

The Milk Biochemical Parameters Having Economic Importance in Machine Milked Cows

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Abstract: This research was aimed to investigate the effect of machine milking on milk biochemical components having economic importance. In the experiment, 10 Machine Milked (MM) and 10 suckled + Hand Milked (HM) cows were used. The milk fat rates were lower for MM animals in 1st, 2nd and 4th weeks ($p < 0.05$). Protein and total solid rates of milks were similar for both groups during study. There was found positive correlation between milk fat and total solids ($r = 0.53$; $p < 0.05$), but there were no significant correlations among other milk parameters. Suckling treatment (in HM group) to increase production of milk with maximum levels of milk fat is essential for achieving the economic benefits. Producers, who utilize the MM system during lactation should expect commercial milk to be low in fat content, which may affect cheese processing characteristics.

Key words: Economic, milk biochemical parameters, machine milked, cow, solids, milk fat

INTRODUCTION

The chemical composition of milk and its physicochemical ability, which are directly linked with technological parameters, decide about its acceptance in the milk industry. Biochemical parameters from animal products have got favorable economic benefits (Cicek, 2007). Milk protein, fat and total solids have economic value because higher protein, fat and total solids lead to higher cheese yields (Hicks *et al.*, 1985). They are therefore called economic parameters. The milk biochemical parameters having economic importance impact product development and international trade in milk components (Colemann, 2004). Recently, dairy producers and reserachers focus on maximizing economic biochemical parameters such as milk fat and protein (Cimen *et al.*, 2007; Cimen *et al.*, 2008a, b; Cimen and Karaalp, 2009).

Current milk pricing formulas emphasize milk fat, giving maintenance of normal milk fat test an economic advantage. However, there were not enough statements about effect of machine milking on biochemical parameters of milk during all lactation period. The studies on the milk parameters in machine milking treatment are limited. This research was aimed to investigate the effect of machine milking on economic biochemical components of milk. This is the first detailed study on economic biochemical parameters of machine milked cows.

MATERIALS AND METHODS

In the experiment, 10 Machine Milked (MM) and 10 suckled + Hand Milked (HM) cows were used. To determine milk composition, samples were obtained by hand milking for first month of early lactation. Milk samples were composites of milk collected at consecutive morning and afternoon for last day of each week. The samples were collected into plastic vials preserved with micro tabs, stored 4°C until analyzed for determination of parameters. The total protein of the milk was determined by Kjeldahl method ($N \times 6.38$). The milk fat was determined by Roese-Gottlieb method (Hundrieser *et al.*, 1984). Total solids were determined by drying a known mass of milk at $102 \pm 1^\circ\text{C}$.

All of the data are indicated as mean \pm SEM. Comparisons were done by using t-test with help of the SPSS (Norusis, 1993).

RESULTS AND DISCUSSION

Table 1-4 shows significant differences between MM and HM animals with respect to milk fat rates. The milk fat rates were lower for MM animals in 1st, 2nd and 4th weeks ($p < 0.05$). Protein and total solid rates of milks were similar for both groups during study ($p > 0.05$). Milk protein and total solid rates of MM and HM cows in this study are consistent with normal values for cows announced by

Table 1: Economic parameters of milk for first week

Parameters (%)	Animals		p-value
	MM	HM	
Fat	2.7±0.1	3.3±0.2	*
Protein	4.4±0.1	4.6±0.2	NS
Total solids	11.8±0.4	11.9±0.3	NS

Table 2: Economic parameters of milk for second week

Parameters (%)	Animals		p-value
	MM	HM	
Fat	3.0±0.2	3.6±0.2	*
Protein	3.9±0.1	4.1±0.3	NS
Total solids	11.5±0.3	11.7±0.4	NS

Table 3: Economic parameters of milk for third week

Parameters (%)	Animals		p-value
	MM	HM	
Fat	3.1±0.3	3.5±0.2	NS
Protein	4.3±0.1	4.6±0.3	NS
Total solids	11.6±0.4	11.9±0.3	NS

Table 4: Economic parameters of milk for fourth week

Parameters (%)	Animals		p-value
	MM	HM	
Fat	3.2±0.1	3.6±0.2	*
Protein	4.0±0.4	4.5±0.2	NS
Total solids	11.4±0.4	11.6±0.2	NS

*p<0.05, NS: Not Significant

Kaneko *et al.* (1997). Weekly milk fat rates of MM group were found lower than normal values (3.5%) (Kaneko *et al.*, 1997). The milk fat rates of MM were low for economic cheese production because, milk must contain a fat percentage at least 3.2% for economic cheese (Kurt *et al.*, 1993). We can explain to reason of low milk fat that the milking machine captures cisternal milk but not alveolar milk, where most of the fat is found (Thomas *et al.*, 2001). Reasons for low milk fat in MM group could involve one or all of the following three physiologic mechanisms: milk ejection during machine milking does not occur, milk fat synthesis is inhibited and milk fat transfer from the alveoli to the cistern between milkings does not occur.

Marnet and Negrao (2000) have addressed the first possibility and have demonstrated that plasma oxytocin concentrations do not increase above baseline levels during machine milking of MM animals, which causes failure of milk ejection during milking but not during suckling, for as long as these dams remain in partial daily contact with their calves. Therefore, only the cisternal milk fraction is assumed to be available during machine milking of MM dams because removal of the alveolar milk fraction would require active myoepithelial contraction (Bruckmaier, 2000). It has been estimated that >75% of the total fat yield within the udder is

Table 5: Correlation coefficients between experimental data

Parameters (%)	Fat (%)	Protein (%)	Total solids (%)
Fat	-	NS	0.53*
Protein	NS	-	NS
Total solids	0.53*	NS	-

*p<0.05, NS: Not Significant

associated with the alveolar milk fraction and thus is only obtainable, when milk ejection occurs during machine milking (Labussiere, 1969). Although, the mechanism is presently unknown, one could imagine that the stress associated with separation of MM dams from their calves might have played a role in inhibiting fat transfer.

There was found positive correlation between milk fat and total solids ($r = 0.53$; $p < 0.05$) but there were no significant correlations among other economic milk parameters (Table 5). The relationships of the fat to total solids and solids-not-fat have been the subject of research for many investigators (Bakalor, 1958; Outlaw *et al.*, 1993).

A decrease in milk fat percentage in MM group can directly lead to financial loss, if the milk price depends on milk fat percentage. In addition, it has been shown that a strong decrease in milk fat percentage is related to a larger and longer lasting negative energy balance for early lactation period. Suitable feeding regimes to increase production of milk with maximum levels of milk fat and protein are essential for achieving these benefits during this critic period (Mcguire *et al.*, 1995; Samuelsson, 1996).

CONCLUSION

Producers, who utilize the MM system during early lactation should expect commercial milk to be low in fat content, which may affect cheese or other milk products processing characteristics. Further researches are needed to improve the interpretations about lactation biology in machine milking treatment considering the reasons for lower milk fat and to determine the effect of biochemical parameters having economic importance on productivity of milk and its products.

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