IJAS Iranian Journal of Applied Animal Science

Comparative Effect of Different Milking Methods and Udder Hygiene on Somatic Cell Count and Milk Quality in Dairy Cows

Research Article

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Received on: 21 Feb 2012
Revised on: 11 May 2012
Accepted on: 6 Jul 2012
Online Published on: Jun 2013

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Online version is available on: www.ijas.ir

ABSTRACT

108 milk samples were collected to study the relationship of somatic cell counts (SCC) and milk composition with milking methods and udder hygiene from 27 Holstein Frisian (HF) dairy cows having moderate milk yield in mid-lactation and parity of 2 to 4, at Khyber Pakhtunkhwa Agricultural University Peshawar dairy farm. All animals were randomly distributed into three categories on the basis of milking methods (Mm) including machine milking (MM); gentle hand milking (GH) and rough hand milking (RH). Each category was further subdivided into three groups on the basis of udder hygienic conditions. Upon cleaning methods and visual contamination of udder, the udder hygienic (UH) conditions were categorized into good (washed with water and disinfectant) (GUH), moderate (washed with water only) (MUH) and poor (cleaned with towel) udder hygiene (PUH), having three animals in each group. 10 ml milk sample was collected in sterilized glass bottles from each animal during 28 days of experiment with weekly interval**.** Milk samples were analyzed for SCC and milk composition i.e. milk fat %, solid not fats (SNF) and total solids (TS). Results showed a significant difference for SCC and SNF, influenced by udder hygiene and TS affected by udder hygiene × milking method interaction (UH×Mm). Non significant differences were observed for all the studied traits. Means table showed maximum value of SCC in (PUH) (0.554 millions/mL) followed by (0.521) in (MUH) and (0.470) in (GUH), where as for (Mm), higher SCC was calculated in MM (0.548 millions/mL) followed by RH (0.474) and GH (0.523). Lowered trend was observed in SCC under (GUH) interactions and lowest SCC was found in (GUH×GH) (0.425 millions/mL). Various treatments showed no significant effect on milk fat %. SNF was significantly affected by (UH) and showed maximum value of (8.94%) in (GUH) and minimum value of (8.58%) in (PUH). For TS, (GUH×MM) interaction showed maximum value of 12.33% while (PUH×RH) interactions showed minimum value of 11.62%. It is suggested that the association of somatic cell count may be used as an indicator of hygienic status of the farm and may be use as a tool for setting milk marketing standards.

KEY WORDS milk composition, milking methods, somatic cells, udder hygiene.

INTRODUCTION

Somatic cell count (SCC) has gained attention as modern analytical techniques to monitor milk quality and determine milk prices in developing countries. Increase in somatic cell count is affected by dairy herd management and poor animal health (Park and Humphrey, 1986) thus reducing milk yield, shelf life and products quality of milk. SCC of 200000 cells/mL is kept as threshold level for distinguishing a healthy udder from infected one in most of advance

countries. Where as SCC of 50000 and 100000 cells/mL refers to better quality milk and as for animal welfare and human health is concerned, a maximum limit of somatic cell count level of 400000 cells/mL is set (Atakan, 2008). However, higher SCC simply defines mastitis or udder infection. Healthy udder SCC limits varies from country to country, ranging from 100000 cells/mL up to 500000 cell/mL. Reducing SCC to half of increased values than normal count, the average production can be increased by 0.6 kg milk per cow per day. Similarly, lowering a herd's SCC from 400000 to 100000, increase in milk production of the herd by 1.3 kg per cow per day can be achieved (Abbas and Iqbal, 2002). Dairy industry's demand for quality milk has made it easier to get dairy farmers involved in quality milk producing, offering cash premiums for lower SCC milk. As a result, farmers not only get more milk, but a higher price as well for quality milk. The key factors involved in reduced load of somatic cell count (SCC) are: post-milking teat disinfection, dry cow therapy, good milking management, treatment of clinical mastitis with antibiotics, and culling of infected cows (Barkema *et al*. 1998). The presence of SCC in cow milk generally represents the natural protection of udder, mainly by leukocytes against bacterial infections. (Philipsson *et al*. 1995). Upon entering of microorganism to milk compartment, the number of immune cells increases rapidly to overcome the infection. Once the infection has been cleared, the SSC level gradually drops to normal, however in chronic infections it may remain high through out the lactation (Robert, 2001). Beside nutritional and managemental factors, SCC level increases with age, at the calving time and with advancement in lactation (Wiggans and Shook, 1987; Tekelioglu *et al*. 2010; Singh and Ludri, 2001). The present study was aimed to investigate the comparative effect of different milking methods and udder hygienic conditions on somatic cell count and milk composition in dairy cattle.

MATERIALS AND METHODS

Experimental animals

27 Holstein Friesian cows having moderate milk yield in mid-lactation and their parities ranged from 2 to 4 were selected from Agricultural University dairy farm. The animals were divided randomly into three categories on the basis of milking method (nine animals in each category). The milking methods used were machine milking, gentle (full hand milking) and rough hand milking (knuckling). Animals in each category were further sub divided into three groups on the basis of udder hygiene. The udder hygiene was defined as good (washed with water and disinfectant then dried with towel), moderate (washed with water and dried with towel) and poor (cleaned with towel) having three animals in each group and upon visible contamination also.

Sample collection and analysis

108 milk samples were collected from 27 animals during 28 days experimental period. 10 mL of sample was collected from whole milk bucket after complete milking of animals in sterilized glass bottles at weekly interval. The samples were analyzed for somatic cell count as described by Schalm *et al*. (1971) milk composition including milk fat % (James, 1995), Solids-not-fat (Harding, 1995) and total solids (AOAC, 1990) in the dairy technology laboratory of department of livestock management.

Statistical analysis

Data were analyzed by ANOVA using SAS (1996) considering milking methods (3 levels: gentle, rough hand milking and machine milking) and hygienic conditions (3 levels: Poor, Moderate and Good) as fixed factors.

RESULTS AND DISCUSSION

Somatic cell count

There was a significant ($P<0.05$) effect of udder hygienic conditions on somatic cell counts (Table 1). Regardless the effect of milking methods, good udder hygienic condition showed lowest SCC followed by moderate and poor udder hygienic conditions (Table 2). On the other side, regardless the effect of udder hygienic conditions, gentle hand milking method resulted in the lowest mean of SCC (0.474 million per ml) followed by rough hand (0.523) and machine milking methods (0.548). Interaction of gentle hand milking with good udder hygienic conditions (GH×G) resulted in the lowest somatic cell count (0.425 million per mL) (Table 2). Teat sphincter and leukocytes provide defense line for external bacterial attacks which ultimately invades by pathogenic organisms resulting in increased level of SCC in milk. Under unhygienic conditions, during milking time or due to damaged teat canal, the pathological bacteria invade internal mammary tissues and obliterate mammary cell lines. Moxley (1978) reported lowered somatic cell count (averaged 49000 cells/mL) and higher milk yield while using teat dipping and udder drying as compared without washing and drying of udder. Pamela Reuge (2003) suggested pre milking udder hygiene for quality milk production resulting in lower somatic cell count (<200000 cell/mL).

Milk composition (Fat %, SNF and TS)

Fat % was not affected ($P>0.05$) by udder hygiene and milking methods (Table 1). Mean fat values are shown in (Table 3).

Table 1 Mean squares for somatic cell count, fat, total solids and solid not fat

Sources of variation	DF	SSC	Fat %	TS	SNF
Udder hygiene (UH)	2	64282411.68*	0.06 NS	0.29	1.15*
Milking methods (MM)	2	50132462.56 NS	0.05 NS	1.61	0.31
UH × MM	4	943920.86 NS	0.12 NS	2.25*	0.04
Error	99	21446929.13	0.30	0.71	0.30

SCC: somatic cell count; TS: total solids; SNF: solid not fats.
* Significant difference (P≤0.05).

Table 2 Mean values for somatic cell count as affected by udder hygiene and milking methods

Parameters	Udder hygiene	Milking methods			
		Machine	Gentle	Rough	Mean
SCC	Good	507.63	425.00	478.47	470.37^{b}
	Moderate	550.69	476.45	538.19	521.78^{ab}
	Poor	586.11	522.91	553.47	554.16^{a}
	Mean	548.14	474.79	523.38	

$LSD_{0.05}$ for udder hygiene= 6.8.
The means within the same column with at least one common letter, do not have significant difference (P>0.05).

Table 3 Mean values for fat as affected by udder hygiene and milking methods

Parameters	Udder hygiene	Milking methods			
		Machine	Gentle	Rough	Mean
Fat	Good	3.31	3.14	3.18	3.21
	Moderate	3.12	3.27	3.35	3.25
	Poor	3.21	3.09	3.19	3.16
	Mean	3.21	3.17	3.24	

SNF was significantly affected (P≤0.05) by udder hygienic conditions only (Table 1). Regardless the effect of milking methods, good udder hygienic conditions showed higher level of SNF, followed by moderate and poor udder hygienic conditions (Table 5). TS showed significant effect (P≤0.05) against interactions (UH×MM) in our study (Table 1). Machine milking showed highest level of TS in poor udder hygienic conditions (MM×P), whereas lowest level were observed in gentle hand milking against moderate udder hygienic conditions (GH×M) (Table 4).

The results obtained are in agreement with those of (Sharif, 2007; Sharif, 2008) where an increase in SCC was observed due to udder infection, and resulted in lower lactose contents and higher proteolysis indexes, thus affecting milk total solids.

Similarly, Filipovic (2009) reported the average higher milk yield per milking at machine method than hand milking, while differences in milk composition (fat, protein and lactose contents) at different milking methods were not significant.

Table 4 Mean values for total solids as affected by udder hygiene and milking methods

Parameters	Udder hygiene	Milking methods			
		Machine	Gentle	Rough	Mean
Total Solids	Good	12.33	12.01	12.11	12.15
	Moderate	12.01	12.05	12.09	12.05
	Poor	11.94	11.68	11.62	11.74
	Mean	12.09	11.91	11.94	

Table 5 Mean values for SNF as affected by udder hygiene and milking methods

Parameters	Udder hygiene	Milking methods			
		Machine	Gentle	Rough	Mean
Solid not fats	Good	9.02	8.87	8.93	8.94^{a}
	Moderate	8.89	8.78	8.74	8.80^{ab}
	Poor	8.73	8.59	8.43	8.58^{b}
	Mean	8.88	8.75	8.70	

$LSD_{0.05}$ for udder hygiene= 0.2562.
The means within the same column with at least one common letter, do not have significant difference (P>0.05).

CONCLUSION

Changes in hygienic conditions of udder subjected significant effect on SCC and TS. Lowest SCC was observed under good hygienic condition in gentle hand milking. However, milking methods showed no effect on milk somatic cell count and milk composition. Milking methods interaction with udder hygienic conditions reflected a significant

effection milk SNF. Fat contents were remained unaffected by either of independent variables. The farm sanitation and udder hygienic conditions could play a key role in quality of milk production.

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