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Apparent digestibility of three diets in the Amiata breed donkey during lactation

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ABSTRACT - The aim of the trial was to evaluate the apparent digestibility of three isonitrogenous and isocaloric diets for lactating donkeys: a diet with 8 kg of hay and 1.5 kg of commercial flaked mixed feed (CM) (Diet 1); a diet with 7 kg of hay and a 2.2 kg of CM (Diet 2) and a diet with 7 kg of hay, 1.5 kg of CM, 200 ml of corn oil and 0.2 kg of soybean meal (Diet 3). Four pluriparous donkeys (309±12 kg BW) at approximately 2-4 months of lactation were used. The trial was conducted according to a 3x3 Latin Square design with 1 or 2 subject per each cell. Feed and faeces samples were analysed for DM, OM, CP, EE, CF, NDF, ADF and gross energy. Acid insoluble ash was used as marker to calculate the apparent digestibility. The apparent digestibility of the main dietary components showed not significant differences among the three diets but generally they were lower in Diet 3. DM intakes of every diet exceeded the estimated energy requirement, whereas protein requirements were not significantly satisfied by Diet 1.

Key words: Donkey, Digestibility, Lactation, Nutrition.

Introduction - A lot of researches had focused on horse nutrition. Although some work explored differences between horses and donkeys (Pearson and Merritt, 1991; Suhartanto *et al.*, 1992; Pearson *et al.*, 2001) there is a need to improve scientific knowledge on donkey nutrition in different physiological state. Lately many studies have been carried out about ass milk production and moreover ass milk is considered a promising alternative hypoallergenic food for infancy (Salimei and Chiofalo, 2006). In a previous study Casini *et al.* (2006) evaluated the digestibility in Amiata donkeys during pregnancy but there is a lack of informations about the lactating period. The aim of the trial was to evaluate the apparent digestibility of three diets with different hay amount and different energy sources in Amiata lactating donkeys.

Material and methods - Four pluriparous lactating Amiata breed donkeys (4-9 years old) at approximately 2-4 months of lactation were used (body weight – BW – 309 ±12 kg and body condition score – BCS – 5.5 (Pearson and Ouassat, 2000). The animals were at rest and fed according to a 3x3 Latin Square design with 1 or 2 subject per cell, so that all animals received all the diets. Experimental periods were divided in two parts: three weeks, to adapt the animals to the new diet, and 6 days sampling period. During the trial donkeys were stabled in individual stalls and each animal was weighed at the start and at the end of each experimental period. The three diets consisted: 8 kg of a medium quality meadow hay (MH) and 1.5 kg of a commercial flaked mixed feed (CM) containing corn, oat, barley, faba bean, pea seeds, wheat bran, carobs pulp and carrots (Diet 1); 7 kg of MH plus 2.2 kg of CM (Diet 2); 7 kg of MH, 1.5 kg of CM plus 200 ml of corn oil and 0.2 kg of soybean meal (CM2) (Diet 3). Diets were isonitrogenous and isocaloric. Feed composition is shown in Table 1. Energy and protein requirements were estimated using the horse National Research Council (1989) recommendations for 300 kg BW lactating mares (2-4 months). The diets were offered twice a day in equal quantities at 8 am and 4 pm. Administered feed and refusal were daily recorded. During sampling periods faeces were collected from the rectum twice a day at the same time. Acid insoluble ash (AIA) was used as marker to calculate the apparent digestibility. Feed and faeces were analysed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF), neutral detergent fibre (NDF), acid

Table 1. Chemical feed and diets composition (% on DM basis).

	Hay	CM	CM2	Diet 1	Diet 2	Diet 3
DM	92.22	90.07	91.55	91.89	91.74	92.06
OM	91.36	96.88	97.25	92.21	92.53	92.68
CP	8.35	15.22	16.85	8.22	8.40	8.78
EE	0.81	3.97	10.53	1.13	1.31	2.64
CF	34.78	7.76	6.79	26.71	23.99	23.81
NDF	67.82	23.66	21.14	53.24	48.46	48.03
ADF	42.67	10.6	9.44	32.92	29.64	29.44
GE (MJ/kg)	17.29	18.62	20.18	152.74	148.47	152.17
DE (MJ/kg) (estimated NRC, 1989)	7.49	14.58	14.86	74.96	77.18	78.03

detergent fibre (ADF), AIA and gross energy (GE) according to the methods reported by Martillotti *et al.* (1987). Results were subjected to ANOVA using SAS Institute software package (2002).

Results and conclusions - The voluntary DM intake (as kg and g/kg BW^{0.75}) (Table 2) were not significantly different among the diets. Hay intake was 88%, 94% and 93% of that provided in Diet 1, 2 and 3, respectively; CM and CM2 were entirely consumed. A lot of reports pointed out on DM intakes in donkeys but any information on lactating donkeys was available. Casini *et al.* (2006) reported values of DM intakes of 86.6 g/kg BW^{0.75} in pregnant donkeys consuming a similar diet. DM intakes was lower in pregnant than in lactating mares as reported by Martin Rosset *et al.* (1990) (113 vs 162 g/kg BW^{0.75}). Our results seem to suggest that lactating donkeys had a higher DM intakes in comparison with pregnant donkeys as in mares. Energy requirement was satisfied by all the diets. Intakes exceeded the estimated energy needs by 21%, 26% and 18% in Diet 1, 2 and 3 respectively. Feeding level (FL) was higher in Diet 2 compared with Diet 1 and 3 but significant differences were not observed. The FL of the three diets was slightly lower than the value (2.6) reported by Martin Rosset *et al.* (1990) in lactating heavy mares fed with a 85% meadow hay and 15% concentrate diet. Mean BW (308, 309 and 311 kg respectively for Diet 1, 2 and 3) and BCS (5.5 for all the diets) were analogous in donkeys and no significant differences among the diets were observed. The donkeys fed Diet 1 had a lower intake of hay than expected and consequently, the total CP intake (as g and g/kg BW^{0.75}) was significantly lower ($P < 0.05$) in Diet 1 compared to Diet 2. Therefore the estimated protein requirements were not satisfied with Diet 1 and only just met with Diets 2 and 3. Apparent digestibility coefficients (ADC) are shown in Table 2. The apparent digestibility of the main dietary component showed not significant differences among the three diets but generally they were lower in Diet 3 with corn oil. All the ADC, excepted protein, were lower than the values reported by Casini *et al.* (2006) in pregnant donkeys fed a similar diet (DM 68.1, OM 70.9, CP 54.1, CF 71.4, NDF 70.2, ADF 62.9 and GE 71.2%). Martin Rosset *et al.* (1990) recorded lower ADC in mares than our values in asses (DM 52.7, OM 55.2, CP 56.7, CF 41.7 and GE 51.2%). The data were significantly lower in pregnant than lactating heavy mares for DM, OM digestibility but not for CP, CF and GE. The better apparent digestibility of donkeys can be explained by the fact that they seem to retain food residues in the gastrointestinal tract longer than do other equids and could consequently digest feed more efficiently than other equids (Cuddeford *et al.* 1995; Tisserand and Pearson, 2003).

In conclusion the lactating Amiata breed donkeys seems to have apparent nutrients digestibility better than those reported for mares. The present study showed that intake of a high forage content diet was unlikely able to provide enough protein to meet the lactating requirements of donkeys. Higher concentrate supplementation improved protein intake but didn't affect apparent digestibility of all

nutrients. Oil seemed to reduce apparent digestibility. The lack of information on lactating donkey did not allow a complete comparison for all investigated parameters, therefore more scientific information are requested to evaluate the effects of different kind of concentrate supplementation on donkeys intake and digestibility, especially in pregnant and lactating donkeys.

Table 2. DM, CP, DE intake, feeding level and apparent digestibility of diets (means \pm SE).

	Diet 1	Diet 2	Diet 3
Daily intake:			
DM (kg)	7.86 \pm 0.15	8.02 \pm 0.12	7.75 \pm 0.32
DM (g/kg BW ^{0.75})	110.33 \pm 1.95	108.80 \pm 1.75	104.28 \pm 2.31
CP (g)	749 ^a \pm 13	810 ^b \pm 22	794 \pm 27
CP (g/kg BW ^{0.75})	10.51 ^a \pm 0.15	10.99 ^b \pm 0.10	10.68 \pm 0.17
DE (MJ)	86.38 \pm 3.47	90.19 \pm 3.47	83.72 \pm 3.01
Feeding Level:	1.98 \pm 0.03	2.10 \pm 0.09	1.92 \pm 0.09
Digestibility (%):			
DM	67.81 \pm 1.17	67.24 \pm 1.99	63.62 \pm 2.04
OM	69.31 \pm 1.06	68.10 \pm 2.10	64.52 \pm 2.01
CP	70.72 \pm 2.22	75.39 \pm 0.52	71.48 \pm 2.19
CF	68.73 \pm 1.70	67.50 \pm 2.04	62.94 \pm 2.05
NDF	68.56 \pm 1.18	66.14 \pm 1.82	61.51 \pm 2.38
ADF	63.47 \pm 1.05	63.11 \pm 2.56	58.92 \pm 1.98
GE	62.73 \pm 1.17	63.83 \pm 2.13	60.23 \pm 2.33

^{a,b}= P<0.05.

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