EVALUATION OF MILK CONSTITUENTS AND QUALITY UNDER MACHINE MILKING COWS

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SUMMARY

For present investigation, 40 cows maintained under loose housing system were included to studied the effect of various factors on the quality of milk. The fat, SNF and TBC were lower in MMC (4.21, 8.55 and 11.40 X 10^4) than HMC (4.45, 8.74 and 13.90 X 10^4) respectively. While TLC and EPC were higher in MMC (13.80 X 10^4 and 4.80 X 10^4) than HMC (11.50 X 10^4 and 4.40 X 10^4) respectively. The effect of methods of milking was significant ($P < 0.01$) on all parameters of this investigation except EPC. Whereas, as the lactation advances, the values of fat, TLC and EPC first decline upto third month and raised significantly ($P < 0.01$) thereafter. Similarly, the values of fat, SNF, TLC and EPC were higher during evening hours than morning. The overall milk quality was better under machine milking as compared to hand milking.

Key Words : Fat, SNF, TBC, TLC, EPC, Machine milking, Hand milking

INTRODUCTION

In many advanced countries milking machine playing an important role, as manual labour is not easily available and the cost of labour is very high. In high yielding animals hand milking is inefficient, since the physiology of milk secretion is such that maximum milk is produced if the udder is evacuated in a short interval of time. With suitable structures and adequate equipment of milking machines, it is possible to produced high quality milk. These machines cause no injury to the udder of animals, if proper hygienic and mechanical procedures are adopted.

Under, Indian dairy farm conditions, manual labour will be a future problem and milking by machine in certain high milk producing areas will become efficient and economic. But studies on the use of machine milking in India are very limited and sporadic. Therefore, present study was undertaken to compare and contrast for the milk quality, bacterial and cellular components under machine and hand milking in cows.

MATERIALS AND METHODS

The present study was conducted on fourty high yielding animals maintained at Dairy Farm, Punjab Agricultural University, Ludhiana. All the animals selected immediately after parturition, then 20 cows were randomly allotted to machine milking and remaining 20 for hand milking.

The data were recorded on all the animals daily for first 15 days after calving and then at fortnightly interval for a period of six months from February, 1995 to January, 1996 as per the following programme.

(A) All the parameters recorded according to parity (parity 1, 2 and 3), stage of lactation (1

month, 2 month....upto 6 months), milking time (Morning and Evening) and milking methods.

(B) All the animals further divided into two groups viz., positive and negative for mastitis.

(C) Milk constituents viz., fat and SNF percent were estimated from each animal.

(D) The evaluation of milk quality with respect to total bacterial count (TBC), total leucocyte count (TLC) and epithelial cells (EPC) from pooled milk sample drawn separately for different factors.

Statistical Analysis: To study the effect of different factors including parity, stage of lactation, milking method, time and mastitis positive - negative on milk constituents and quality parameters, data were subjected to statistical analysis by least square technique (Harvey, 1966).

RESULTS AND DISCUSSION

The least square means for fat %, SNF %, TBC, TLC and EPC in buffaloes and cows have been given in table 1. The analysis of variance for factors affecting milk quality and components are presented in table 2.

Fat per cent : The overall least square mean for fat percent was 4.33 ± 0.09. Fat per cent significantly ($P < 0.01$) increased from first to third lactation. Similar results were reported by Adams *et al* (1969) and Nigam and Bector (1991). Least square analysis also revealed highly significant differences for methods of milking and stage of lactation (Table 2). The lower fat per cent was observed by machine milking. It might be due to the large fat globules evacuated with more difficulty and also remain with the residual milk in the udder (Johansson and Rendel, 1968) and variation in milk yield. Fat per cent declined first to third month of lactation and thereafter increased gradually. Present findings fairly agreed with the report of Gangwar (1976), and Nigam and Bector (1991).

SNF per cent : Least square analysis of variance revealed highly significant effect of methods of milking and milking hours on SNF per cent (Table 2). Whereas, overall mean for SNF percent was observed 8.64 ± 0.08. Findings of Adams *et al* (1969) and Raghunandan *et al* (1993) agreed well with our findings. SNF per cent declined gradually from first (8.71) to third (8.56) lactation. Low SNF per cent was observed in machine milking cows (MMC). Almost similar results were reported by Nigam and Bector (1991).

Total Bacterial Count : All the factors have significant effect on TBC except stage of lactation, where non significant effect was observed ($12.60 \pm 0.42 \times 10^4$). Lower estimate reported by Hassan and Badran (1988), but higher means reported by Charles *et al* (1990) as compared to present findings. The TBC were observed lower by MMC (11.40×10^4) as compared to hand milking cows (HMC). These findings are in agreement with the report of Thomas and Anantakrishnan (1949). Present findings of TBC revealed that milk obtained by machine milking was of higher bacteriological standard.

Total Leucocyte Count : Least square analysis revealed that MMC milk contained higher TLC (13.80×10^4) than HMC (11.50×10^4) per ml of milk. It might be due to variation in udder size and infection rate. Rainard *et al* (1990) reported higher TLC value, whereas, George and Robert (1983) reported lower estimate as compared to present results. The effect of all factors were observed in close agreement with the report of Kennedy *et al* (1976) and Rao (1986).

Table 1: Least square means of some milk constituents and cellular fraction in cows.

Factors	Fat per cent	SNF per cent	TBC ($x 10^4$)	TLC ($x 10^4$)	EPC ($x 10^4$)
Overall mean ± S.E.	4.33 ± 0.09 (2057)	8.64 ± 0.08 (2057)	12.60 ± 0.42 (2057)	12.70 ± 0.41 (2057)	4.60 ± 0.21 (1997)
Methods of milking					
Machine	4.21 (1023)	8.55 (1023)	11.40 (1023)	13.80 (1023)	4.80 (984)
Hand	4.45 (1034)	8.74 (1034)	13.90 (1034)	11.50 (1034)	4.40 (1013)
Parity					
1	4.12 (1025)	8.71 (1025)	11.30 (1025)	3.90 (1025)	3.10 (1005)
2	4.23 (360)	8.66 (360)	12.30 (360)	13.30 (360)	4.90 (336)
3	4.64 (672)	8.56 (672)	14.30 (672)	15.70 (672)	5.80 (656)
Stage of Lactation					
1 month	4.66 (1257)	8.80 (1257)	14.30 (1257)	11.20 (1257)	3.60 (1210)
2 month	4.27 (160)	8.63 (160)	12.30 (160)	10.60 (160)	3.70 (157)
3 month	4.18 (160)	8.55 (160)	12.10 (160)	10.10 (160)	3.60 (160)
4 month	4.18 (160)	8.55 (160)	12.90 (160)	17.00 (160)	6.00 (160)
5 month	4.26 (160)	8.60 (160)	12.20 (160)	12.00 (160)	4.60 (160)
6 month	4.52 (160)	8.70 (160)	12.10 (160)	15.10 (160)	5.60 (160)
Milking hours					
Morning	4.26 (1020)	8.59 (1020)	13.70 (1020)	12.10 (1020)	4.40 (988)
Evening	4.39 (1037)	8.70 (1037)	11.60 (1037)	13.20 (1037)	4.80 (1009)
Mastitis					
Positive	4.11 (149)	8.41 (149)	24.40 (149)	71.70 (149)	27.80 (149)
Negative	4.25 (1923)	8.78 (1923)	8.10 (1923)	7.80 (1923)	1.80 (1923)

Figures in parentheses indicate the number of observations.

Epithelial Cell Counts : The overall mean for EPC was 4.60 ± 0.21 X 10^4 per ml of milk. The effect of parity, stage of lactation and mastitis found to be significant. The EPC were observed higher in MMC, third parity, advancement of lactation and during evening hours (Table 1). These findings agreed with the report of Schalm *et al* (1971), Bettenay (1978) and Singh (1993).

Table 2 : ANOVA for factors affecting milk quality and constituents.

Sr.No.	Source of Variation	d.f.	FAT	SNF	TBC	TLC	EPC
1.	Methods of milking	1	285.05**	47.27**	215.95**	19.23**	3.44
2.	Parity	2	83.21**	6.65	24.91**	102.11**	59.34**
3.	Stage of lactation	5	28.75**	4.09	4.64	21.17**	14.78**
4.	Milking hours	1	3.58	14.85**	33.95**	12.91**	4.71
5.	Mastitis	1	4.58	23.55**	108.60**	5998.70**	2985.73**

** = (P < 0.01).

Effect of Mastitis : The effect of mastitis was observed nonsignificant on fat %, but slightly higher means were observed in negative milk samples. However, SNF %, influenced significantly by mastitis positive samples. Almost similar results reported by Singh (1993). The lower estimate of fat and SNF from mastitis positive milk samples might be due to general stress during disease, impaired synthesis and change in secretory activity of the udder tissues (Schultz, 1977).

Least square means for TBC, TLC and EPC milk quality traits showed a very adverse and significant effect of mastitis. Mastitis positive milk samples indicate a very high level of cellular and bacterial counts as compared to negative milk samples. These findings fairly agreed with the report of Joshi *et al.*(1976) and Shukla and Supekar (1987).

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