Original Research

Effects of Milking Temperament on Milk Yield, Udder Health and Milk Composition in Crossbred Jersey Cows

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Abstract

The aim of study was to investigate the effects of milking temperament on milk yield; milk ability and udder health in Jersey crossbred cows. The experiment was conducted on Jersey crossbred cows (N=94) maintained at ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal. Temperament score (TS) of cows was assessed in 5 points scale (1-docile, 5-aggressive). Calmer cows (TS-1&2) comprised of relatively higher (75.24%) proportions and none for TS-5. Milk yield (kg)/day of TS-1cows was significantly (P<0.01) higher (11.19±0.14) compared to TS-2, 3 & 4(7.50±0.11, 5.30±0.14 and 4.13±0.77, respectively). Milking durations, exit score, flight speed and milk flow rate gradually declined as TS increased from 1 to 4. Cows with TS-1 had higher (P<0.01) milk fat, solids not fat and protein% compared to TS-4. Somatic cell counts did not differ significantly with TS. The temperament score was positively correlated (P<0.01) with stepping/milking (0.72), exit score (0.33) and flight speed (0.43), while negatively (P<0.01) correlated with milk yield (-0.64), milk flow rate (-0.65) and milking duration (-0.61). It was concluded from the above study that milking temperament significantly influenced milk yield, composition, milk flow rate and ease of milking in Jersey crossbred cows. Thus, docile cows should be selected for getting benefits of milk yield, milk composition, milking ease and milk flow rate.

Key words: Jersey Crossbred Cow, Milk Composition, Milk Flow-Rate, Milking Temperament, Milk Yield, Somatic Cell Count

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Introduction

Temperament may be defined as type and degree of reaction of the animal in its overall surrounding conditions (Herve *et al.,* 2007). The temperament of cattle has been of interest since the time of their domestication. For many centuries, natural selection for calmer animals has been conducted (Dickson *et*

al., 1969). In the past decade, a considerable increase of the average size of herds for milk production has been observed in many parts of the world, which necessitates farmers to invest less time in the individual animal (Cziszter *et al.,* 2016). Milking speed and temperament are the traits that have major effect on the time needed to serve the individual animal and therefore, they are extremely important in large farms. In addition, very nervous and slowly milked cows are exposed to a greater risk of early culling compared to calm and medium counterparts (Berry *et al.,* 2005; Sewalem *et al.,* 2010). *Bos indicus* cows with unfavorable temperament score produced less milk and their ability of releasing milk was the worst compared to cows having better temperament (Gupta and Mishra, 1979). Moreover, cows highly reactive to handling show poor adaptation to surroundings (Cziszter *et al.,* 2016).

Studies on temperament during milking of crossbred cattle are of great importance because selection and improvement in this character can further improve milk yield and production efficiency in dairy cows. Crossbred cattle contribute major portion (26 %) of total cows' milk produced in India (DAHD, 2017). Temperament studies of beef, exotic dairy breeds and small ruminants (Murray *et al.,* 2009; Orban *et al.,* 2011; Cziszter *et al.,* 2016) are widely available, however, information on temperament score of Jersey crossbred cows maintained under tropical climate is limited. Currently, there is an increasing interest in improving animal temperament at the farm level due to elevated awareness of its relationship with productivity and animal health (Cziszter *et al.,* 2016). Keeping in view the above background, present study was aimed to investigate the effects of temperament on milk yield, udder health, other milking behaviours and easiness of milking in Jersey crossbred cows.

Materials and Methods

Location of the Study

The study was conducted on ninety four Jersey crossbred cows belonging to 1st to 8th lactations and maintained at ICAR-National Dairy Research Institute (ICAR-NDRI), Eastern Regional Station (ERS), Kalyani, West Bengal. The ERS of ICAR-NDRI, Kalyani is in lower Gangetic plain. The altitude of the city is 9.75 meter above mean sea level, latitude and longitude position being 22°58′30″N and 88°26′04″E, respectively. There are three major seasons in the year in this area viz. winter (November to February), summer (March to June), rainy (July to October). The minimum ambient temperature falls up to 10^{o}-15^{o}C in winter and maximum goes approximately up to 35^{o}-40^{o}C in summer. The average annual rainfall is 1300 mm (1000-2000 mm), most of which is received from early June to September. The observations were collected in batches both morning and evening time of milking and whole lactating herd was covered within one week.

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Management of Cows and Type of Milking Parlour

All experimental animals were maintained under loose housing system. All the feeding management practices and the feed ingredients were same for the whole lactating herd. Concentrate mixture, seasonal green fodder (ad libitum) and straw were provided to complete the nutrient requirement of all the lactating animals. The amount of concentrate was calculated for every animal according to their body weight and milk production. Concentrate was offered@1.5 kg/day as the maintenance diet between 8 to 8.30 A.M. and rest of the amount was provided during milking. Clean and wholesome water supply was provided throughout the whole day.

Milking operations was done in Double Row Milking Barn type of parlour equipped with semi-automatic milking machine. Machine milking was done twice a day during morning from 6.00 to 8. 30 AM and evening from 2.30 to 4.30 PM. The milk was weighed and recorded in kg for individual animal. Before milking, the animals were groomed and washed. Udders of cows were thoroughly washed with clean water just before the milking. Towels soaked with antiseptic solution were used for wiping of the udder and teats just before attaching the teat cups.

Recording of Parameters

The milking behaviour of cows were recorded from 1m distance without disturbing them. Animals were being observed from the rear view during milking operations was carried out. All the behavioural parameters were observed by a single observer throughout the study period.

Parameters Recorded

Temperament Score (TS)

Temperament of each animal was measured at the milking parlour during preparation for milking and actual milking with semi-automated milking machine. Temperament score was assessed under 1-5 scale as per procedure of Gergovska *et al.* (2012) and Prasad and Jayalaxmi (2014).

Milk Yield and its Composition

Milk yield was recorded on routine basis and milk composition was evaluated by Milkoscreen equipment (indiFoss, Indifoss Analytical Pvt Ltd). Somatic cell count (SCC) was estimated by methods described by Schalm *et al.* (1971) and Modified California Mastitis Test (MCMT; 0-4) as per procedure described by Devi (1989).

Exit Score

Exit score (scale: 1-3) was evaluated by observing the gait of cows after releasing from milking (Lanier and Grandin, 2002).

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Parlour Leaving Speed (PLS)

It is the time taken by animal to cross a specified distance in milk parlour after their release from milking. Central passage was scaled at 0.5 m intervals. The time interval to cover the measured specific distance was recorded using a stop watch. The parlour leaving speed was calculated as distance covered divided by time taken and denoted as m/s.

Statistical Analysis

The data were analyzed by SPSS software (16.0 versions). Statistical methods used for analysis were General Linear Model and Pearson correlation coefficient. The data on SCC were transformed into log scale before analysis to minimize the heterogeneity of variance.

Results

The overall least squares mean ± SE of milk yield, milking durations, and milk flow rate (MFR) of Jersey crossbred cows were 7.03±0.20 kg/d, 228.51±4.70 min and 934.95±15.48 g/min, respectively. The mean values of milking behavioural features, milk yield and milk ability of Jersey crossbred cows were given in Table 1.

Table 1: Least squares mean (± SE) of milking behavioural parameters under different temperament scores in Jersey crossbred cows

Parameters	Temperament Score(TS)				p-value
	TS-1(n=502)	TS-2(n=765)	TS-3(n=399)	TS-4(n=18)	
Morning milk yield (kg/day)	7.44 ± 0.09^{A}	5.01 ± 0.07^{B}	3.54 ± 0.09^{C}	2.65 ± 0.51^{C}	0
Evening milk yield (kg/day)	3.75 ± 0.05^{A}	2.49 ± 0.04^{B}	1.77 ± 0.05^{C}	1.48 ± 0.29^{C}	0
Total milk yield (kg/day)	11.19 ± 0.14^{A}	7.50 ± 0.11^{B}	5.30 ± 0.14^{C}	4.13 ± 0.77^{C}	0
Milking duration (seconds)	325.81 ± 3.37^{A}	235.29 ± 2.48^{B}	186.03 ± 3.20^{C}	166.89 ± 18.03^{C}	0
Milk Flow Rate (g/minute)	1250.30 ± 11.10^{A}	1004.30 ± 8.18^{B}	759.45 ± 10.55^{C}	725.57 ± 59.42^{C}	0
Parlour exit score	1.06 ± 0.02^{A}	1.08 ± 0.01^{A}	1.41 ± 0.02^{B}	2.05 ± 0.10^{C}	0
Parlour leaving speed (m/s)	0.43 ± 0.01^{A}	0.48 ± 0.01^{B}	0.55 ± 0.01^{C}	0.63 ± 0.03^{C}	0
No. of defecation/milking	0.33 ± 0.03^{A}	0.52 ± 0.02^{A}	0.83 ± 0.02^{B}	0.93 ± 0.13^{B}	0
No. of urination/milking	0.57 ± 0.02^{A}	0.70 ± 0.02^{AB}	0.87 ± 0.02^{C}	0.86 ± 0.13^{CB}	0
No. of vocalization/milking	0.03 ± 0.01^{A}	0.03 ± 0.01^{A}	0.05 ± 0.01^{A}	0.27 ± 0.05^{B}	0

Row-wise means with different superscripts differ significantly (P<0.01)

Milk yield, milking durations and milk flow rate differed significantly with TS in Jersey crossbred cows. The results showed docile cows had significantly (P<0.01) higher milk yield, milking durations and MFR compared to nervous cows. Exit score and parlour leaving speed (PLS) varied significantly with TS in Jersey crossbred cows. Docile cows had lower exit score and PLS compared to nervous categories (P<0.01). The overall least squares mean ± SE of SCC (million/ml) was 0.52 ± 0.07. The overall Modified California

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Mastitis Test (MCMT) score was 2.36±0.15.Details of SCC and MCMT among different TS are demonstrated in Table 2.

Table 2: Least squares mean (± SE) of udder health status under different temperament scores in Jersey crossbred cows

Parameters	Temperament Score				p-value
	TS-1(n=247)	TS-2(n=261)	TS-3(n=102)	TS-4(n=6)	
Somatic cell counts-SCC/ml ($x10^6$)	0.52 ± 0.04	0.50 ± 0.04	0.43 ± 0.05	0.59 ± 0.03	0.434
log SCC	5.52 ± 0.03	5.53 ± 0.03	5.44 ± 0.04	5.70 ± 0.22	0.288
Modified California Mastitis Test (MCMT) score	2.27 ± 0.08^{a}	2.12 ± 0.07^{a}	1.94 ± 0.11^{a}	3.10 ± 0.60^{b}	0.032

Row-wise means with different superscripts differ significantly (P<0.05)

Findings of present study revealed that TS have no significant bearing on udder health. Among TS-1, 2 and 3, there were no significant differences on MCMT. However, in TS-4, MCMT score was significantly (P<0.05) higher compared to others. The overall least squares mean ± SE of milk fat, SNF, protein % were 4.76±0.04, 9.06±0.02 and 3.82±0.02, respectively. Milk compositions in different TS categories are demonstrated in Table 3.

Table 3: Least squares mean (± SE) of milk composition under different temperament scores in Jersey crossbred cows

Parameters	Temperament Score				p-value
	TS-1(n=1840)	TS-2(n=1839)	TS-3(n=453)	TS-4(n=49)	
Fat (%)	4.79 ± 0.03^{A}	5.06 ± 0.02^{B}	4.96 ± 0.04^{AB}	4.21 ± 0.16^{C}	0
Solids not fat (%)	9.14 ± 0.01^{A}	9.18 ± 0.01^{A}	9.10 ± 0.02^{A}	8.83 ± 0.06^{B}	0
Protein (%)	3.85 ± 0.01^{A}	3.99 ± 0.01^{B}	3.96 ± 0.02^{AB}	3.50 ± 0.08^{C}	0

Row-wise means with different superscripts differ significantly (Significant P<0.01)

Fat% differed significantly (P<0.01) between calm (TS-1), moderate (TS-2 & 3) and nervous (TS-4) categories. A similar pattern was observed in protein per cent. In TS-4, milk fat, solids not fat and protein per cent were significantly (P<0.01) less compared to others. The above results indicated that docile and moderate cows were having better milk compositions compared to nervous cows (P<0.01). The phenotypic correlation of TS with other milking behavioural traits, milk yield, milk ability and SCC were also estimated. Milk yield, milking duration and MFR showed negative correlation with TS (r = -0.64 and -0.61 and -0.65, respectively; P<0.01). The score was positively correlated (P<0.01) with stepping/milking (0.72), exit score (0.33) and parlour leaving speed (0.43). The association of TS with SCC (-0.07) was not significant, however, it was significant (P<0.05) with MCMT (0.11).

Discussion

Like present findings, calmer Simmental cowshad significantly higher milk yield compared to moderate and nervous animals (Czister *et al.,* 2016). Similar association of calm temperaments with higher milk yield

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in other Taurus dairy breeds had been reported (Breuer *et al.*, 2000; Sutherland and Dowling, 2014; Haskell *et al.*, 2014). They also observed that moderate temperament animals had lowest milking speed compared to calm and nervous cows, however, in the present study lowest MFR was observed in TS-4 compared to calm and moderate temperament cows (P<0.01). The overall milk yield and composition observed in the present study was within the normal range as reported earlier in these crossbred cows (Mandal *et al.*, 2016; Sahu *et al.*, 2018). Higher milking duration in TS-1 compared to TS-4 might be due to higher milk yield (nearly 3 times more) in TS-1 than TS-4 category cows. Moreover, there is no or less tendency to hold up milk in docile cows, whereas nervous animals hold up milk as they remain under stress during milking animals (Prasad and Jayalaxmi, 2014). Similar to the present observations, Prasad and Jayalaxmi (2014) reported that in Murrah buffaloes average daily milk yields in the docile, slight restless, restless, aggressive and nervous categories were 6.70 ± 0.15, 6.50 ± 0.34, 5.70 ± 0.26, 4.90 ± 0.30 and 4.60 ± 0.34 kg, respectively. Present findings were in conformity with the observations of Mishra *et al.* (1975), Dogra *et al.* (2002), Bharadwaj *et al.* (2007) and Lallawmkimi and Singh (2009).The descending order of milk yield from docile to nervous cows might be attributed to the fact that under optimum conditions of milking the docile ones did not hold up any milk, while other categories held up milk due to secretion of adrenalin (Prasad and Jayalaxmi, 2014).Like present study in Jersey crossbred cows, significant differences were found in MFR and milk yield (P <0.01) among different temperament groups of Murrah buffaloes.

In present study, TS showed no significant effect on SCC, and similar findings were reported by Sewalem *et al.* (2011). Contrary to above findings, calmer and docile Jersey and Holstein cows had lower SCC compared to nervous counterparts (Fulwider *et al.*, 2007; Orban *et al.*, 2011). MCMT score in present study showed non-significant difference among TS-1, 2 & 3, whereas TS- 4 differed significantly (P<0.05) with others. Although, present results showed TS has no significant bearing with SCC/udder health, however, higher MCMT in nervous cows (TS-4) indicated a propensity to questionable udder health for higherTS in Jersey crossbred cows.

In our study, temperament had significant negative relationship (P<0.01) with milk yield of Jersey crossbred cows. Kruszynski *et al.* (2013) had estimated positive correlations between TS and milk yield (0.07), fat (0.08) and protein (0.09). MFR was negatively correlated with TS of Jersey crossbred cows in the present study, which was in accordance with the observations of Cziszter *et al.* (2016). Significant phenotypic correlation was found between TS and fat yield (-0.14) and protein yield (-0.18) in Simmental cows (Cziszter *et al.*, 2016). In nervous cows, the milk ejection was slower (Szentleleki *et al.*, 2015) in Holstein cows. Like present study, negative correlation between TS and milk yield was observed in Murrah buffaloes (Prasad and Jayalaxmi, 2014).The present study showed that Jersey crossbred cows of higher temperament scorehad lower daily milk yield and inferior milk composition compared to calm and moderate temperament cows.

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Conclusion

It was concluded from the above study that milking temperament significantly influenced milk yield, composition, milk flow rate and ease of milking in Jersey crossbred cows. Thus, docile cows should be selected for getting benefits of higher milk yield, milk composition, milking ease and milk flow rate.

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