IMPACT OF MILKING TECHNIQUE ON MILK PRODUCTION IN COWS

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Abstract

The effect of manual stimulation on milking performance and on some parameters of milk production showed that the average milk production per milking was higher in animals with manual stimulation (12.3 kg) compared to the average milk production in animals without stimulation (12.0 kg).

At the same time, the average time per milking in animals with manual stimulation was 4.8 minutes, and in animals without stimulation it was 5.3 minutes (in addition 0.5 minutes). The compositional quality was not affected by the two treatments. There were also no significant differences between the means of fat or protein percentages. The average number of somatic cells in the milk of animals with manual stimulation was 197,000 cells/ml, and in animals without stimulation of 246,000 cells/ml of milk. An increase of 49,000 cells/ml can be observed in animals without stimulation, the difference in this case being significant ($p< 0.05$). The higher number of somatic cells in unstimulated animals is the result of not removing the first milk jets that contain the highest load of bacteria and somatic cells.

Regarding the milk flow, it is 2.56 kg/minute (average milking 1 + milking 2) in animals with stimulation and 2.26 kg/minute in animals without stimulation. The difference between the 2 means was + 0.30 kg/minute, being distinctly significant ($p < 0.01$).

Regarding the influence of the standard milking routine on milking performance and milk production parameters, it must ensure a uniform treatment for each cow, at each milking, regardless of the stage of lactation, the number of lactations or the person performing the milking. Almost 15-25% of the total milk secreted by the mammary gland represents residual milk, also called complementary milk. In the research carried out in the animals of the first group, residual milk represented 15.48% of the total milk produced by the mammary gland and 14.72% in the animals of the second group.

The residual milk fat percentage was 9.38% in group 1 animals and 9.42% in group 2 animals.

Key words: milking, milk, milking routine, somatic cells

INTRODUCTION

Modern dairy farming systems must combine profitability with responsibility for animal health, human health, animal welfare and the environment. The management of the farm that chooses the automated milking system is a determining factor of the success of this system because it includes the problems that may appear during the transition period. In addition to the routine changes faced by cows and milkers, farm managers lose the opportunities for direct contact with the animals that used to take place 2-3 times a day. For most, this means that they have to get used to the information provided by the robotic system.

As a result, a successful transition is dependent on the milkers and farm managers who take and respect managerial decisions and execute the necessary actions to achieve them. In most cases, farmers who install robotic milking systems expect to obtain a larger amount of milk due to increased milking frequency.

Going from two to three milkings per day can lead to an increase in production from 5% to 25% (Hilerton and Winter, 1992). Studying 69 farms in Denmark (Rasmussen MD et al, 2001), reported an increase of 2% (from 23.9 to 24.4 kg/day). In the

Netherlands (de Koning, 2002) he observed an increase of 11.4% due to the introduction of the robotic milking system.

It is also stated that this increase in production was obtained in animals with similar genetic potential. In addition, compared to those noted previously, practical experiences have proven that there is a great variability in the performances achieved in various farms (M. Cola, F. Cola, 2021, 2023). Rasmussen could not provide a scientific explanation for this increase, but he suggests that a lot of attention should be paid during the settling-in period. Another study, carried out in the Netherlands (Van der Vorst, 2002), based on data from 392 farms from 3 countries, also indicates the deterioration of the number of somatic cells and the total number of germs, the decrease of the freezing point and the level of acids fat free. Users of the automatic milking system no longer have close contact with the animals during milking. An adaptation to an "exception management" is necessary to identify exceptions from the information collected for the purpose of processing the cow management software, which should be able to generate standard management reports and warning lists.

MATERIALS AND METHODS

The research was carried out within S.C. Fenov SRL, on Holstein Friză breed cows. They are characterized by a production potential of 9000 liters of milk/lactation with a fat percentage of 4.0% and protein of 3.45%. The aim of this research was the coordination of milk ejection with the attachment of the milking units in order to obtain a high flow of milked milk and reduce the attachment time of the milking units, as well as to determine some performance parameters of the milking parlor and milk production in order to implementation of a standard milking routine.

Genetic transformation can increase animals' resilience to climate-related stresses, and increases reproductive performance. The EU's import dependency is particularly high in the case of forage soybeans for the European livestock sector, as the production of bean soybeans in the EU states covers less than 5% of its own demand. The EU also imports significant quantities of GM maize to meet domestic demand (Bonciu, 2023 a). But the production of food and feed must also be taken into account in an environmentally sustainable way (Bonciu, 2023b, 2022).

Regarding the effect of manual stimulation on milking performance and on some parameters of milk production, a herd of 8 Holstein Friză cows from SCFenov SRL was studied. The 8 cows were 100-105 days of lactation (3 heads), 110-112 days of lactation (3 heads) and 120-130 days of lactation (2 heads). The selection criterion was that each animal had 4 functional quarters and no clinical signs of disease.

All specimens were in the second lactation and were divided into 2 treatment groups consisting of:

- the first: removal of the first jets (2-3) of milk followed by manual massage of the nipples and the ventral portion of the mammary gland for 30 seconds, after which the milking units were attached;
- in the second treatment, the first jets were not removed, nor was manual massage performed, but only the milking machines were attached.

The experiments were carried out in the 2x5 Herringbone milking parlour, each experiment lasted 6 days, with data recorded both at the morning milking (milking 1) and at the evening milking (milking 2).

Milk production and the time the milking units were attached were recorded. Detachment of the milking units was done automatically with light signaling.

Milk samples were taken and analyzed in the laboratory for protein and fat content. The analyzes were done with the Ekomilk device.

Residual milk was obtained on the 4th day of observation by injecting at the end of milking 10 ml IU oxytocin. After 1 minute, the milking units were reattached and the residual milk was measured, taking samples to determine the percentage of fat and protein.

RESULTS AND DISCUSSIONS

1.The effect of manual stimulation on milking performance and some parameters of milk production.

The average milk production per milking was higher in animals with manual stimulation (12.3 kg) compared to the average milk production in animals without stimulation (12.0 kg). The difference between these 2 means was + 0.3 kg, being insignificant ($p > 0.05$).

The average milking 1 morning milking of animals with manual stimulation is higher (14.3 kg) than the average milk production of animals without stimulation (13.8 kg), with a difference of 0, 5 kg also being insignificant ($p > 0.05$).

The average milk production at the 2nd (evening) milking of stimulated animals was slightly higher than the average milk production of non-stimulated animals (10.3 kg and 10.2 kg respectively), and in this case the difference was insignificant (table 1).

Regarding the average time the milking units were attached, the following results were obtained:

- the average time per milking in animals with manual stimulation was 4.8 minutes, and in animals without stimulation it was 5.3 minutes (in addition 0.5 minutes); this difference is distinctly significant ($p < 0.01$);
- the average time at milking 1 was 5.1 minutes in stimulated animals and 5.5 minutes in non-stimulated animals, plus 0.4 minutes. This difference was significant ($p < 0.05$).

The average time the milking units were attached to milking 2 in animals with stimulation was 4.6 minutes and in animals without stimulation 5.3 minutes (an additional 0.7 minutes). The difference between the two means is significant ($p < 0.05$).

The compositional quality was not affected by the two treatments.

The average number of somatic cells in the milk of animals with manual stimulation was 197,000 cells/ml, and in animals without stimulation of 246,000 cells/ml of milk. An increase of 49,000 cells/ml can be observed in animals without stimulation, the difference in this case being significant ($p< 0.05$). The higher number of somatic cells in unstimulated animals is the result of not removing the first milk jets that contain the highest load of bacteria and somatic cells (Graph 1).

Regarding the milk flow, it is 2.36 kg/minute (average milking 1 + milking 2) in animals with stimulation and 2.26 kg/minute in animals without stimulation. The difference between the 2 means was + 0.30 kg/minute, being distinctly significant ($p < 0.01$).

The average milking 1 flow rate was 2.80 kg/minute in stimulated animals and 2.50 kg/minute in non-stimulated animals. The difference between the 2 means was distinctly significant ($p < 0.01$).

Average milking 2 flow was 2.24 kg/minute in stimulated animals and 1.92 kg/minute in non-stimulated animals (graph 2). In this the difference was significant ($p < 0.01$).

To date, scientific research has examined various aspects of automatic milking system technology and its effect on milk quality, herd health, welfare, behavior, and management. Multiple differences exist between and conventional parlors, making targeted research on new milking systems necessary. The fully automatic milking process of the automatic milking system, which milks the udder on a quarter basis, and the automatic teat-cleaning and milking cup-attachment process have the potential to affect milk variables and udder health. Cows must be motivated to voluntarily approach and enter automatic milking system milking stalls, as they are no longer brought to the milking parlor 2 or 3 times daily by human handlers.

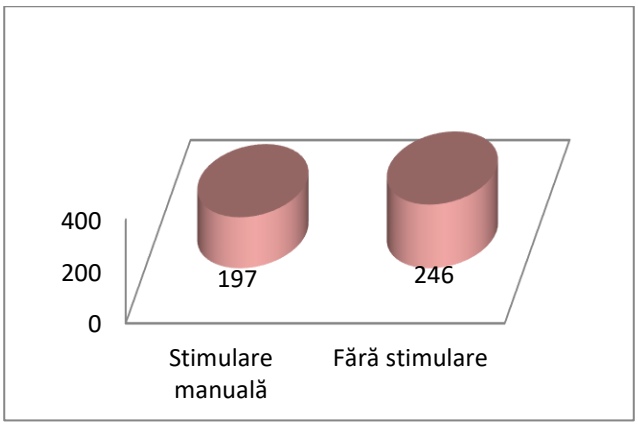

Figure 1. Results of manual stimulation on milking performance-Average number of somatic cells x 1000.

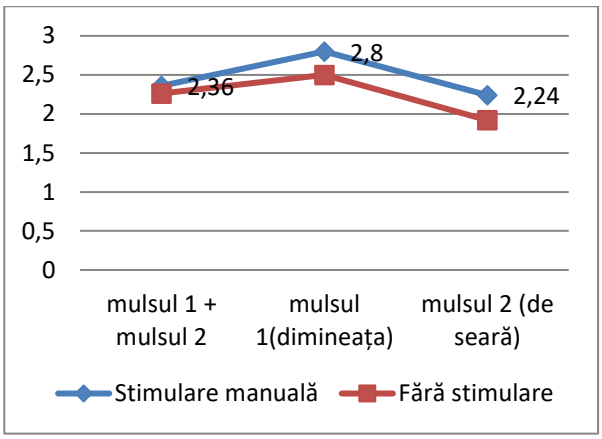

Figure 2 Results of manual stimulation on milking performance.

Table 1. Results of manual stimulation on milking performance, milk production, fat, protein and somatic cell count

No. crt.	Specification	Treatment				distinction	
		Manual stimulation		Without stimulation		±	The meaning
		$\overline{X}$	±	$\overline{X}$	±		
1	*Milk production per milking cow*						
	- milking 1 + milking 2	12.3	0.6	12.0	0.6	+ 0.3	Not significant p>0.05
	- milking 1 (morning)	14.3	0.6	13.8	0.6	+ 0.5	Not significant p>0.05
	- milking 2 (evening)	10.3	0.4	10.2	0.3	+ 0.1	Not significant p>0.05
2	*Time the milking units were attached (min)*						
	- milking 1 + milking 2	4.8	0.2	5.3	0.2	- 0.5	Significant p < 0.05
	- milking 1 (morning)	5.1	0.2	5.5	0.3	- 0.4	Significant p < 0.05
	- milking 2 (evening)	4.6	0.3	5.3	0.4	- 0.7	Significant p < 0.05
3	*Average flow rate (kg/minute)*						
	- milking 1 + milking 2	2.36	0.1	2.26	0.1	+ 0.30	p < 0.01
	- milking 1 (morning)	2.80	0.2	2.50	0.2	+ 0.30	p < 0.01
	- milking 2 (evening)	2.24	0.2	1.92	0.1	+ 0.32	p < 0.05
4	*Average percentage of fat - % (* milking 1+milking 2)	4.15	0.2	4.12	0.2	+ 0.03	Insignificant
5	*Average protein percentage - %* (milking 1+milking 2)	3.34	0.1	3.33	0.1	+ 0.01	Insignificant
6	*Average number of somatic cells x 1000* (milking 1+milking 2)	197	15	246	14	+ 49	Significant p < 0.05

Table 2 The influence of standard milking routine on milking performance and milk production parameters

No. crt.	Specification	Average mammary gland preparation time	
		Group 1 – 35 seconds -	Group 2 - 64 seconds -
1	Observations	18	22
2	Average time with milking units attached (minutes)	5.75	5.76
3	Average milk flow (kg/minute)	2.05	2.05
4	Average milk production per milking cow (kg)	11.81	11.82
5	Fat percentage (%)	4.06	4.08
6	Protein percentage (%)	3.42	3.43
7	Residual milk (kg)	1.98	2.04
8	Fat percentage of residual milk (%)	9.38	9.42
9	Total milk milk + residual (kg)	12.79	13.86
10	Residual milk from total milk (%)	15.48	14.72
11	Total milk fat + residual (kg)	0.664	0.674
12	Residual fat from total fat (%)	27.86	28.48

2.The influence of the standard milking routine on some milking performances and on some parameters of milk production.

By preparing the mammary gland before milking, the following aspects are followed: hygiene of the mammary gland; identification of abnormal milk and subclinical nipples; stimulation of milk ejection.

40 observations were made on mean mammary gland preparation times. These times were divided into two groups according to their duration. Group 1 with an average preparation time of 35±7 seconds and group 2 with an average preparation time of 64±12 seconds. There were 18 observations in group 1 and 22 observations in group 2 (table 2).

The average milk production per milking was 11.81 kg in group 1 animals and 11.82 kg in group 2 animals.

Based on these milk productions, the average milk flow was calculated as follows: we divided these average productions by the average time the milking units were attached. The average milk flow was 2.05 kg per minute in both groups of cows. Almost 15-25% of the total milk secreted by the mammary gland represents residual milk, also called complementary milk. Milk left in the udder increases the risk of breast infections, as residual milk is an excellent environment for the development of microorganisms.

In the research carried out in the animals of the first group, residual milk represented 15.48% of the total milk produced by the mammary gland and 14.72% in the animals of the second group.

The residual milk fat percentage was 9.38% in group 1 animals and 9.42% in group 2 animals.

As a result of the research carried out, it emerged that residual milk is in greater quantity in animals with lower milk productions than in those with high productions.

CONCLUSIONS

Following the research carried out at SC Fenov SRL, the following conclusions result from the Holstein Friza breed cows:

1.The functionality of an efficient milking was ensured by introducing the Herringbone 2 x 5 milking system with 10 milking stations.

2.Mammary stimulation of the nipples and ventral pressure of the mammary gland, before attaching the milking units, for 30

seconds is sufficient to achieve effective milk ejection.

3.Coordinating the ejection of milk with the attachment of the milking units resulted in a high milk flow and a reduction in the time the milking units were attached.

4.Sanitizing the teats and the ventral portion of the mammary gland reduces the risk of infections between milkers.

5.By removing the first 3-4 spurts of milk before attaching the milking units, the abnormal milk is practically eliminated, which must not end up in the raw milk.

6.The average time the milking units were attached was under 6 minutes, being an optimal time, without implications on the integrity of the teat canal. Prolonged milking is the cause of stretch marks and infections of the tissues of the teat ducts.

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