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Effect of machine-milking regimes on lactation performance and Oxytocin release in Syrian Shami cattle

Kaskous[a], Shehadeh, Yassin Masri[a], Al-Moutassem Billah AL-Daker[b], Abdallah Nouh[b] and Rupert Bruckmaier[c]

a Department of Animal production, Faculty of Agriculture, Damascus University, P. O. Box: 30621, Damascus, Syria, skaskus@scs-net.org
b General Commission for Scientific Agricultural Research, Animal Wealth Research Administration, P. O. Box: 5391 Damascus, Syria.
C Department of Veterinary- physiology, Vetsuisse- Faculty, University of Bern, Bremgartenstrasse 109a, Ch-3001 Bern, Switzerland

Abstract

Two different machine-milking regimes were used to evaluate the lactation performance and Oxytocin (OT) release in primiparous Syrian Shami cows. For this purpose 12 Shami cows were investigated and divided randomly into two equal groups. Six cows were milked in the presence of the calves (PC) and subsequently suckled, whereas the remaining six cows were exclusively machine milked without the presence of their calves (WC). Milk yield and milk composition were measured each week from day 7 until day 91 of lactation
during two milkings (morning and evening).
Blood samples were taken during the two milking times from each individual cow between days 43 and 65 of lactation. A day before blood sampling, cows were catheterized in jugular vein. Sampling was performed before, during and after milking. Blood samples were anticoagulated with K3-EDTA, cooled on ice, centrifuged at 3000 g for 15 min. Plasma was separated and stored at -20_C until used for radio immunological determination of OT concentration. The degree of udder evacuation was determined by the succeeding removal of residual milk For statistical evaluation, analysis of variance was calculated based on least-square means using the MIXED procedure of SAS (SAS, 8.1). Results are presented as means ± SEM.
PC released OT during the milking process, whereas in the WC group no OT release was detected throughout the milking process. Consequently, the residual milk fraction was much lower in PC than in WC (11 v. 58 %, $p < 0.05$) and daily milk yield until day 91 post partum was higher in PC than in WC (12.6 ± 0.3 v. 7.1 ± 0.4 kg, $p < 0.05$). In conclusion, Syrian Shami cattle are not suitable to be exclusively machine milked without the presence of their calves.
Keywords: Oxytocin, residual milk, suckling, Syrian Shami cattle

Introduction: Cattle husbandry plays a major role in supplying milk and meat for human consumption in Arabic countries such as Syria. About 50 years ago Shami was the predominant breed in Syria and the whole Middle East, the region where domestication of cattle has started (Troy et al. 2001). In the meantime, most of the Shami cattle had been replaced by imported Holstein-Friesian, Friesian and Schwarzbuntes-Milchrind animals despite the local breeds being better adapted to the specific climatic conditions. However, it seems to be necessary and it is

traditionally practised, that Shami cows are milked in the presence of their calves to achieve adequate emptying of the udder. Because of lower yields and the higher work load due to the calf-handling during milking, Shami cattle are economically unattractive for dairy farmers.
The aim was to establish OT profiles throughout the milking process and to determine lactation performance in primiparous Shami cows that were machine milked either with or without the presence of their calves.

Materials and Methods:

Animals and husbandry:

The study was conducted at the Deir Al-Hajar Shami Cattle Research Station, Twelve primiparous Shami cows used. Cows were kept in an open loose housing stall and fed twice daily at 09:00 and 16:00 with a restricted ration of wheat straw, green maize and alfalfa hay. Concentrate (barley, maize, bran, extraction cotton seed meal, minerals and vitamins) was provided according to individual production levels.

Experimental procedure

Cows were randomly selected either for machine milking without the presence of the calf (WC; n = 6) or for machine milking in the presence of the calf and restricted suckling at the end of machine milking (PC; n = 6). Both groups were machine milked twice daily at 6:00 and 18:00. WC calves were weaned at day 3 after parturition. PC calves were separated from their dams after day 3 and were kept separately throughout the day except for the time of milking. Except for suckling in PC, calves had no visual contact to their dams after day 3 after parturition. A bucket milking machine (DeLaval, Tumba, Sweden) was used. Milking was performed at a vacuum of 45 kPa, a pulsation rate of 60 cycles/min and a pulsation ratio of 70/30 %. The milking routine was highly standardized, consisted of manual pre-stimulation and subsequent machine milking until milk flow ceased.
PC calves were moved to their dams immediately before milking. The calves had access to the udder for 5-10 s immediately before the start of manual pre-stimulation and were subsequently tethered close to their dams. A manual teat stimulation was performed until 1 min after the calf´s first contact to the udder. Therefore total stimulation time before the start of milking (suckling and manual) was 1 min. Thereafter machine milking was performed on three teats. The calf was allowed to suck the remaining right front teat, which was not machine milked, after the end of milking for 5 min. The milk yield obtained during machine milking in PC was multiplied by 1.33 to estimate the total milk yield under the assumption that the milk production is evenly distributed between the four quarters. In WC 1 min of manual pre-stimulation was applied before the start of machine milking.
Milk yield and milk composition was measured during two milkings (morning and evening) each week from day 7 until day 91 of lactation. To determine the degree of udder evacuation residual milk was extracted. Residual milk in WC was extracted before calves were allowed to suck. Milk composition was estimated using a MilkoScan analyser (Foss Electric, 3400 Hillerød, Denmark).
Blood samples to determine OT concentrations were taken during two milkings (morning and evening) in each individual cow. Cows were catheterized in one jugular vein for blood sampling on the day before the first experimental milking OT concentrations were measured according to Schams (1983).

Statistical analysis

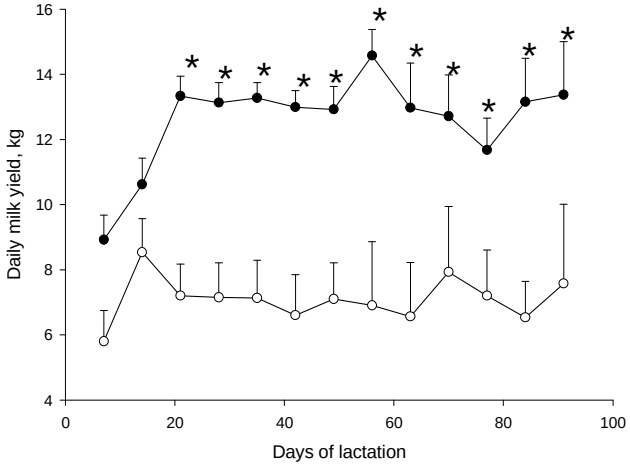
Results were presented as means ± SEM. The statistical analysis were performed using the MIXED procedure of SAS (SAS 1999).

Results

Milk yields and constituents

During the first 2 weeks of lactation milk yields in PC and WC did not differ significantly. However, after the second week milk yields in PC increased whereas yields in WC remained unchanged (Fig. 1).

Fig. 1. Daily milk yield throughout the experimental period (until day 91 post partum). Open circles indicate cows that were milked without the presence of their calves (WC). Closed circles indicate cows that were milked in the presence of their calves (PC). * indicate significant differences between treatments ($P < 0.05$).



Throughout the experimental period of 91 days post partum, milk yields in WC were about 56 % of the milk yields in PC (Table 1). Fat, protein and lactose yield were significantly reduced in WC compared to PC, although relative fat content was higher in WC compared in PC. The residual fraction in PC was about 11 % of the totally stored milk, whereas in WC the residual fraction account for about 58 % of the totally stored milk (Table 2). Consequently, residual milk fractions of fat, protein and lactose was dramatically increased in WC compared with PC.

Table 1: Daily milk yield and milk constituents during the experimental period of the first 91days post partum

Parameters		**Milking in the presence of the calves (PC)**	**Milking without the presence of the calves (WC)**
Milk yield	**kg/day**	12.6 ± 0.3 [a]	7.1 ± 0.4 [b]
Fat	**g/l**	33.9 ± 0.7 [a]	42.0 ± 1.4 [b]
	g/day	439 ± 14 [a]	301 ± 20 [b]
Protein	**g/l**	37.2 ± 0.3	36.8 ± 0.4
	g/day	464 ± 10 [a]	256 ± 13 [b]
Lactose	**g/l**	48.6 ± 0.2 [a]	45.2 ± 0.3 [b]
	g/day	613 ± 15 [a]	324 ± 18 [b]

a, b: means within a row without common superscript letters differ significantly ($P < 0.05$).

Table 2 Milk yield and milk constituents in main and residual milk during one morning milking between days 50 and 60 of lactation.

Milking in the presence of the calves (PC, n=4)		*Main milk*	**Residual milk**	**Residual yield relative to total yield, %**
Milk yield	kg/milking	5.8 ± 0.5 [a]	0.76 ± 0.3 [a]	11
Fat	g/l	32.0 ± 5.8	117.3 ± 7.4 [a]	
	g/milking	187 ± 4 [a]	88 ± 3 [a]	32

Protein	g/l	35.7 ± 2.1	30.7 ± 2.1	
	g/milking	209 ± 3 [a]	24 ± 2 [a]	10
Lactose	g/l	50.0 ± 1.5 [a]	45.2 ± 1.9	
	g/milking	294 ± 3 [a]	35 ± 2 [a]	11
Milking without the presence of the calves (WC, n=5)				
Milk yield	kg/milking	1.4 ± 0.5 [b]	1.9 ± 0.6 [b]	58
Fat	g/l	37.9 ± 7.9	63.9 ± 7.3 [b]	
	g/milking	46 ± 3 [b]	117 ± 5 [b]	72
Protein	g/l	34.9 ± 3.2	36.7 ± 2.3	
	g/milking	49 ± 3 [b]	69 ± 3 [b]	59
Lactose	g/l	41.6± 3.5 [b]	42.6 ± 3.5	
	g/milking	60 ± 3 [b]	84 ± 4 [b]	58

a, b: treatment means without common letters differ significantly (P < 0.05).

Oxytocin concentrations

For both PC and WC, OT concentrations were low before the start of milking (Fig. 2). OT concentrations increased after the start of stimulation in PC, whereas in WC, OT concentrations remained at the baseline level throughout the course of milking. In PC, OT concentrations peaked 1.5 to 2 min after the start of stimulation and decreased to basal level until 10 min after the end of milking.

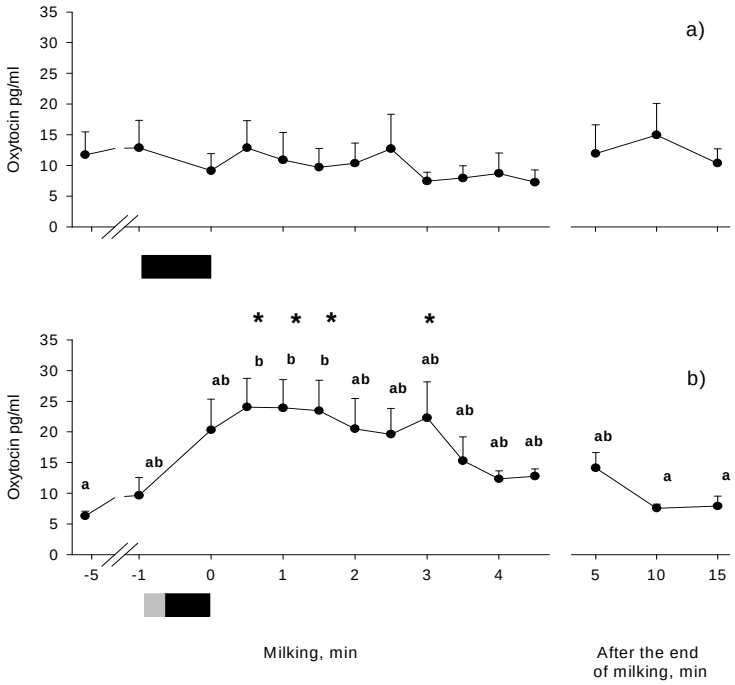


Fig.2. Oxytocin concentration before, during and after milking without the presence of the calf (a, WC), and with the presence of the calf (b, PC). The black bar indicates manual pre-stimulation of the teat, the grey bar indicates stimulation by the calf. * indicate significant differences between treatments, means without common letters within treatments differ significantly (P<0.05)