MILKING FREQUENCY IN RELATION TO SOME BEHAVIOURAL PATTERNS, PERFORMANCE AND WELFARE OF HIGH PRODUCING DAIRY COWS

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ABSTRACT

Twenty Fresian dairy cows belonging to private dairy cows farm in Sharkia province were divided into two equal groups, each of 10 cows to study the effect of milking frequency on lying down, getting up behaviour, performance and welfare of dairy cows.

Results showed that, non significant increase of frequency of total lying, total standing and interrupted lying down in two times milking group, while there was significantly increase (P<0.01) of eating while standing and rumination while standing in two times milking group. Moreover, there was non significant increase in rumination while lying in three times milking comparing to two times milking cows. The two times milking cows stood during morning and ruminate while standing during morning significantly longer time than the three times milking cows, while three times milking group spent significantly (P<0.01) longer time in lying and getting up movement before morning milking. Moreover two times milking group showed more percentage of stap wounds (10%) and teats trampling (20%) comparing to 0.0% and 0.0% in three times milking group. Milk yield or production was increased in three times milking, while California mastitis test scores and days to first breeding was increased in two times milking. From this work, it could be concluded that, three times milking daily contributes to increase comfort, performance, reproductive efficiency and welfare in high producing dairy cows.

INTRODUCTION

Lying behaviour is a high priority activity in dairy cows. The need for lying is relatively constant and can dominant other basic needs after only a few hours of forced standing **(Metz and Wierrenga, 1984)**. Deprivation of lying induces abnormal behaviour indicating frustration as well as changes in the hypothelamopituitary-adrenal axis **(Krohn and Konggaard, 1982)**. Re-

strictions in the lying behaviour can result in traumatic injuries and other health problems and lower production level **(Blom, 1981)**. Several studies have shown that a more frequent milking will increase the milk yield **(Allen et al., 1986)** who found that milking cows three times a day has been employed by dairy mangers to increase milk yield and utilize facilities more efficiently. **Lush and Shrode (1950) and Pelissier et al. (1978)** reported 18% increase in milk yield, 15% by **Logan et al. (1978)** and 12% by **Gisi, et al. (1986)** in three times daily milking as compared to two times daily milking, while the reproductive efficiency were not affected as reported by **Amos et al. (1985)** while **Depeters et al. (1985) and Gisi et al. (1986)** reported reduction efficiency in 3 times milking as compared to two times. Udder health was not affected in cows milked three times daily as compared to two times in many trials as **(Gisi et al., 1986; Pearson, et al., 1979 and Waterman et al., 1983)**. There is an economic benefit of a higher milking frequency of high producing cow as well as increased lying comfort. Cows with completely filled udders may have greater difficulty in performing certain movements as lying down and getting up. These movements are largely genetically pre-programmed and fixed determined by the skeletal and muscular structure meaning that the cows has small or no possibilities to adapt these movements to the actual circumstances. Also an over filled udder together with a suboptimal environment as poorly designed cubicles or slippery floors may increase the risk of stap wounds on the teats during getting up and lying down movements. **Krohn and Munksgaard (1993)** suggested that a hard surface in combination with a distorted lying down movement pattern were causal factors for the higher frequency of teat trampling wounds, in turn is a well known factor behind mastitis, which is one of the most common reason for culling in dairy cows Swedish **Dairy Association (1998)**. Furthermore it may be uncomfortable or even painful for the cows to lying with a filled udder. Since there is an external pressure on the udder during lying. Thus a high lactation yield in combination with milking only twice per day may involve decreased welfare of the dairy cows and possibly even suffering.

The aim of this work was to investigate the effect of milking frequency on the lying down and getting up movements performance, reproductive efficiency, udder health and welfare of dairy cows.

MATERIALS AND METHODS

This study was carried out in private dairy cows farm in Sharkia Province in the period from November 2001 until the May 2002. Twenty Fresian dairy cows were used, they housed in an individual cubicles (1.2 m x 1.7m). Cows were fed individually and had free access to water, they were fed green feed (barseem) and concentrate ration and wheat straw. They were divided into

two equal groups each of ten cows. First group were milked two times daily at 6.00 and 18.00 hour and second group were milked three times daily at 6.00, 14.00 and 22.00 hours.

1- Behavioural observation:

Each cow was observed individually using of focal sample technique according to **Altmann, 1974**, starting four weeks post partum and during lactation in week 8, 12 and 16. Each cow was observed through two hours before each milking period.

The following behavioural patterns were recorded:

Lying down movements: were divided into two phases:

Lying down phase one. Started when the nose was moved in a pendulum movements close to the ground and ended when the cow had one knee on the floor.

Lying down phase two:

The time spent for the cow to move from one knee on the floor until the lying down movement was completed i.e when the cows lies down on one of its own hips.

Getting up movements:

The time spent for the cow from beginning to move her head forward on sideways, pull her feet under herself until she was standing with four feet in contact with the floors in a balanced position.

Total standing time: Total standing time independent of activity or passivity.

Total lying time: Total lying time independent of activity or passivity.

Eating while standing: Feed intake or chewing while standing.

Eating while lying: Feed intake or chewing while lying.

Rumination while standing: Standing up while chewing bolus or in the process of regurgitating bolus.

Rumination while lying: Lying down while chewing bolus or in the process of regurgitating bolus.

Recording of stap wounds and teats trampling of both groups.

Recording of milk yield of both groups : recording of days milk yield or production after calving.

Application of California mastitis test scores on both groups for detection of mastitic cases : The statistical analysis were carried out using SAS **(Little et al., 1996).**

RESULTS AND DISCUSSION

Results in Table (1) showed that, cows milked twice daily had significant (P<0.01) higher frequency of eating while standing and rumination while standing than in 3 times milking group, while no differences were found in the frequency of standing, lying, rumination during lying and interrupted lying downs. In this study two times milking had higher frequencies of eating and rumination while standing than the three times milking, this may be due to increased frequencies of specific behaviour as eating and rumination may be displacement activities caused by frustration due to the thwarting of lying behaviour **(Munksgaard and Simonsen, 1996)**, these results are in agreement with **Wierenga and Hopster (1990)**, they found that with loose housed cows hardly any cows spent time eating during the hours before morning milking.

Results in Table (2) revealed that cows milked twice a day had significantly (P<0.01) shorter total time lying and longer total standing time as compared to cows milked three times two hours before morning milking, while there were no differences between the two groups through two hours before morning milking, while there were no differences between the two groups thrugh two hours before the afternoon milking. Also there was a tendency that standing rumination was significantly (P<0.01) longer for two times milking cows as compared to 3 times milking, while the total time spent in rumination during lying and total times spent eating while standing did not differ significantly between the two groups. The results are in agreement with **Albright (1987)** who stated that increased standing in cattle is often taken as a sign of discomfort or discontent, and that the productivity of the dairy cows may be adversely affected, at the same time **Wierenga and Hopster (1990)** suggested that a reduction of lying during the night is compensated by an increase lying time in the evening. In their experiment conducted in a cubicle house with 25% overcrowding, they found that a reduction in lying time during the 4 hours before morning milking did not result in a significant reduction in lying time per 24 hours, while the lying time increased, although there was no significant difference from the afternoon milking onward for 10 hours. Although they found that animals with highest reduction in lying time during the night showed the highest increase in lying time during the evening. In present study there were no differences in lying time during the hours between afternoon milking and the evening feeding. At this time of the day, there were no disturbances in the byre, such as feeding or cleaning and hence this would be the time for the cows to lie down and rest. **Munksgaard and Simonsen (1996)** found that cows which were prevented from lying down from 9.00 to 16.00 and from 22.00 to 5.00 primarily spent increasing standing time in idling and rumination. This is in accordance with present results where the cows in the two times milking had a tendency to spent more time performing standing rumination than the cows in three times milking group. Several studies showed that cows prefer to lie down when rumination **(Wagnon, 1963; Ruckebusch and**

Bueno, 1978) and the tendency for increased standing, rumination in this study strengthen the conclusion that the cows in the two times milking group had found it comfortable to lie down, they probably would have preferred to ruminate while lying instead of while standing.

Results in Table (3) revealed that, the durations of lying bouts 2 hours before both morning and afternoon milking did not differ between the two groups, the mean duration of getting up movements was significantly longer ($P<0.01$) of the two times milking. In this behaviour there also was an effect of the milk amount and the udder extent. The time is took to lie down did not differ significantly between two times and three times milking. These results in disagreement with the findings of **Krohn and Munksgarrd (1993)** who found that the duration of the total lying down movement was significantly longer for tied cows, milked twice per day, on a concrete floor covered with straw than for tied cows milked four times per day, in byres with rubber mats and straw. The results are in agreement with **Herlin (1997)** who found that the preparation time required before lying down was significantly shorter on rubber mats than on a concrete floor. The cows in this experiment stood on straw. There was no significant differences between the two groups in lying down movement during two hours before milking. Perhaps it is the surface of the lying area that has the influence on the lying down movement as was reported by **Andreae and Smidt (1982)**, while the size of the udder is of little consequences for this specific behaviour.

Results in Table (4) showed that, two times milking let to increase of stap wounds number and percentage (10%) and teat trampling (20%) as compared to three times milking (not recorded). This may attributed to the cows during getting up movement through 2 hours before morning milking, the udder distention in this movement indicate that the cows probably had difficulties in carrying out this movement. A filled udder may lead to a more uncomfortable getting up, which might be a reason for the hesitation in the getting up movement in the two times milking cows. Difficulty in getting up movement may make a problem and may cause stap wounds on the teats which consider predisposing factor leading to mastitis.

Results in Table (5) revealed a significant increase in milk yield ($P<0.01$) in three times milking compared to two times milking. These results are in agreement with **Lush and Shrode (1978), Pellisser et al. (1978), Logan et al. (1978) and Gisi et al. (1986)**. Regarding days to first breeding this was numerically increase in two times milking compared to three times milking, these results are in disagreement with **Amos et al. (1985), Depeters et al. (1985) and Gisi et al. (1986)**. While udder health represented by California mastitis test scores was decreased in three times milking compared to two times milking. This may be due to or attributed to repeated and frequent handling of teats. These results are in agreement with the finding of **Pearson et al. (1979); Waterman et al. (1983) and Gisi et al. (1986)**.

Means within the same raw, in each category with different superscripts are significantly different from each other (at P<0.01).

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CONCLUSION

From this work it could be concluded that, a low milking frequency (two times) causes discomfort for the dairy cows and a potentially increased risk of injuries to the teats due to trampling and stap wounds. Milking three times per day may contributes to increased comfort in high producing cows, partly due to reduced udder pressure, which permits higher comfort when lying down. The results confirm that cows milked three times daily significantly produced more milk than cows milked two times. Udder health, as measured by CMT scores, was lower for cows milked three times. Under these circumstances three times milking may be beneficial and advantageous.

Table (1): Frequency of total standing, lying, eating and rumination during 2 hours before morning milking for cows milked two and three times daily.

Behavioral patterns	Two times milking	Three times milking
Lying	1.75±0.23[a]	1.50 ± 0.24[a]
Standing	1.45±0.20[a]	1.20 ± 0.24[a]
Eating while standing	1.43±0.17[a]	0.85±0.16[b]
Rumination while standing	1.45 ± 0.10[a]	1.06 ± 0.9[b]
Rumination while lying	1.10 ± 0.20[a]	1.24 ± 0.18[a]
Interrupted lying down	1.27± 0.20[a]	1.00 ± 0.17[a]

Table (2): Total time spent in (minutes) in standing, lying, eating and rumination per two hours before morning and afternoon milking for cows milked two and three times daily.

Behavioral patterns	Two times milking	Three times milking
Total lying duration (morning)	55.00±7.45[a]	87.11±6.19[b]
Total lying duration (afternoon)	56.29±5.20[a]	56.25±4.40[a]
Total standing duration (morning)	64.50±7.47[a]	32.44±6.20[b]
Total standing duration (afternoon)	57.50±5.38[a]	61.00±4.50[a]
Eating while standing (morning)	11.29±2.27[a]	8.28±2.19[a]
Rumination while standing (morning)	30.26±4.68[a]	17.64±4.01[b]
Rumination while lying (morning)	31.45±3.50[a]	39.40±2.27[a]

Table (3): The lying down and getting up movement in seconds for cows milked two times and three times daily for two hours before morning milking.

Behavioral patterns	Two times milking	Three times milking
Lying down movement	14.21±2.35[a]	16.20±2.00[a]
Getting up movement	10.36±1.14[a]	6.37±1.22[b]

Table (4): Effect of milking frequency on occurrence of stap wounds and teat trampling of studying animals (Fresian cows).

Milking frequency	Stap wounds		Teats trampling	
	Number	Percentage	Number	percentage
Two times milking	1	10	2	20
Three times milking	-	-	-	-

Table (5): Effect of milking frequency on Fresian cows performance, reproductive efficiency and udder health.

Trait	Two times milking	Three times milking
240 day milk yield	5363±21.70	63.85±28.70*
Days to first breeding	61.05±0.73	51.13±0.85
CMT test	1.10±0.05	1.05±0.04

significant at p<0.01

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الملخص العربى

عـدد مـرات الحليب وعلاقتها ببعض الأنمـــاط السلوكيـة، كفاءة وراحـة أبقـار الحليب عاليـة الأدرار

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أجريت هذه الدراسة على ٢٠ بقرة فريزيان لإنتاج الألبان تنتمى لمزرعة خاصة بمحافظة الشرقية - قسمت هذه الأبقار إلى مجموعتين متساويتين كل مجموعة تحوى عشرة أبقار وذلك لدراسة تأثير عدد مرات الحليب على بعض أنماطها السلوكية، كفاءتها الإنتاجية وراحتها.

أبرزت النتائج :

هناك زيادة غير معنوية فى معدل أو تكرار الرقاد الكلى - الوقوف الكلى والرقاد المضطرب بينما كان هناك زيادة معنوية فى سلوك تناول الطعام أثناء الوقوف، الاجترار أثناء الوقوف فى الأبقار التى حلبت مرتين يومياً، بينما كان هناك زيادة غير معنوية فى الاجترار أثناء الرقاد فى الأبقار التى حلبت ثلاث مرات يومياً.

أظهرت النتائج :

أن الأبقار التى حلبت مرتينه يومياً قضت وقتاً أطول فى الوقوف قبل حليب الصباح ووقتاً أطول فى الاجترار أثناء الوقوف قبل حليب الصباح بالمقارنة بالأبقار التى حلبت مرتين يومياً، بينما قضت الأبقار التى حلبت ثلاث مرات يومياً وقتاً أطول فى الرقاد والنهوض قبل حليب الصباح.

وأظهرت النتائج أيضاً :

أن الأبقار التى حلبت مرتين يومياً أظهرت زيادة النسبة المئوية لجروح ومشاكل الحلمات بالمقارنة بالأبقار التى حلبت ثلاث مرات يومياً، زيادة معنوية فى إنتاج اللبن فى الأبقار التى حلبت ثلاث مرات يومياً، بينما زادت نسبة نتيجة إختبار الكالفورنيا لاستبيان التهاب الضرع فى المجموعة التى حلبت مرتين يومياً.

ونستخلص من ذلك :

أن حلب الأبقار عالية الإدرار ثلاث مرات يومياً يؤدى إلى زيادة إنتاجية الحليب وراحة الحيوان وتقليل نسبة إلتهاب الضرع بها.