Nutritional status of dairy asses managed with different machine milking strategies

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ABSTRACT - Nutritional status have been studied in dairy asses machine milked according to two different routines: 20 pluriparous asses, were divided into two groups subjected to two consecutive milkings at different intervals: group A was milked at 15:00h and 11:00h of the subsequent day, while group B was milked at 11:00h and 15:00h. Although the total milk yield was unaffected by the different milking management, in the morning milking group B showed a lower milk production than group A but higher levels of plasma energy indices, glucose, triglycerides, cholesterol, NEFA and phospholipids and plasma nitrogenous constituents, total protein and urea. The nutritional status of both groups matches the observed different amount of milk yielded in the morning milking and suggests different efficiency in mammary secretion, as a possible response to the milking strategy.

Key words: Dairy asses, Nutritional status, Milking management.

INTRODUCTION - Since efficacy of ass’s milk as a hypoallergenic food for infants has been proved (Carroccio et al., 2000), feasibility of ass’s milk production has been tested and studies on donkey’s milk yield and composition, becoming more frequent, suggest that management of dairy equids could influence the amount of milk extracted by the mammary gland, characterised by low capacity (Salimei, Chiofalo, 2006). The development of this food chain therefore requires a specific husbandry system and investigations on the nutritional status of donkeys, since they are related to productivity, besides animal health and welfare.

Although literature data on donkeys do not normally consider the interaction between the physiological-nutritional status and metabolic variations, hyperlipaemia, the most common medical condition of donkeys, seems to be more frequent at times of environmental stress (Svendsen,1997).

In order to deepen the knowledge on donkeys’ metabolic responses to milking management, the present study, as a part of a broader research project, is focused on the evaluation of the effects of different machine milking routines on nutritional status of asses involved in an innovative food chain.

MATERIAL AND METHODS - Twenty pluriparous pregnant asses (89 ± 42 days of lactation), previously adapted to machine milking, were divided into two homogeneous groups (A: 382.5 ± 86 kg BW; B: 342.8 ± 55 kg BW) and were subjected to two consecutive machine milkings in a proper facility (Simoni et al., 2004) every 28 days with different intervals within 24 hours: group A was milked at 15:00h and 11:00h of the subsequent day (20 hours interval) and group B was milked at 11:00h and 15:00h (4 hours interval). Asses were stabled with their foals in two boxes provided with a wide external paddock; foals were physically separated from the dams since 3 hours before each milking. The animals were daily fed in average 8kg meadow hay (CP 9%; EE 1.8%, DE 6.8 MJ·kg–1, as fed) and 2.5kg grain-based commercial concentrate (CP 15%, EE 2.2%, DE 11.5 MJ·kg–1, as fed), divided in two meals;
Dry matter consumption (about 3.2% of body weight) was on average characterised by 100 g crude protein and 8.5 MJ DE/kg dry matter. The study lasted 150 days; at milkings, individual milk yield was recorded, ass's body condition was monitored according to Martin Rosset (1990), and jugular blood samples from asses were collected after the morning milking and before the animals were fed.

Plasma metabolites analysis were performed using commercial kits: glucose, urea, total and HDL cholesterol, triglycerides, albumin, total bilirubin, total protein, creatinine (Biotecnica Instruments, Roma, Italy), NEFA and phospholipids (Randox Laboratories Ltd, Crumlin, UK).

Data were analyzed by analysis of variance for repeated measures, also considering the covariate effect of days of lactation (SAS Inc., Cary, NC USA).

RESULTS AND CONCLUSIONS - Asses' body condition score was always close to the optimal evaluation for mares (Martin-Rosset, 1990) and was not influenced by the milking strategy. Notwithstanding total daily milk yield was unaffected by the different milking routine (A: 1365.77 ± 91.7 mL·d⁻¹; B: 1096.68 ± 92.77 mL·d⁻¹), the average milk yield of the morning milking was found lower (P<0.1) in group B (A: 706.2 ± 57.6 mL milk; B: 489.6 ± 58 mL milk), which confirm results obtained by Others (Chiofalo et al., 2004; Salimei et al., 2004; Salimei et al., 2005). It should be reminded that milking management significantly influenced both the fat content and the hygienic quality of milk (Salimei et al., 2006). If a more efficient milk ejection during the middle part of the day could support the hypothesis of a coadaptation of the dam to the suckling rhythm and activity patterns of the foal (Salimei et al., 2004), on the other hand milking management practices can affect residual milk and milking strategy may also directly influence further milk secretion (Dodd, Griffin, 1983).

The plasma biochemical constituents of dairy asses milked according to the different milking strategies are reported in Table 1. As a first approach, it has to be noted that the investigated indices of both energy and protein metabolism are consistent with values reported in literature for adult donkeys, also subjected to stressors, such as feeding management or pregnancy and lactation (Jordana et al., 1998; Mori et al., 2003; D'Alessandro et al., 2006). Moreover, the observed levels of total cholesterol, protein and bilirubin resulted comprises within the reference ranges for horses (Kaneko, 1989; Svendsen, 1997).

Table 1. Nutritional profile of dairy asses machine milked.

| Analyte                  | Groups | SE   |
|--------------------------|--------|------|
|                          | A      | B    |      |
| Glucose, mmol/L          | 3.36B  | 3.93a | 0.02 |
| Triglycerides, mmol/L    | 0.64b  | 0.71a | 0.03 |
| Cholesterol, mmol/L      | 1.60B  | 2.13a | 0.02 |
| HDL cholesterol, mmol/L  | 0.65   | 0.67  | 0.01 |
| NEFA, mmol/L             | 0.15B  | 0.17a | 0.002|
| Phospholipids, mmol/L    | 1.55b  | 1.64a | 0.03 |
| Total protein, g/L       | 63.2b  | 65.7a | 0.71 |
| Albumin, g/L             | 26.8A  | 25.4B | 0.18 |
| Urea, mmol/L             | 4.00B  | 5.58A | 0.07 |
| Total bilirubin, µmol/L  | 9.10A  | 8.86B | 0.08 |
| Creatinine, µmol/L       | 105.1  | 102.2 | 1.28 |

a, b = P<0.05  A,B = P<0.01.

Notwithstanding the clinically healthy status of experimental subjects machine milked, the milking routines affected the nutritional profile of dairy asses; as table 1 shows, the energy plasma indices were in fact significantly higher in group B, except for HDL cholesterol. Similarly, urea and total protein plasma levels were higher in group B, suggesting a less intensive metabolic rhythm likely related to the milk constituents secretion. Among the nitrogenous plasma constituents, only albumin and total bilirubin levels were significantly higher in group A. As
a possible explanation, it has to be noted, according to Kaneko (1989), that plasma albumins are capable of binding bilirubin, whose elevation in the serum may be observed secondarily to many environmental conditions.

The different amount of milk yielded in the morning milking matches the nutritional status of the two groups, suggesting a higher efficiency in mammary secretion in group A, as a possible response to the milking routine. As far as the productive system of ass’s milk is developing, a better knowledge on donkey’s physiology of lactation in “dairy” subjects is needed in order to achieve a positive interaction between the innovative husbandry system and the adaptive capacity of donkeys.

The Authors want to thank Giuseppe and Davide Borghi (Azienda agricola “Monte Baducco”, Salvarano di Quattro Castella, RE), Gianvincenzo Lebboroni (UniCam) and Eljeddahd for their co-operation.

The research was supported by MIUR (PRIN 2003 - Salimei E.) and University of Camerino (Contributo 2006 Fantuz F.).

REFERENCES - Carroccio, A., F. Cavataio, G. Montaldo, D. D’amico, L. Alabrese & G. Iacono, 2000. Intolerance to hydrolysed cow’s milk proteins in infants: clinical characteristics and dietary treatments. Clin. Exp. Allergy, 30: 1597-1603. Chiofalo, B., Azzarra, V., Liotta, L., Chiofalo L., 2004. The chemical and physical parameters of the Ragusana ass's milk during lactation. Proc. 6th Congress SIDI, Campobasso (I), july 2004: 77-84. D’Alessandro, A.G., Martemucci, G., Palazzo, M., Simone, N., Colella, G.E., Pizzo, R., Casamassima, D., 2006. Values on serum metabolites in lactation jennies of Martina Franca breed. EAAP publ. 120, Wageningen Academy Press, Wageningen, NL: 171-174. Dodd F.H., Griffin T.K., 1983. Milking routines, In Thiel C.C. and Dodd ed., Machine milking, The Hannah Research Inst., Ayr, Scotland. Jordana, J., Folch, P., 1998. Clinical biochemical parameters of the endangered Catalan donkey breed: normal values and the influence of sex, age, and management practices effect. Res. Vet Sci., 64: 7-10. Kaneko, J.J., 1989. Clinical biochemistry of domestic animals. 4th ed. Academy Press, San Diego. Martin-Rosset, W., 1990. Bases du rationnement. In: Martin-Rosset, W., L’alimentation des chevaux, Ed. INRA, Paris, 1990. Mori, E., Fernandes, W.R., Mirandola R.M.S., Kubo, G., Ferreira R.R., Oliveira, J.V., Gacek, F., 2003. Reference values on biochemical parameters of brazilian donkey (Equus asinus) breed. J. Equine Vet. Sci., 23: 358-364. Salimei, E., Chiofalo, B., 2006. Asses: milk yield and composition. EAAP publ. 120, Wageningen Academy Press, Wageningen, NL: 117-132. Salimei, E., Fantuz, F., Coppola, R., Chiofalo, B., Polidori, P., Varisco, G., 2004. Composition and characteristics of ass’s milk. Anim. Res., 53: 67-78. Salimei, E., Fantuz, F., Varisco, G., Maglieri, C., Polidori, M. (2005). Different fiber sources in dairy ass's diet: effects on milk yield and composition. Ital. J. Anim. Sci. 4 (suppl 2): 430-432. Salimei, E., Maglieri, C., Polidori, M., Socci, R., Chiofalo, B., Gambacorta M., Varisco G., 2006. Machine milking of dairy asses as related to milk production and body condition. EAAP publ. 120, Wageningen Academy Press, Wageningen, NL: 181-182. Svendsen, E.D., 1997. The professional handbook of the donkey, 3rd Ed. For the donkey sanctuary, Whittet Books Limited, London, 400 pp. Simoni, A., Salimei. E., Varisco, G., (2004). Struttura e routine di mungitura e caratteristiche della produzione di latte di asina. Proc. 6th SIDI Congress, Campobasso, (Italy, 7-8 luglio: 85-91.)