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EFFECT OF STIMULATION TYPES ON MACHINE MILKING PROCESS IN EGYPTIAN BUFFALOES

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ABSTRACT: ***The present study was carried out at a commercial buffalo farm named "El-koumy farm", located in Elbeheera province, Nubaria, El-shagaha village on the desert road (Cairo – Alexandria, Egypt) at 90 km, from Alexandria. The experiment was conducted to study the effect of stimulation type on milking process such as parlor waiting management, milk yield per milking and milk flow rate. Animals were classified according to: type of stimulation, milking frequency per day, times of milking; and milkers team. A total numbers of 92 randomly chosen machine milked animals in their second to sixth lactation were used in the present experiment. Data were analyzed using SPSS program version 10, (1999). Results reveled that type of stimulation had a highly significant effect on stimulation period and parlor waiting period. In general, milking process duration can be arranged in the following descending order: hand massage and machine stimulated buffaloes (7.85 min.), only machine stimulated buffaloes (7.16 min.) and finally oxytocin treated buffaloes (6.53 min.). Type of stimulation had a highly significant effect on stimulation period, the longest stimulation period was achieved in hand massage and machine stimulated Buffaloes (9.66 min.) which was significantly higher than oxytocin administrated animals (7.68 min.). The lowest period was observed in only machine stimulation which was significantly lower than another two groups.***

Type of stimulation had no significant effects on milk yield per milking or milk flow rate.

Key words: ***Machine milking, Parlor management, stimulation type , milk yield, flow rate, Oxytocin, Buffaloes***

INTRODUCTION

Buffalo cows have small udder cistern and almost 95% of the milk is stored in the alveolar compartment. As a result, pre-milking stimulation is of extreme importance for optimal milk ejection response in buffaloes. Different from cows, the buffaloes' cisternal compartment is more prominent in the teats than in the gland (Thomas *et al.,* 2004).

Buffaloes' stimulation for milk letdown requires more time compared to cows, in average 2 minutes. For this purpose, the calf is used, in most cases, when milking is done by hand. A number of researchers from different parts of the world have reported the problem of disturbed milk ejection and rapid

termination of lactation when calves die or if the usual milker is replaced (Sastry and Tripathi, 1988). In general buffalo are known to be difficult to milk. However, the practice of using calves is not adopted in some herds where buffalo cows are machine milked in parlors (Svennersten-Sjaunja, 2000).

In Egypt there are many farms where herds of about 100 and more using machine milking. Milk ejection in mammals is a process that is controlled by the maternal instincts of the lactating animal. The importance of oxytocin release for the removal of alveolar milk during machine-milking is well established and has been previously reviewed (Gorewit *et al.,* 1983 and Lefcourt and Akers, 1983).

In dairy cows hereditary traits like milk ejection have been improved by selective breeding and the large volume of milk produced by these animals further influences quick milk ejection. Thus modern dairy cows are conditioned to respond to stimuli like feeding during milking, the presence and touch of the milker, and the sound of the milking machine. Buffalo have not been selectively bred to the extent that dairy cattle have been, hence the maternal instinct remains dominant in them and they can be easily disturbed by even small changes in milking routines.

Much work has been done on the milking management of dairy cattle, sheep and goat, but comparatively little research data is available on the milking management of buffaloes (Sastry and Tripathi, 1988).

Therefore, the present study was conducted to investigate the effect of stimulation type on machine milking process in Egyptian Buffaloes.

MATERIALS AND METHODS

This experiment was carried out at a commercial buffalo farm "El-koumy farm", located in Elbeheera province, Nubaria, El-shagaha village on the desert road (Cairo – Alexandria, Egypt) at 90 km, from Alexandria. The farm was specialized in buffalo milk production.

Animals

A total numbers of 92 machine milked animals in their second to sixth lactation were used in the present experiment and distributed as follows: 66 buffaloes were milked 4 times per day at 1 am, 7 am, 1 pm and 7 pm. On the other hand 26 buffaloes were milked only twice daily at 7 am and 7 pm. Three kinds of stimulation were used as follows:

A: Only machine stimulation (MS).

B: Machine stimulation in addition to oxytocin administration (MSO).

C: Hand massage in addition to machine stimulation (MSH).

One milkers team milked animals at 7 am and 7 pm while other milkers team milked animals at 1 am and 1 pm. (Table 1).

(Table 1): Distribution of animals used in first experiment.

Stimulation type	Milking frequency per day		
	Four times (4x)	Two times (2x)	
	At 1 am, 7 am, 1 pm and 7 pm	At 7 am and 7 pm	At 1 am and 1 pm
MS	50	19	7
MSO	10	-	-
MSH	6	-	-

Herd and parlor management:

Animals were kept in loose housing system in open, half-shaded pens. The sandy ground replaced periodically. Animals were fed a total mixed ration (TMR) for ad lib intake. The diet consists of the following ingredients as available (clover, silage, clover hay, corn, soybean meal, wheat barn, minerals and vitamins).

Machine milking was performed in a constant milking parlor. Milking parlor consists of 16 standing points; only 8 points of them were equipped with milking machine. Consequently only half of the buffaloes were milked together in the same time while the other half of the animals waiting and watching milking process (Pre-stimulation)

Animals were milked in their stall in non-fixed sequences, which allow animals to choose any milking stall. high yielding buffaloes milked 4 times daily while buffaloes at the end of lactation milked only twice daily. No food was offered during milking. A pre-stimulation routine before each milking consisting of washing the udder and teats with water and then were completely dried.

Criteria studied and recorded

Concerning the parlor waiting management, the following criteria were observed.

1. **Parlor waiting period (pre-stimulation): The time spend from entering the milking parlor until attaching milking unit or starting stimulation process (the second period).**

2. **Stimulation period:** **The time spend from attaching milking unit or starting stimulation until milk let down starting.**
3. **Milking process duration:** **The time spend from milk let down until ceased of milk flow.**
4. **Post- milking period:** **The time spend from ceased of milk flow until removal of milking unit.**
5. **Parlor waiting period (post- milking):** **The time spend from the removal of milking unit until the animal left the milking parlor.**
6. **Total parlor waiting period:** **The time spend from entering milking parlor until animals departure it.**

Recording and observation of criteria studied were done using stop watch and special video camera. The results relating to each criterion were expressed in absolute mean figures per animal and as a percentage of total milking periods.

Milk yield and milk flow rate per milking were also recorded as following:

1. **Average milk yield per milking (kg).**
2. **Average milk flow rate (milk yield / milking duration) per milking (kg/min).**
3. **The range of milk flow rate per milking (kg/min).**

Statistical analysis and Models

Statistical analysis were conducted to study the effect of type of stimulation on the parlor waiting management and milk yield as well as milk flow rate. Data were analyzed using the general linear model of SPSS (Statistical Package for Social Science) program version 10, (1999). According to the following model:

$$Yjklmn = \mu + S\,i + Tj + Fk + M\,l + eijklm$$

Where:

Yijklm — **Criteria studied for buffaloes in the ijklm subclass.**

μ — **Overall mean**

Si — **Effect due to the j_{th} type of stimulation, j = 1, 2, 3, where:**

- **1= machine stimulation only**
- **2= machine stimulation in addition to oxytocin administration**
- **3= hand and machine stimulation**

Tj Effect due to the k_{th} time of milking, k = 1, 2, 3, 4, where:
1=milking at 7 pm
2=milking at 1 am
3=milking at 7 am
4=milking at 1 pm

Fk Effect due to the l_{th} milking frequency, l = 1, 2, where:
1= milking 4 times daily (4X)
2= milking 2 times daily (2X)

M l Effect due to the m_{th} milkers team, m= 1, 2, where:
1= first milkers team milked all animals that were milked at 7 am and 7 pm.
2= second milkers team milked all animals that were milked at 1 am and 1 pm.

eijklm Random error

RESULTS AND DISCUSSION

Effect of stimulation type on parlor waiting management

Table (2) and Fig. (1) shows that, total parlor waiting period was the longest for hand and machine stimulation buffaloes (36.36 min.) which was related also to the longest stimulation period (9.66 min.).

On the other hand, the shortest total parlor waiting period (32.29 min.) was observed with machine stimulated buffaloes which could be attributed to the shortest pre-stimulation and stimulation period recorded in this group (7.96 min and 4.45 min. resp.) In addition stimulated buffaloes to oxytocin administration had the intermediate mean value of total parlor waiting period being 33.71 min. (Table 2). However differences among three groups were not significant.

Furthermore extra hand stimulation resulted in an insignificant increase of milking process duration than only machine stimulated animals (7.85 and 7.16 minutes, respectively). This result was not in agreement with that of Tancin *et al.* (2007) who studied the milking with or without manual stimulation and reported that pre-stimulation process resulted in a reduction of milking time. Administration of oxytocin caused a reduction of milking process duration (6.53 min.) Differences among three groups were also not significant. These results were in agreement with that reported by Maurya and Ludril (1992) who found that milk let-down time decreased from 196 s for buffaloes not given oxytocin to 79 s for buffaloes given 10 IU oxytocin before milking.

In general, the milking process duration can be arranged in the following descending order: hand and machine stimulated group (7.85 min.), machine

stimulated group (7.16 min.) and group that was machine stimulated plus oxytocin administration (6.53 min.). Post- milking period was almost equal among three groups (2.48 min., 2.13 min. and 2.37 min.) for only machine stimulation, hand and machine stimulation and stimulation in addition to oxytocin administration. Type of stimulation had a highly significant effect on stimulation period, the longest stimulation period was achieved with hand and machine stimulated Buffaloes (9.66 min.) which was significantly higher than oxytocin administration animals (7.68 min.). The lowest period was observed in only machine stimulation which was significantly lower than another two groups.

Table (2): Effect of stimulation type on parlor waiting management.

Parlor waiting management (min.)	Only Machine stimulation	Hand and Machine stimulation	Machine stimulation and oxytocin administration	Sig
	$\bar{X} \pm SE$	$\bar{X} \pm SE$	$\bar{X} \pm SE$	
N = 316	252	24	40	
Parlor waiting period (pre-stimulation)	7.96 [a] ± 0.58	10.17 [ab] ±1.48	11.36 [b] ±0.93	0.05
Stimulation period	4.45 [a] ±0.32	9.66 [c] ±1.25	7.68 [b] ± 0.83	0.01
Milking process duration	7.16 ± 0.19	7.85 ± 0.66	6.53 ± 0.28	NS
Post- milking period	2.48 ± 0.29	2.13 ± 0.41	2.37 ± 0.51	NS
Parlor waiting period (post- milking)	10.24 [b] ± 0.57	7.55 [a] ± 1.32	5.77 [a] ± 0.80	0.01
Total parlor waiting period	32.29 ± 0.86	36.36 ± 1.76	33.71 ± 1.48	NS

a ,b, c means within each row with different superscript differ significantly,P >0.05 non significant, P < 0.01 highly significant and P < 0.05 significant.

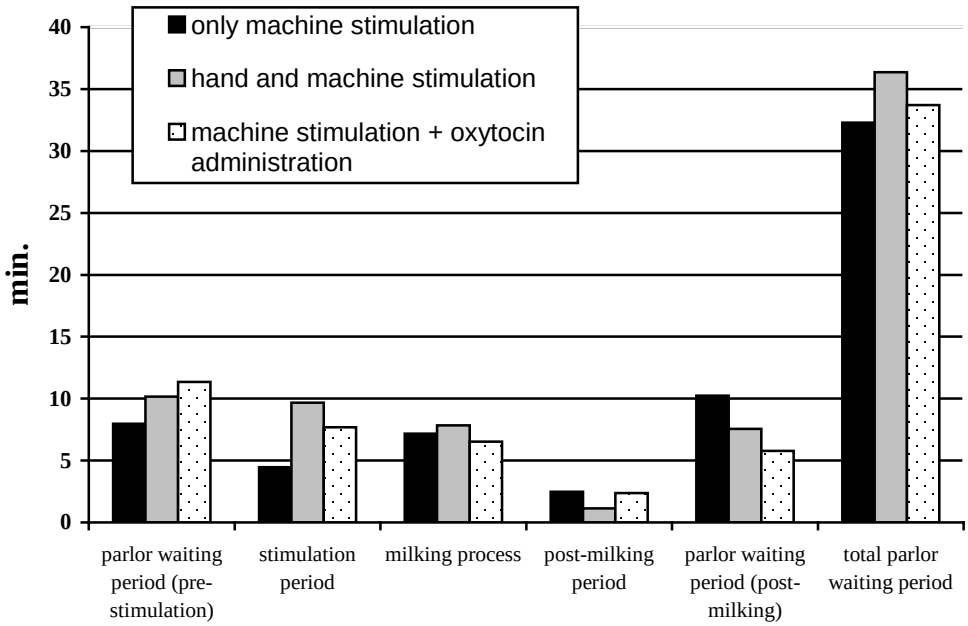

Fig (1): Effect of type of stimulation on parlor waiting management (Minute)

Th total parlor waiting period for buffaloes according to the type of stimulation was listed in Table (3). In machine stimulated group, the greatest part of total parlor waiting period was observed in parlor waiting period (post-milking) (31.71 %) followed by parlor waiting period (pre-stimulation) (24.65 %) then by the milking process duration period (22.17 %). In hand stimulated group, the greatest part of the total parlor waiting period was occupied by parlor waiting period (pre-stimulation) (27.97 %) followed by the stimulation period (26.57 %), then by milking process duration (21.59 %) and finally by the parlor waiting period (post-milking) (20.76 %). Treated buffaloes with oxytocin followed the same trend that recorded in hand and machine stimulated group: pre-stimulation period (33.70 %); stimulation period (22.78 %); milking process duration (19.37 %); parlor waiting period (post-milking) (17.12 %).

Table (3): Effect of stimulation type on parlor waiting management as a percentage of total parlor waiting periods (%)

Parlor waiting management	Machine stimulation	Hand and Machine stimulation	Machine stimulation + oxytocin treatment
	(%)	(%)	(%)
N = 316	252	24	40
Parlor waiting period (pre-stimulation)	24.65	27.97	33.70
stimulation period	13.78	26.57	٢٢.٧٨
Milking process duration	22.17	٢١.٥٩	١٩.٣٧
post- milking period	7.69	٣.١١	٧.٠٣
Parlor waiting period (Post- milking)	31.71	٢٠.٧٦	١٧.١٢
Total parlor waiting period	١٠٠	١٠٠	١٠٠

Effect of stimulation type on milk yield and milk flow rate

Data in Table 4 and Figures 2 and 3 shows the milk yield and milk flow rate of Egyptian buffaloes according to the type of stimulation. Machine stimulated buffaloes, on the average, produced 3.11kg milk per milking. Extra hand stimulation did not alter the milk yield and still at the level of 3.11kg. The addition of oxytocin resulted in an increase in the average milk yield to reach 3.31kg per milking. Also with oxytocin increased the average milk flow rate (0.52 kg/min). The average values du to machine stimulation and extra hand stimulation were 0.46 and 0.44 kg/min., respectively. However each group had a range of milk flow rate being 0.13-1.01, 0.21-0.89 and 0.17-0.99kg/min. for groups of machine stimulation, addition of oxytocin administration or extra hand stimulation, respectively. These differences observed in milk yield or milk flow rate due to type of stimulation were not significant (Table 4).

These results were in agreement with that reported by Bava *et al.* (2007) who found that administration of oxytocin before milking did not significantly affect milk flow in buffalo cows. On the other hand Mallikarjun Bidarimath and Anjali Aggarwal (2008) reported that, with Murrah buffaloes, a significant increase in milk flow rate in oxytocin treated buffaloes (5.0 IU/ml IM) was found. In Holstein cows, Leone *et al.* (2007) showed that there is a decrease in milk production effect when removing cows from exogenous oxytocin treatment.

Rohit Bishist and Kamboj (2010) concluded that pre-milking udder and teat stimulation enhances milking efficiency. Unal *et al.* (2008) found that milk yield obtained by oxytocin injection plus machine milking technique was higher than machine milking technique during whole lactation period in Bafra sheep.

Table (4): Effect of stimulation type on milk yield and milk flow rate.

	Type of stimulation		
	Machine stimulation	Hand and Machine stimulation	Machine stimulation + oxytocin administration
	$\bar{X} \pm SE$	$\bar{X} \pm SE$	$\bar{X} \pm SE$
N = 316	252	24	40
Average milk yield (kg)	3.11 [a] ± 0.01	3.11 [a] ± 0.19	3.31 [a] ± 0.8
milk flow rate (kg/min): Average	0.46 [a] ± 0.00	·.44 [a] ± 0.00	0.52 [a] ± 0.00
Range	0.13 – 1.01	0.17 - 0.99	0.21 - 0.89

*** The same letters means that no significant differences were detected among values.**

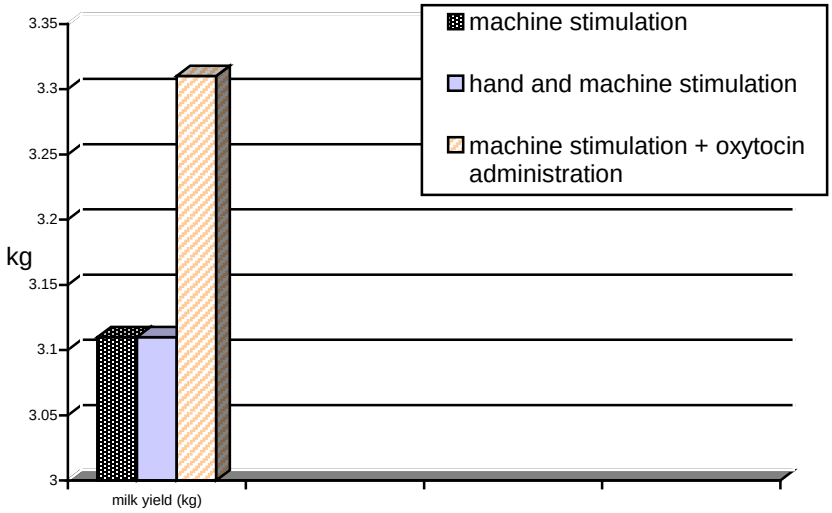

Fig (2): Effect of stimulation type on milk yield.

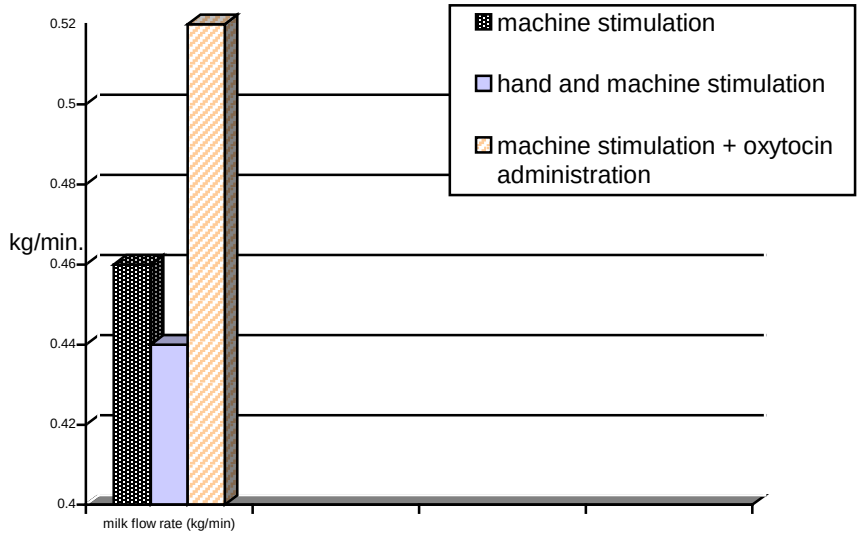

Fig (3): Effect of stimulation type on milk flow rate.

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تأثير طريقة التحنين على عملية الحليب الآلى فى الجاموس المصرى

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الملخص العربى

أجريت هذه الدراسة في مزرعة جاموس تجارية "مزرعة الكومي" والواقعة في محافظة البحيرة – في النوبارية – قرية الشجاعة على الطريق الصحراوي (القاهرة – الأسكندرية، في مصر) على بعد ٩٠ كم من الأسكندرية. وقد اجريت التجربة بغرض دراسة تأثير نوع التحنين على فترات الانتظار والحلابه داخل المحلب ومحصول اللبن اليومى ومعدل تدفق اللبن.

تم الاختيار العشوائي لعدد ٩٢ جاموسه حلابه من الموسم الثاني الى السادس. اجري التحليل الاحصائي للبيانات بواسطة برنامج التحليل الحصائي SPSS الاصدار العاشر لعام ١٩٩٩م. تهدف هذه الدراسة الى معرفة تأثير نوع التحنين على عملية الحلابة من حيث إدارة المحلب بالإضافة الى التأثير على محصول اللبن ومعدل نزوله من الضرع. وقد تم تقسيم الحيوانات حسب نوع التحنين ، وعدد مرات الحلابة اليومية ، ووقت الحلابة اليومية بالإضافة الى نوعية فريق الحلابين. وقد أشارت نتائج الدراسة الى وجود تأثير عالى المعنوية لنوع التحنين على فترة التحنين وفترة الإنتظار فى الحلب. وبوجه عام تدرجت الفترات المختلفة لعملية الحليب تنازليا على النحو التالى : التحنين بالتدليك اليدوى بالإضافة الى ماكينة الحلابة (٧.٨٥ دقيقة) ، الإعتماد على ماكينة الحلابة فقط للتحنين (٧.١٦ دقيقة) ، وفى النهاية إستخدام الأكستوتسين للتحنين قبل عملية الحلابة بالماكينة (٦.٥٣ دقيقة). أيضا كان لنوع التحنين تاثيرا عالي المعنوية على الوقت المنقضي في كل من فترة التحنين وفترة الانتظار داخل المحلب ما بعد الحلابة. في نفس الوقت الذي كان لنوع التحنين تاثيرا معنويا على الوقت المنقضي في فترة الأنتظار ما قبل التحنين داخل المحلب . سجل الوقت المنقضي في فترة الأنتظار ماقبل التحنين داخل المحلب اعلى القيم نتيجة لزيادة الحقن بالأوكسيتوسين (١١.٣٦ دقيقة) ، ومع ذلك فقد أدت زيادة التحنين اليدوي الى زيادة طول فترة التحنين حيث كان الوقت المنقضي (٩.٦٦ دقيقة) كما انه لم تكن هناك فروق معنوية في كل من محصول اللبن او معدل تدفق اللبن نتيجة لتأثير نوع التحنين.

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