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Effects of the foal at the milking and dietary supplementation with extra virgin olive oil on jennet milk production

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ABSTRACT - The effects of the foal at the milking and the extra virgin olive oil supplementation in the diet, on the milk obtained by 12 Ragusana jennets were studied. The jennets were each fed 3.5+1.5 kg/d of concentrate+bran, and hay *ad libitum*. They were divided into 2 equal groups with one group receiving an additional dietary supplement of 100 ml/d of olive oil. Milk was collected at day 20 post foaling and every 15-18 d for 5 times. At each collection period jennets were milked 4-times per day. At 07:30 h foals were separated from the jennets and after a 4 hour interval were milked manually (1MNF;1st milking, foal absent). At the end of the 1MNF, each jennet was milked again, with the foals kept near the udder, but prevented from suckling (2MYF; 2nd milking, foal present). After 2MYF, foals were removed a second time and the sequence repeated after another 4 hour interval for the 3rd (3MNF) and 4th (4MYF) milkings. Milk yield was recorded at each milking and samples analyzed for qualitative variables. The milk yield was 26% higher than that reported by Giosuè *et al.* (2008) in similar conditions. The milk fat content were positively influenced by the presence of the foal at the milking but was not effect by the dietary supplement of olive oil.

Key words: Jennet milk, Fat, Foal, Extra virgin olive oil.

Introduction - Jennet milk is of growing interest due to its biological properties, but studies about the factors affecting the milk release during the milking are few. Jennet milk is considered a product with a low fat percentage, ranging from 0.3% (Blasi *et al*., 2007) to 1.16% (Guo *et al*., 2007), but some studies indicated that the fat content is affected by the milking procedure (Giosuè *et al.*, 2008). The effect of the maternal instinct on milk release at the milking could be the explanation. In dairy rustic cows (Alabiso *et al*., 2000) and in the mares (Doreou & Boulot, 1989) not selected for milking, the milk collected by milking is only a portion of the milk produced by the udder. Part of the milk indeed is retained since the animals keep this milk for the foals. The dripping milk is the richest in fat, considering the fat density and its accumulation on the surface of the milk remained inside the udder. The necessity to increase the fat content in jennet milk is related to the main jennet milk consumers, which are infants affected by Cow Milk Protein Allergy. The fat content in this milk is indeed not enough to satisfy the baby energetic requirement, and often paediatricians add an extra energy source such medium-chain triglycerides, or sunflower oil to the babies diet (Iacono *et al.*, 2006). A good alternative energetic resource could be the extra virgin olive oil, because its fatty acid profile is very similar to human milk fat one (Caramia, 2006). However, this oil is not added directly to the baby's diet because of palatability issues. The present study was carried out to evaluate the effects of the foal pres-

ence at the milking for the complete milk release, and the effect of a dietary supplement of extra virgin olive oil on the milk production of the jennet.

Material and methods - Twelve dairy Ragusana pluriparous jennets foaled from March to August 2006 were investigated from day 20 to day 107 ± 1.7 postpartum. The study was carried out at the ISZS, at 100 m a.s.l.. The jennets were kept in box stalls with paddocks without access to pasture, and divided into 2 homogenous groups based on body weight, milk production of the previous lactation, and foaling date. Each jennet in the control group (C) was fed a diet of 3.5 kg/d of a concentrate mixture, which consisted of crushed maize, crushed barley, fine beans and carobs, and 1.5 kg/d of bran (CP 18.50%, EE 3.23% NDF 14.34%). Each jennet in the experimental group (O) received the same diet plus 100 ml/d of extra virgin oil; the oil was mixed with the concentrate and the bran so that the composition was CP 18.19%, EE 5.00% NDF 15.88%. Jennets in both groups also received hay (CP 11.00%, EE 1.53%, NDF 63.59%) *ad libitum*, the individual consumption of which was estimated to be equivalent on average at 3.5 kg/d. The concentrates were offered each morning before milking. Body weight of the jennets was determined at the beginning and at the end of the study. At day 20 post foaling and every 15-18 days for other 5 times, each jennet was manually milked 4 times in a day. The foals were separated from the jennets at 07:30 h and after a 4 hour interval the jennets were milked. The 1st milking was done without the foals (1MNF), which were kept in a box near the jennets. At the end of the 1st milking, jennets were again milked with the foals kept near the udder (2MYF): the foals were allowed to touch the udder but did not have the possibility to suck the milk, which was milked. After 2MYF, foals were removed a second time and the sequence repeated after another 4 hour interval for the 3rd (3MNF) and 4th (4MYF) milkings. This milking design was adopted for each sampling day. In a preliminary study we found no differences in jennet milk production in comparisons between having the foal presence and with oxytocin injection at the milking (data not published). On each sampling day, the individual milk yield in each milking was recorded. In the same time, individual milk samples were collected from the 4 milkings and analyzed for fat, protein, lactose and somatic cell contents by Milkoscans calibrated with the results of laboratory analysis on jennet milk. The data from the 4 milkings were analyzed by the GLM procedure of the SAS 9.1 using a mixed model that included as fixed factors the diet (D) (1..2), the foal (F) (1..2), the milking in the morning and in the afternoon (M) (1..2), the number of the control (1..6), the interaction foal x milking, and as a random effect the jennet within the diet, used as error term. The data from total milk yield in the morning and in the afternoon milkings and their main qualitative variables were processed using the same model above reported without the foal factor and the interaction. The data from the total daily milk yield were processed in the same manner, but the model consider only the diet factor, and the interaction. The results are reported as lsm ±SE and differences between means were tested with the Student's *t*-test.

Results and conclusions - After the foaling, C and O groups weighed respectively 299.8±29.1 and 313.7±32.4 kg. At the end of the trial, C and O groups weighed respectively on average 303.0±34.1 and 316.8±20.5 kg. No significant differences in body weight were observed between treatment groups. In table 1 the jennet milk variables considering the 4 milkings are reported. The milk yield in the morning was on average greater than in the afternoon (1.27±0.02 vs. 1.03±0.02 kg/d; $P \leq 0.05$), as is normally observed in other dairy species (Aguggini *et al.*, 1992). Adopting a double milking in the morning and in the afternoon, the daily milk yield was on average about +26% than that reported by Giosuè *et al.* (2008) in similar conditions with 2 daily milkings where the foal was not present, and the milk yield was 1.7±0.1 kg/d. The total fat content was lower in the morning than in the afternoon (0.87±0.040 vs. 1.45±0.040 %; $P \leq 0.01$), in relation with a greater milk yield. In general, the milk obtained by MYF can be considered the dripping milk, which presents a high fat content and is not released when the jennets are milked without the foals. These results confirmed the hypothesis proposed in previous studies about the milk release during the milking and its effect on the milk yield and its fat content (Giosuè *et al.,* 2008). Moreover, these results explain partially the high variability and the low content of the fat reported in previous studies that involved only a single milking (Salimei *et al.*, 2004).The milk quantity and the fat content were therefore inversely related as observed in the ruminants. This differs from other studies carried involving jennets that were milked 2 times a day without the foals being present (Salimei *et al*., 2004, Giosuè *et al.*, 2008). The lactose content was on average higher in the milk

obtained by MNF than in the one produced by MYF (P≤0.01). This result could be explained considering that the lactose is in water solution, and the milk collected by the MNF had a lower dry matter and a higher water contents than the milk collected by the MYF, for the fat and the protein amounts. The dietary supplement of olive oil had no effect on any of the milk variables (Table 1 and 2). The milk fat content were positively influenced by the foal at the milking but not effected by the dietary supplement of olive oil. Considering the use of jennet milk as human food, the possibility to have jennet milk with different fat content, as a consequence of different milking modality, is an important dietetic aspect. The milk with high fat content could be better used for infant nutrition, having a positive effect on the energetic value of the diet. Anyhow the milk with low fat content could be better for infants or adults that need a low fat and caloric diet.

Table 1. The jennet milk variables considering the 4 milkings (means ±SE).

Variables	Milking					Effect			
	1MNF	3MNF	2MYF	4MYF	SE	M	F	D	M*F
Milk yield (kg/day)	0.82A	0.67B	0.45Ca	0.35Cb	0.022	*	***	ns	ns
Fat (%)	0.33Aa	0.64Ab	1.95B	3.12C	0.086	**	***	ns	ns
Protein (%)	1.84	1.82	1.91	1.86	0.014	ns	ns	ns	ns
Lactose (%)	6.35Aa	6.41Ab	6.25Bc	6.25Bc	0.017	ns	**	ns	ns
[1]SCS Log_{10} (n*1000/ml)	4.35	4.42	4.51	4.60	0.049	ns	ns	ns	ns

*=P≤0.05; **= P≤0.01; ***= P≤0.001; A, B, C: P≤0.01; a, b, c: P≤0.05; [1]SCS=somatic cell score.

Table 2. The total daily milk variables considering the diet (means ± SE).

Variables	Diet			Effect
	no oil	with oil	SE	D
Milk yield (kg/day)	2.30	2.28	0.052	ns
Fat (%)	1.07	1.18	0.042	ns
Protein (%)	1.84	1.86	0.018	ns
Lactose (%)	6.37	6.31	0.021	ns
[1]SCS Log_{10} (n*1000/ml)	4.68	4.37	0.065	ns

*=P≤0.05;**= P≤0.01; ***= P≤0.001; [1]SCS=somatic cell score.

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