STUDY ON MILK STIMULATION INTERVAL IN CAMEL USING THE NOMADIC TRADITIONAL METHOD

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Abstract- *16 she-camels were chosen from a large herd of camel belonging to the Lahween tribe in Eastern Sudan. The breed is known locally as (Arabi-Lahwee). This study was thus initiated to identify the actual time needed to stimulate the milk let-down reflex by introduction of the calf and to investigate on the effect of parity orders, dams body weight and time of milking on milk stimulation interval. Neither parity order, body weight groups nor day hours (morning and evening) not showed any sig. impact on milk stimulation interval (MSI). For the 3rd, 4th and 5th parity orders MSI was 116.4±21.5, 127.0±42.8 and 109.8±7.7 seconds, respectively (means 116.3±12.7 seconds). Body weight groups scored 113.8+18.2 and 118.9±18.9 seconds for <500 and >500 kg, respectively, and at morning and evening time reported 68.1±5.4 and 70.9±73 seconds, respectively as MSI. Milk yield (MY) (912±119.6 ml), milking duration (MD) (78.2±4.2 sec.), udder measurements including size, depth, circumference, teat length and diameter showed negative and non-sig. correlation with MSI. While body weight (517.9±19.3 kg) was positively and sig. (P < 0.05) correlated and milk flow rate (11.7±1.3 ml/sec) reported positive and non-sig. correlation with MSI. Sig. (P<0.01) variations in the measurements of the udder depth, circumference, size, teat length and teat diameter before and after milking were observed.*

Keys words: *Camel, milk, stimulation, body weight, milking time, udder measurements*

دراسة زمن التحنين (إدرار اللبن) في الإبل بإستخدام الطريقة التقليدية للبدو

الخلاصة -تم إجراء هذه الدراسة في 16 ناقة تم إختيارها من قطيع من الإبل العربية اللحوية التي تنتمي الي قبيلة اللحويين في شرق السودان (الشوك) . الهدف من هذه الدراسة معرفة المدة الزمنية المطلوبة لنزول اللبن (التحنين) باقتراب الحوار من امه ومعرفة تاثير كل من عدد الولدات، وزن الأم ووقت الحلابة على فترة التحنين. في هذه الدراسة لم يلاحظ أي تأثير معنوي لاي من عدد الولأدات، المجموعات الوزنية للنوق أو وقت الحلابة (الصباح والليل) في زمن التحنين. لمجموعات النوق التي كانت في الولادة الثالثة، الرابعة والخامسة الزمن المستغرق في عملية التـحنين هـو (116.4 ± 21.5)، (127.0 ± 42.8) و(109.8 ± 7.7) ثانية علي التوالي (المتوسط 116.3 ± 12.7) ثـانية. المجموعـات الوزنية للنوق سجـلـت (113.8 ± 18.2) و(118.9 ± 18.9) ثانية لكل من المجموعتين أقل من 500 وأكثر من 500 كيلو جرام علي التوالي .في كل من ساعات الصباح والليل سجـلـت فترة التحنين (68.1 ± 5.4) و(70.9 ± 7.3) ثانية علي التوالي. كل من إنتاج اللبن مل (912±119.6) ، الوقت المستفرق في عملية الحـلابة (78.2 ± 4.2ث) وقياسات الضرع التي شملت العمق، المحيط والحجم وطول الحلمة وقطرها سجلت إرتباطاً سالباً وغير معنوياً مع الزمن المستغرق في عمليـة التحنين . بينما وزن الجـسم (517.9±119.3) كج سجل إرتباطاً موجباً ومعنويـاً (P < 0.05) وتدفق اللبن مل/ثانية (11.7±1.3) سجل إرتباطاً موجباً ولكنه غير معنوياً مع الزمن المستغرق في عملية التحنين (الإدرار). كما لوحظ أن هنالك فروقات معنوية في كل من القياسات التي أجريت لعمق الضرع، محيط الضرع، حجم الضرع، طول الحلمات وقطرها قبل وبعد الحـــلابة (P < 0.01).

المفتاح: الابل, فترة التحنين, اللبن, الوزن, فترة الحلابة , قياسات الضرع

Introduction

In the she-camel as in others dairy animals, milk is stored within two compartments of the mammary gland: the cistern (including teat and gland cisterns and large milk ducts) and alveoli (small milk ducts and alveoli lumni). The cisternal milk, which comprises only a small portion, can be easily removed by suckling, hand and or machine milking, without any previous stimulation. In contrast, the alveolar milk can only be removed under milk ejection reflex activation. Tactile stimuli on the teat initiate a neuroendocrine mechanism resulting in the release of oxytocin from the posterior lobe of the hypophysis into the blood stream. Oxytocin causes the contraction of the myoepithelial cells that surround the alveoli, thus forcing the alveolar milk into the cisternal compartment [1].

In she-camels, the presence of calf is considered imperative for milk let-down, and hand massaging of the teat plays a complementary role to enhance milk let-down responses. If a calf dies, the dam dries up if milking is not stimulated [2]. For this a foster calf or conditioning of the mother is necessary. Often arranging for the dam to see the skin of her dead calf is enough to stimulate let-down of milk. Milk let-down response in the she-camel is easily noticeable shortly following the introduction of the calf manifested by sudden swelling of the teats. This necessitates a quick removal of milk because of the short duration of response, which last only for 1.5 minutes according to [3].

Data on the actual milk yield of she-camels are not very accurate for judging the milk potential, because the calf must be allowed to suckle and how much the calf drinks varies with its age, size and health. The amount of grazing and water available to the dam will also determine the amount of milk suckled by calves.

Epistein (1971) documented that the amount of milk the calf is allowed is determined by its needs and the milking capacity of the mother. He continued that when calves have finished suckling the amount left for consumption by the tent dwellers can vary from 1 to 4kg [4]. This aspect, no doubt, result in giving erroneous estimates of actual milk yield of camel herds especially under traditional husbandry system where calves run freely with their dams.

The present study was thus initiated to identify the actual interval needed to stimulate the milk let-down reflex by introduction of the calf and to investigate on the effect of parity orders, dams body weight and time of milking on milk stimulation interval.

1.- Material and methods

1.1.- Experimental animals

16-lactating she-camels of type Arabi-Lahawi with different parities, stage of lactation (3^{rd}, 4^{th} and 5^{th}) and age were randomly selected from the village herd, maintained under natural habitat and managed according to the traditional husbandry system deeply rooted in the society. The system is characterized by transhumance mode of life dictated by the prevailing ecosystem.

For the purpose of this study, young calves are kept in isolation from dams and were allowed to their dam only at milking times, which was performed twice a day in the morning and the evening, since the presence of the calf is imperative for milk let-down in the she-camel.

1.2.- Monitoring of milk stimulation interval (MMSI)

For determining the MMSI, the calves are introduced to their respective dams. Just before milking time. Once, the calf is introduced to his mother certain behavioural signals seem to be involved in the initiation of milk let-down. These signals can be summarized as follows:

(i) Once the calf is introduced and finds his way between the mothers rear legs, the mother first smell the calf back and the latter will raise his tail upwards. This is considered as the beginning of milk let-down response and is recorded using a stopwatch.

(ii) The calf start whiggling his tail in an up and down movement in a quick manner and simultaneously grasp with his tongue all the teat in very fast way. The teats then start to swell.

(iii) Eventually, the calf will end-up with suckling one teat and maintain his tail horizontally with the end piece in an S-shaped. Signaling that it received milk. This was considered as the terminal point for the MSI. This time was recorded by means of the stopwatch.

This procedure was adopted to measure the MSI (time lapse between step (i) and step (iii)) in the experimental animals, in morning and evening milking through 6-month period).

1.3.- Udder measurement

Udder measurement, including udder depth (UD), udder circumference (UC), udder size (US), teat length (TL) and teat diameter (TD) were monitored. Throughout the experimental period on a monthly basis pre and post-milking to assess changes associated with MSI.

1.4.- Determination of milk yield (MY), milking duration (MD) and milk flow rate (MFR)

The MY is taken as the total milk yield (in ml) obtained from the four quarters per milking. MD is the time required to obtain that amount of milk (in second by stopwatch). MFR is the amount of milk (ml/sec) obtained by dividing MY/MD.

1.5.- Statistical analysis

The data was subjected to statistical analysis programme described by Minitab 12.1 (1997). Analysis of variance (ANOVA) was used for variables affecting the MSI (parity order, body weight and milking time), while persons correlation was adopted to describe the relationship between MSI with MY, MD, MFR, body weight and udder measurement.

2.- Results

2.1.- Parity order

The data describing the mean MSI as affected by parity order is presented in Table I. The result indicates that, the MSI in the three parities studied were 116.4±21.5, 127.0±42.8 and 109.8±7.7 seconds for the 3rd, 4th and 5th parities, respectively. The data reflects a non-consistent pattern. The shortest MSI was secured by the group in the 5th parity, followed by the third parity group, while the longest MSI was in the 4th parity group. The statistical analysis showed a non-significant (P < 0.05) effect of parity order in MSI.

Table I.- Average MSI/sec according to parity order

Parity order	N	Mean	±S.E
3rd	8	116.4[a]	21.5
4th	3	127.0[a]	42.8
5th	5	109.8[a]	7.7
Total	12	116.3	12.7

When the minimum and maximum MSI were considered the result in Table II showed that, the minimum MSI in the three parities were 55, 59 and 82 second, while the maximum values were 240, 206 and 128 seconds, respectively for the 3rd, 4th and 5th parities, respectively. Table II also indicated that, maximum MSI decreases with the increase in parity order. The differences, however maintained a non-significant value (P < 0.05).

Table II.- Minimum and maximum MSI/sec according to parity order

Parity order	Minimum	Maximum
3rd	55[a]	240[a]
4th	59[a]	206[a]
5th	82[a]	128[a]

2.2.- Body weight

The data in Table III concerning the effect of body weight of the dams on MSI revealed non-significant effect (P < 0.05). However, the lighter females (< 500 kg) secured shortest MSI than the heavier (> 500 kg). The lighter group mean MSI was 113.8±18.2 second as compared to 118.9±18.9 seconds for the heavier group.

Table III.- Average MSI/sec according to body weight

Parity order	N	Mean	±S.E
< 500 kg	8	113.8[a]	18.2
> 500 kg	8	118.9[a]	18.9
Total	16	116.3	12.7

In the figure 1 minimum and maximum MSI for the two body weight, groups were 55, 206, 59 and 240 for the lighter and heavier groups, respectively.

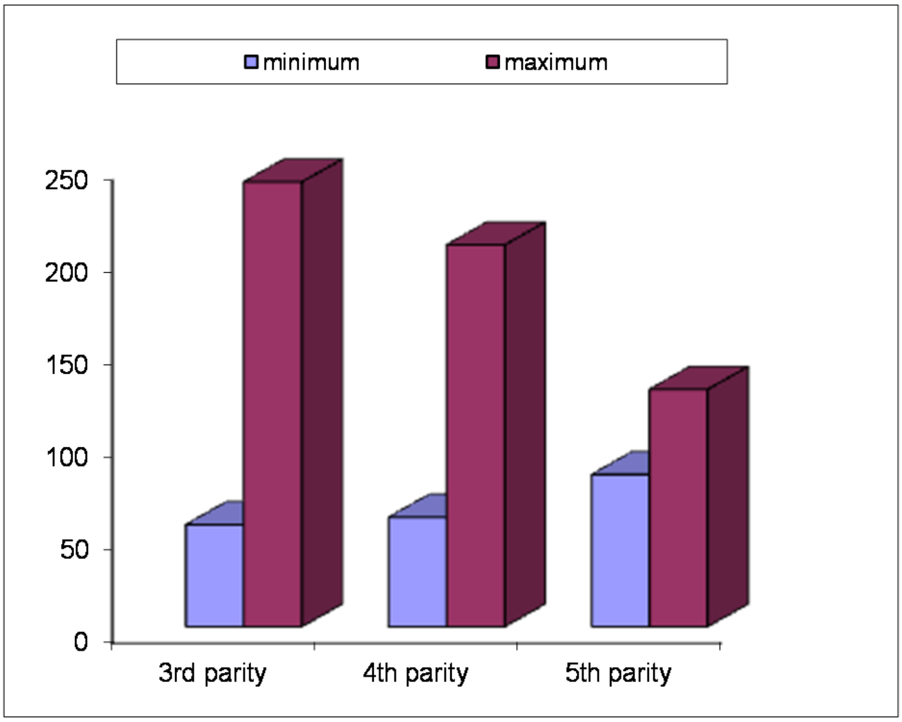

Figure 1.- Minimum and maximum MSI/Sec according to parity order groups

2.3.- Udder measurements

The results on udder measurement monitored pre and post milking are presented in table IV the obtained values indicated a highly significant difference in all measured parameters (P < 0.01). The udder depth (UD) before milking was 16.9± 0.109 cm, which declined to 15.9± 0.109 cm post milking. The udder circumference (UC) was 91.4± 0.688 cm prior to milking, and which declined to 85.3±0.688 cm after milking. The udder size (US) too witnessed a sharp decrease, 1559.5±18.5 cm^3 before milking compared to 1375.1± 18.5 cm^3 after completion of milking. The teat length (TL) and diameter (TD) also showed significant (P < 0.01) increase when compared before and after milking. The results showed that UD, UC and US increased by 6.3%, 7.2% and 13.4% during the pre-milking and post-milking, respectively. Similarly, the teat length and teat diameter increased by 12.8% and 15% when compared during pre and post-milking episodes.

Table IV.- Udder measurements before and after milking (P<0.01)

Measurement (cm)	Mean		±S.E	% increase
	Before	After		
Udder depth	16.9^a	15.9^b	0.109	6.3
Udder circumference	91.4^a	85.3^b	0.688	7.2
Udder size (cm^3)	1559.5^a	1375.1^b	18.5	13.4
Teat length	4.4^a	3.9^b	0.106	12.8
Teat diameter	2.3^a	2.0^b	0.057	15.0

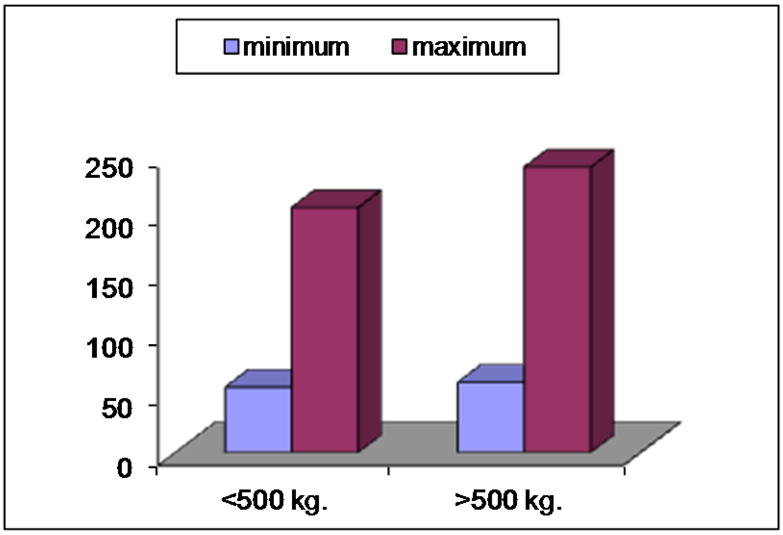

Figure 2.- Minimum and maximum MSI /sec. according to body w.t groups

2.4.- Time of milking

The data pertaining to MSI as affected by morning and evening milkings, are presented in table V The result indicated that, the MSI during the morning and milking (6–9 am) was 68.4±5.4 second, while that of the evening milking (8–11 pm) was 70.9±7.3 second with non- significant (P < 0.05) differences suggested that time of milking did not influence MSI.

Table V.- Average morning and evening MSI/sec

Time	Hours	N	Mean	±S.E
Morning	6-9 am	16	68.1^{a}	5.4
Evening	8-11 pm	16	70.9^{a}	7.3

2.5.- Correlation between MSI with milk yield and milk traits

Data describing the correlations between MSI in one hand and milk yield (MY), milking duration (MD) and milk flow rate (MFR) on the other hand are tabulated in table VI. The MY per-milking of the four quarters averaged 912±119.6 ml, while mean milking duration (MT) was 78.2±4.2 seconds. Both trails showed negative and non-significant (P<0.05) correlation with MSI. The average MFR measured in ml/second secured a value of 11.7±1.3 ml/second and was found to be positively with non-significant (P<0.05) correlation with MSI (r = 0.048).

Table VI.- Correlation between MSI with MY, MD and MFR (n.s: non-significant, P < 0.05; N: number of observation)

Parameters	N	Mean	±S.E	(r)
Milk yield/milking ml	16	912	119.6	$-0.154^{n.s}$
Milking time/second	16	78.2	4.2	$-0.454^{n.s}$
Milk flow, ml/sec	16	11.7	1.3	$0.048^{n.s}$

2.6.- Correlation with body w.t and udder measurements

The correlation between body weight of the dam and MSI was found to be positive and significant (P<0.05) (tab. VII) The udder measurement, including US, UD, UC, TL and TD have negative and insignificant correlation with the MSI.

Table VII.- Average body weight and udder measurement and their correlation with MSI **(**n.s : non-significant, P < 0.05; *: significant, P < 0.05)

Parameters	N	Mean	S.E±	(r)
Weight/kg	16	517.9	19.3	0.600*
Udder size/cm^3	16	1559.5	97.1	- $0.311^{n.s}$
Udder depth/cm	16	16.9	0.63	- $0.298^{n.s}$
Udder circumference/cm	16	91.4	2.5	- $0.317^{n.s}$
Teat length/cm	16	4.4	0.35	- $0.182^{n.s}$
Teat diameter/cm	16	2.3	0.20	- $0.108^{n.s}$

3- **Discussion**

A few authors documented that, the presence of the calf is imperative to milk let-down in the she-camel. In the present study, which allowed close observation of the behavioral signals from both the mother and calf following the introduction of the calf prior to milking and the subsequent activation of milk let-down response emphasizes the importance of the calf presence to initiate milk ejection reflex. Mares (1954) postulated that, if a calf dies the dam dries up if milking is not stimulated. The adoption of a foster calf by arranging for the dam to see the skin of her dead calf is enough to stimulate let-down of milk [2]. In the present study and due to the close observation and recovering of thee dam and calf behavior it can be anticipated that both a visual and olfactory stimuli are important for milk ejection reflex to be initiated. This is also true for tropical breeds of dairy cattle, which are usually milked with the calf penned at the rear quarters of the dam.

The release of oxytocin from the posterior pituitary gland is essential for the contraction of the myoepithelial cells surrounding the alveoli, thus forcing the alveolar milk into milk ducts. This is reflected by the swelling of the udder and teats. The measurements of udder depth, size and circumference and teat length and diameter witnessed significantly higher values during the evoke of the MSI as compared to their values after milking, suggesting the flow of milk following the introduction of the calf and initiation of milk ejection reflex. This result emphasizes previous reported claimed by Lefcourt and Akers (1983); Bruckmaier and Blum (1998) [1]. The oxytocin is released in response to tactile stimulation of the teat [1]. The authors also claimed that in camel the smell of the young by his mother is an important psychosomatic stimulation, which may cause increased release of oxytocin and facilitate milk ejection. This fact is re-emphasized in the present study by the significant (P < 0.01) increases in udder and teat measurement during the pre milking interval.

The mean MSI found in this study was 116± 12.7 seconds falls well within the range reported by Yagil *et al.* (1999) who found that MSI in the she- camel is initiated shortly after suckling (1.5 seconds) and is easily noticeable through the engorgement of udder and teats [3].

The present results highlighted that parity order does not affect significantly the MSI, despite the fact that it decreases with increasing parity. The high value of MSI recorded for the 4^{th} parity group may be attributed the small number of observation in this group (only 3 animals). The results also indicated non-significant ($P > 0.05$) effect of body weight on MSI. However, the lighter group (<500 kg) maintained a shorter (113.8+18.2 seconds) MSI as compared to the heavier group (>500 kg) MSI (118.9+18.9 seconds).

The MSI during day time was slightly shorter in the morning than that of evening-milking (68.1±5.4 versus 70.9±7.3) seconds. The difference was insignificant. The milk yield /milking amounted to 912±119.6 ml, while the milking duration averaged 78.2±4.2 second. Both parameters showed negative and non-sig. ($P<0.05$) correlation with MSI. The MFR on the other hand was 11.7±1.3 ml/seconds and was positive and non-significant correlated with MSI. These traits (MY, MT and MFR) are beyond doubt affected by the milker and milking interval. In the present study the milking intervals were maintained constant whereby, the morning milking was practiced between 6 – 9 am, while the evening milking between 8-11 pm.

The present study could have provided more solid data on interval of time needed to evoke the milk ejection reflex if oxytocin profiles in the plasma were monitored.

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