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Effect of oils administration on diets digestibility and haematic fatty acids profile in exercising horses

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RIASSUNTO – Effetto della somministrazione di due diversi tipi di olio sulla digeribilità della razione e sugli acidi grassi ematici in cavalli in attività. *Nel cavallo sportivo l'elevata richiesta energetica obbliga all'uso di razioni contenenti notevoli quantità di concentrati. Essendo ben tollerati, i grassi vengono utilizzati come fonte energetica alternativa ai cereali. Scopo del presente lavoro è stato quello di confrontare la digeribilità di due diverse razioni contenenti rispettivamente olio di mais e un derivato dell'olio di oliva in cavalli in attività e valutare il livello ematico degli acidi grassi derivante dalla assunzione degli stessi. I CUDa ottenuti hanno mostrato una buona digeribilità di entrambe le diete. La digeribilità dei grassi è risultata significativamente più elevata (P<0,01) nella dieta contenente olio di mais (80,34±3,42* vs. *77,10±1,31%). Il livello degli acidi grassi ematici è risultato influenzato dalle diete.*

Keywords: horse, digestibility, olive oil, haematic fatty acids.

INTRODUCTION – The ration of performance horse usually includes great amount of cereals. Nevertheless there is a limit to the amount of starch which a ration should contain. Addition of dietary fat to improve the caloric density of horse mixed feed is a common practice. Fat supplement reduces the negative effect of excessive starch fermentations in large intestine. Triglycerides of either plant or animal origin are the most common form of fat supplementation in horses diets. There are a number of different fat sources available for use in horse feeds, and many of these have been extensively studied (Potter *et al.*, 1992; Pagan, 1996). Others have received less attention. Probably to improve fat utilisation could be useful to use fat with a specific free fatty acid composition. The aims of this study were to compare the digestibility of two different diets containing corn oil (a common fat supplement for working horse diets) and a mix of mono-di and triglycerides of olive oil and evaluate the fatty acids haematic profile before and after a prolonged oils administration.

MATERIALS AND METHODS – Four adult trained Standardbred geldings (mean BW = 481±27) were used in a repeated twice 2 x 2 Latin square design to determine the apparent digestibility of a mixed hay-concentrate diets containing corn oil (CORN) or a mix of mono-di and triglycerides of olive oil (MDTO) (Baby oil olive, SILO srl). Oils composition is shown in Table 1. Diets were formulated to be isocaloric and isoprotein (Table 2). Before the trial, all horses received a hay-concentrate balanced ration formulated according to NRC (1989) requirements for intense work and a blood sample was taken to evaluate the basal fatty acids profile. The horses were randomly assigned to two groups. Both groups were exercised daily on treadmill. In order to adapt to experimental diets one group received CORN as supplement while the other group received the diet with MDTO for a period of four weeks. The horses were fed twice a day and housed in box stalls with water *ad libitum*. At the end of the four weeks adaptation period total faeces were collected for six days. Venous blood samples were collected too. Then the groups were switched. Feed and faeces samples were analysed for dry

matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF), neutral detergent fibre (NDF), acid detergent fibre (ADF), cellulose, hemicellulose, lignine (ADL) and ash according to ASPA methods (Martillotti *et al.*, 1987). Gross energy (GE) was determined by adiabatic calorimeter. Fatty acid composition of oils was determined by gas-chromatography as suggested by method C41-B (N.G.D., 1976). Data, subjected to ANOVA with the effects treatment, period and Latin square, were analysed using the JMP software package (JMP, 2002).

Table 1. Fatty acid composition of oils (as percent).

Fatty Acid	CORN	MDTO
C14:0 (myristic)	0.04	0.08
C16:0 (palmitic)	10.23	13.21
C16:1 (palmitoleic)	0.02	0.04
C18:0 (stearic)	1.09	4.17
C18:1 (oleic)	28.41	68.45
C18:2 (linoleic)	54.24	9.85
C18:3 (linolenic)	0.02	0.00
C20:4 (arachidonic)	0.01	0.00
C20:5 (eicosapentanoic)	0.02	0.00
SFA	11.37	17.39
MUFA	28.44	68.48
PUFA	54.28	9.85
SFA/MUFA+PUFA	0.14	0.22

Table 2. Diets composition (/100 kg BW).

Hay (kg as fed)	1.26
Concentrate (kg as fed)	0.84
Oils (kg as fed)	0.10
D.E. (MJ)	21.77
Crude protein (g)	207
Fat (g)	151

RESULTS AND CONCLUSIONS – The results are presented in Table 3 and 4. Despite the high amount of fat supplement (approximately 500 g/d/horse), digestibility values were in normal range and in accordance with previous studies (Gatta *et al.*, 1990, Kline e Frey, 1997; Pagan *et al.*, 1997; Jansen *et al.*, 2000). CORN diet shows a higher (P<0.01) EE digestibility (80.34±3.42 *vs.* 77.10±1.31%). This result can be explained by the different fatty acid concentration of the oils, in particular as a consequence of the higher saturated fatty acids level in olive oil mixture (17.39 *vs.* 11.37%). In fact the saturated fatty acids could be less digestible that unsaturated fatty acids in horse (Lewis, 1995).

Table 3. Apparent digestibility of diets (as percent, means±SE).

	CORN	MDTO
DM	60.42±2.85	60.19±1.87
OM	63.33±2.55	62.73±2.64
CP	64.91±4.88	67.03±3.98
EE	80.34^{A}±3.42	77.10^{B}±1.31
CF	29.68±2.78	26.83±4.76
Ash	12.06±7.52	10.47±6.83
NDF	38.34±2.23	38.01±4.16
ADF	31.97±4.77	32.55±4.05
ADL	13.56±12.99	13.59±8.45
Cellulose	42.22±7.32	42.91±6.96
Hemicell.	49.95±8.67	46.82±15.37
GE	62.13±2.34	61.86±1.73

A, B: P<0.01

In agreement with literature data (Jansen *et al.*, 2000) we found low digestibility values of CF and fibre fractions (NDF, ADF, cellulose and hemicellulose), as consequence of fibre digestibility reduction owing to the increasing of fat in diet. The blood serum fatty acids percentages (except C18:3) show higher values with some

significant differences (P<0.05) in the horses fed experimental diets. No differences were observed between the two treatments in spite of different composition of the oils used. The FFA values were also significantly higher (P<0.05) in horses fed fatty diets. Finally, despite the high unsaturated fatty acids level in oils, no differences about saturated/unsaturated fatty acid ratio were found. These results are not completely in accordance with literature. In particular C18:0 was lower than value reported by Bergero *et al.* (2002) in animals receiving an unsaturated fatty acid rich oil, but was higher than data reported by Hallebeek and Beynen (2002) in horses fed soybean or palm oil. Moreover, we observed an higher percentage of PUFA in comparison with SFA. The differences could be explained by the different diets used and confirm the importance of a nutritional influence in determining the percentages of blood fatty acids. It is concluded that both diets show good digestibility values and the feeding of mix of mono-di and triglycerides of olive oil to horses does not affect the fatty acid serum composition when compared to the feeding of corn oil.

Table 4. Relative serum fatty acids profile (as percent) (means±SE).

	BASAL	CORN	MDO
C14:0 (myristic)	1.31±0.07	1.47±0.08	1.40±0.01
C16:0 (palmitic)	23.02±0.45	21.91±0.25	22.15±0.41
C16:1 (palmitoleic)	1.72±0.20	1.35±0.02	1.43±0.06
C18:0 (stearic)	9.68^{a}±0.45	10.57^{b}±0.16	10.92^{b}±0.07
C18:1 (oleic)	13.09^{a}±0.17	14.28^{b}±0.08	14.22^{b}±0.31
C18:2 (linoleic)	30.30±0.91	31.73±0.75	31.95±0.27
C18:3 (linolenic)	5.99^{a}±0.96	3.87^{b}±0.12	3.63^{b}±0.01
C20:4 (arachidonic)	7.70±0.36	8.32±0.19	8.36±0.14
C20:5 (eicosapentanoic)	1.39±0.14	1.41±0.03	1.25±0.01
SFA	34.01±0.40	33.95±0.64	34.47±0.15
MUFA	14.81^{a}±0.32	15.63^{b}±0.09	15.64^{b}±0.53
PUFA	45.38±0.27	45.33±0.70	45.19±0.75
SFA/MUFA+PUFA	0.56±0.0004	57±0.0001	56±0.0002
FFA (μmol/l)	261.00^{a}±1.66	307.50^{b}± 6.90	315.20^{b}±8.50

a, b: P<0.05

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