovac-Zimmermann et al., 1997, Pagliarini et al., 1993) and, more, the consideration that it could be utilized in cow's milk allergic children diets, as a substitute (Businco et al., 2000, Curadi et al., 2001), supports its potential utilization in pediatric dietetics and, generally, in human nutrition. The purpose of our studies concerns the evaluation of mare's milk in different breeds, since some our current researches seem indicate an heavy variability not only connected with administered feedstuff but also with ethnological factors; by this way Thoroughbreed and

Haflinger mare's milk leads us to believe interesting characteristics. Aim of this work belongs to the study of fatty acids variations, specially essential fatty acids, in milk samples during lactation to evaluate saturated/unsaturated and linoleic/α-linolenic ratio regarding to a concrete qualitative mare's milk fat evaluation.

MATERIALS AND METHODS

Mare's colostrum and milk samples from 8 Thoroughbreed (group 1) and 12 Haflinger (group 2) multiparous mares belonging to 2 different stud-farms, were collected; because of different breeding conditions and management, Thoroughbreed samples were collected from delivery (presuckle samples) until 90 days; Haflinger samples from 30 until 105 days. All samples were collected everytime in the presence of the foal, after a period of two hours of separation between mare and foal. Mares were fed with a diet consisting of 4-5 kg concentrate, ad libitum medium hay and fresh pasture (group 1), and medium hay, fresh pasture and 2-3 kg concentrate (group 2), whose chemical composition is reported in Table I. Every sample was obtained as a pool of two complete milkings, in the same day, before feeding time. All samples were frozen at -20°C until chemical investigations were performed. FA colostrum and milk composition was performed according to Roese-Goettlieb extraction (FIL-IDF: 1D-

Tab. I. Chemical composition of administered diets (% d.m.) and LA, ALA amounts (% total lipids).

	Thoroughbreed			Haflinger		
	Hay	Concentrate	Pasture	Hay	Concentrate	Pasture
Dry matter	85.53	92.36	29.68	89.42	90.01	36.74
Crude proteins	9.27	16.68	14.97	4.95	12.58	11.00
Ether extract	1.27	2.66	1.93	2.00	3.00	1.60
Crude fibre	28.43	4.49	24.15	34.52	6.57	24.37
N-free extract	50.93	63.28	49.28	53.33	74.43	54.27
ash	10.20	12.89	9.67	5.20	3.42	8.76
C18:2n-6 (LA)	7.96	21.61	5.01	3.37	26.76	6.36
C18:3n-3 (ALA)	3.98	1.60	9.16	3.40	2.17	15.25

1996) by using capillary gas chromatographic investigation for methyl esters (FAME), with a HP 23 cis/trans polar column, length 30 m (i.d. 0.32 mm.; d.f. 0.25 μm), according to FIL-IDF:182-1999 method (CE Instruments, GC8000). Gas-chromatographic analysis was also carried out for animal feedstuff, using 100 m x 0.25 mm capillary column, d.f. 0.25 μm. The profile of fatty acids considered includes from C8:0 until C24:1. MANOVA with repeated measures for linoleic and α-linolenic acids to evaluate significative differences at different collection times was performed by JMP (SAS Inst., 1994).

RESULTS AND DISCUSSION

In Thoroughbreed's milk samples linoleic acid (Tab. II) was 22.77% on total fatty acids in colostrum, with a significative decrease at 10 (16.94%), 20 (15.15%) and 30 days (15.06%) increasing at 60 (17.82%). The other essential fatty acid, α-linolenic, significantly increased from 4.56% on total FA in colostrum samples, at 8.20% at 30 days, 9.11% at 60 days, until 10.58% in 90 days milk samples. These amounts are very higher in mare's mik than in cow's; they are required in human nutrition because they can't be produced and could be extremely important for formula-fed infants. Some Authors have found different linoleic and α-linolenic contents in mare milk (Doreau & Boulot, 1989, Mariani et al., 1998). We can also observe strong variations in α-linolenic concentrations, ranging from 2-3% until 15-

Tab. II. LA and ALA amounts (% total FA), LA/ALA and Sat/UnsatFA ratio in Thoroughbreed milk samples at different collection times.

	presuckle	10 gg	20 gg	30 gg	60 gg	90 gg
C18:2n-6 (LA)	22.77 a	16.94 b	15.15 b	15.06 b	17.82 b	17.29
C18:3n—3 (ALA)	4.56 a	4.02 a	5.78 b	8.20 bc	9.11 c	10.58
LA/ALA	4.99	4.21	2.62	1.89	1.95	1.63
AG Sat/AG Insat	0.60	0.94	0.91	0.87	0.68	0.57

a, b, c: $p < 0.05$.

20% (Csapò et al., 1995, Mariani et al., 1998). Hoffman et al. (1998) increased the content of C18:2n-6 in milk by feeding corn oil and fiber to their subjects, so it is supposed a very close correlation between diet and milk presence of FA. Doreau (1994) confirms that composition of the diet, particularly forage/concentrate ratio doesn't greatly modify milk yield of mares fed *ad libitum*, but an increase in the proportion of concentrates results in a decreased in milk fat, protein content and in a change in FA composition, mainly characterized by a decrease in the proportion in α-linolenic acid, with a contemporary increase of linoleic. Orlov and Servetnik-Chalaya (1982) found deep differences in α-linolenic acid amounts between summer and winter milk samples. In effect we can observe, by the Table I, an interesting composition in linoleic and α-linolenic acids in our mare's diets, as good amounts of these acids on total FA, in hay and fresh pasture, with opposite linoleic/α-linolenic ratio, while in concentrates we can find higher linoleic acid amounts. ALA increasing amounts, in samples collected between 10 and 90 days, could be explained with increasing pasture fed from mares in these periods and, consequently, LA/ALA ratio decreases, so we can suppose a direct relation between feeding content and FA milk composition. As suggested by ESPGAN (1991) a desirable 5:1 to 15:1 linoleic/α-linolenic ratio has been established in a convenient human nutrition. We observed a linoleic/α-linolenic ratio as about 5:1 in our presuckle samples and a progressive decrease, with an increasing α-linolenic acid amounts during lactation, until 1.6:1 at three months in thoroughbreed samples and between 1.84 and 1.29 in Haflinger milk samples. Saturated/unsaturated ratio was more favourable to the second ones in presuckle and 90 days samples and we note an increasing favourable ratio to α-linolenic from 30 until 90 days samples, in accordance also with Mariani et al. (1998). Unsaturated FA are found in high proportion in the structural lipids of cell membranes, particularly those of the central nervous system and their accretion primarly occurs during the last three months of pregnancy and in the first year of life (Crawford, 1993). In Haflinger mare's milk (Tab. III) LA amounts were 10.35% on total fatty acids at 30 days, about 1/3 less than corresponding Thoroughbreed samples amounts, with not significative decrease at 105 (8.59%). Alpha-linolenic acid amounts changed between 5.46% at 30 days and 6.01% at 60, until a significative increase at 105

Tab. III. LA and ALA amounts (% total FA), LA/ALA and Sat/UnsatFA ratio in Haflinger milk samples at different collection times.

	30 gg	60 gg	90 gg	105 gg
C18:2n-6 (LA)	10.35	10.02	8.48	8.59
C18:3n—3 (ALA)	5.46 a	6.01 a	5.85 a	6.50 b
LA/ALA	1.84	1.61	1.43	1.29
Sat/Unsat FA	1.20	1.16	1.39	1.24

a, b: $p < 0.05$

(6.50%) and decreasing LA/ALA ratio between 1.84 in 30 days samples until 1.29 in 105 days ones. In spite of Thoroughbreed samples, saturated acids prevailed over unsaturated, between 1.16 and 1.39.

CONCLUSIONS

Mare's milk presents large EFA amounts, especially linoleic, progenitor of arachidonic acid and α-linolenic, progenitor of EPA and DHA, and that's probably connected with the diet, although differences highlight between Thoroughbreed and Haflinger mares. Concentrations of FA are interesting and required because they can't be produced by human body. We can affirm that linoleic/α-linolenic ratio in our samples could be convenient for human nutrition in low linoleic and α-linolenic diets and ideal for preterm infant's diets, since their liver is probably capable to transform them in EPA, DHA and AA.

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