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Effect of Seasons on Expressions of Milking Parlour Behaviours and Milk Yield of Crossbred Jersey Cows in Tropical Climate

Ajit Kumar[1], Dilip Kumar Mandal[2]

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ABSTRACT

Background: Milking behaviour of dairy cows has remarkable influences on their production efficacy. A number of genetic and environmental features controls and affects lactating behaviour of dairy cow. The aim of present study was to investigate the influence of seasons on milking behaviour and milk production of Jersey crossbred cows in tropical climate.

Methods: The experiment was conducted on 94 Jersey crossbred cows maintained at organized dairy farm at ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal, India and there lactating behavioural features were studied during milking time inside the milking parlour under different seasons. The study period was divided into 3 season's *viz*. rainy (September-October), winter (November-February) and summer (March-May).

Result: Seasons showed influence upon milking behaviour and milk yield of cows. Temperament of cows were least (1.91±0.03) during winter seasons as compare to rainy and summer (2.15±0.03; 2.09±0.03) respectively and it differed significantly (P<0.01), simultaneously daily milk yield were also more (9.36±0.11) kgs during winter seasons as compare to rainy and summer (6.63±0.13; 8.58±0.13) respectively and it differed significantly (P<0.01). It can be concluded from the study that seasons showed significant influence on the milking behavioural features and milk yield in Jersey crossbred cows in tropical climate, which suggests that if dairy animals get favourable micro-climatic environment and reduced level of environmental stress they will behave more favourably and simultaneously their production efficacy also inclines.

Key words: Jersey crossbred cow, Milking behaviour, Tropical climate.

INTRODUCTION

Heat stress is one of the utmost challenges faced by livestock persons around the world. Heat stress arises when any combination of climatic factors origins the actual temperature to be higher than the animals Thermo Neutral Zone. *Bos taurus* cattle shows significant physiological modifications when they are exposed to extended periods of elevated heat and humidity (Beatty *et al*., 2006). These changes continue for a few numbers of days even after the heat stress situations have been settled. *Bos indicus* also feels similar but less noticeable physiological changes as they are better in regulating their body temperature in response to heat stress than *Bos taurus* breeds (Dalcin *et al*., 2016).

Milking behaviour of cattle and buffaloes is a significant aspect of animal ethology because it has enormous impact on milk yield of animal, milk flow rate throughout milking, milking duration, ease of milking, selection of animals and eventually farm economics (Gergovska *et al.,* 2012; Haskell *et al.,* 2014; Bharti and Kamboj, 2019). Milking behaviour is positively associated with production efficacy of dairy cows. Animals showing ideal behaviour before, during and after milking frequently showed improved health status and are expected to give higher monetary returns to the farmers (Gergovska *et al.,* 2012). Temperament one of the primary milking behavioural features of animal, specifies how animal responds to the external stimuli and it is one of the most significant features of milking behaviour, which is a valuable tool for refining productivity of cows (Haskell *et al.,* 2014; Kumar *et al.,* 2019).

[1]Department of Livestock Production Management, Faculty of Veterinary and Animal Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata-700 037, West Bengal, India.
[2]Department of Livestock Production Management, ICAR-National Dairy Research Institute (Deemed University), Eastern Regional Station, Kalyani-741 235, Nadia, West Bengal, India.

Corresponding Author: Ajit Kumar, Department of Livestock Production Management, Faculty of Veterinary and Animal Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata-700 037, West Bengal, India.
Email: ajitk3058@gmail.com

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There are very less researches done on milking behaviours and its impact on production of Jersey crossbred cows and there is very scanty information available regarding association between milking behaviours with milk quantity as well as quality and also how different animal as well as environmental factors affects milking behaviour and milk yield in tropical lower Gangetic region. Therefore, present study was designed to assess the milking behaviours and impact of factors (parity, stage of lactation, time of milking and seasons) on milking behavioural features in milking

parlour and milk yield in Jersey crossbred cows at tropical lower Gangetic region.

MATERIALS AND METHODS

Location of the study

The present study was carried out on Jersey crossbred cows (N=94, 1st to 8th lactations) and maintained at organized dairy farm at ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal, India, during the year 2017 to 2018. The climate of Kalyani is warm and tropical; the extreme ambient temperature in summer goes up to 39°C and minimum temperature in winter falls down to about 8°C.

Management of cows during the experimental period

All animals were kept under loose housing system. The feeding management practices and feed ingredients were similar for the entire lactating herd. Concentrate mixture, seasonal green fodder (*ad libitum*) and chaffed paddy straw as dry fodder was provided to complete the nutrient requirement of all lactating animals. The quantity of concentrate was considered for every animal as per their body weight and milk production level. Concentrate was provided @1.5 kg/day as the maintenance ration between 8 to 8.30 A.M. and rest of the quantity was provided during milking time fortnightly adjusted depending upon milk yield as per farm schedule. Clean drinking water was provided throughout the day.

Recording of parameters

Milking was done at cattle yard, organized farm at ERS (Eastern regional station)- NDRI by semi-automatic machine milking (DeLaval India), two times in a day *i.e*., during morning from 5.00 to 7.00 AM and evening from 2.30 to 4.30 PM. The milk was measured in kg and noted for individual cow. Prior to milking, the animals were washed and groomed. Udders of cows were meticulously cleaned with clean water before the milking. Towels drenched with antiseptic solution were used for smearing of teats and udder just prior to attaching the teat-cups within the teats. The milking parlour behavioural features of cows were noted down during milking operations from 1m distance away from behind the animals without disturbing them. All the behavioural parameters were observed at weekly period of intervals by a single observer during the study period to evade personal error disparity.

Temperament score (TS)

Temperament of each individual animal was observed at the milking and temperament was scored under (1-5;1: Docile, 2: Slightly restless, 3: Restless, 4: Aggressive, 5: Nervous) of milking temperament score given by Prasad and Jayalaxmi (2014).

Milk yield

Every day, milk productions were noted at cattle yard, at ERS-NDRI. Milk recording continued for 9 months (morning and evening) following complete let-down for individual cows.

Parlour leaving speed or flight speed (m/s)

It is the duration of time engaged by cows to cross a certain specified distance in milk parlour afterward their release from milking byre once the milking operation is over. The time period to cover the measured fixed distance was noted down by means of stop watch. The parlour leaving speed was evaluated as the total area (distance) covered divided by time period taken by them to cover that certain specified distance and it is denoted as meter per second (m/s).

Exit score

Exit score stated patterns of movement of cows after liberation from parlour *i.e*., how animals are approaching out of milk parlour at the end of milking procedures. It was judged on a scale of (1 to 3; 1: Walked, 2: Trotted, 3: Ran out) as well-defined by Lanier and Grandin (2002).

Statement of animal rights (Ethical approval)

The usage of cattle in this trial (experiment) was permitted by the local institutional animal ethical committee vide institute approved project-NDRI/IRC Project code B-40 and it is an observational study.

Statistical analysis

The data obtained were analysed using SPSS software (SPSS Inc, 2007). The statistical methods used to analyse each parameter was General Linear Model and for categorical variables, data on frequency distribution were analysed using Chi-Square χ^2 test of independence. The significant difference levels were set at 5% ($P<0.05$) and 1% ($P<0.01$).

RESULTS AND DISCUSSION

Overall milking behavioural features of Jersey crossbred cows

Study of milking behaviour of dairy cows is one of the very important aspects of milking management of dairy cow, because behaviour considerably affects the production efficiency of animals. Overall Mean±SE of milking behavioural features of crossbred Jersey cows throughout the study period of 9 months revealed that mean value of temperament score (1.98±0.02), no. of stepping/milking (1.25±0.02), exit score (1.14±0.01), flight speed/parlour leaving speed (0.47±0.01), milking durations (249.68±1.92), daily milk yield (DMY) (8.27±0.08), milk flow rate (1015.05±6.51) was within the normal range. The mean values of DMY observed in the present study were similar to others reported in Jersey crossbred cows under tropical climate (Mandal *et al.,* 2016, 2018, 2021; Kumar *et al.,* 2020). Gergovska *et al.* (2012) assessed the milking temperament scores of cows from Holstein Friesian (HF) and Brown Swiss breeds and the scale they used was reverse (1-very nervous and 5-very calm cow) than those most popularly used in many countries and the present study used the later one.

The mean values of temperament scores of HF and Brown Swiss cows were 3.74 and 3.65, respectively which is similar to our findings revealing that calmer cows are having better efficacy of production. Rousing *et al.* (2004) reported that 27% of the cows showed stepping behaviour once during milking, 3% stepped more than once during milking which corroborate our findings. Abe *et al.* (2002) evaluated the milking temperament of Holstein cows in Japan and the mean score obtained was 2.31, which is in support to our findings.

Impact of season on milking behavioural parameters and milk yield

The study period was divided into three seasons *i.e*., rainy (July-October), winter (November-February) and summer (March-May) and data were analyzed to assess the effect of seasons on milking behavioural features.

Statistically analysed data (Table 1) revealed that temperament score was lower in winter season and varies significantly (P<0.01) as compared to rainy and summer seasons. Similar findings were observed in case of no. of stepping/milking and exit score. Milking durations, milk flow rate and milk yield were higher in winter season as compared to summer and rainy seasons that differed significantly (P<0.01). The above findings could be explained by the fact that during winter season environment was less stressful and more comfortable for the animals, so their production efficiency and milking behaviour were more conspicuous as compared to summer and rainy seasons, where THI became higher and their production levels also declined (Mandal *et al.,* 2016; Prasanna *et al.,* 2021). Enhancement in microenvironment of the cow shed through false roof reduced heat loads and assisted in maintaining standard physiological indices of cows and thereby showed more daily milk yield per cow (Mandal *et al.,* 2018; Sahu *et al.,* 2018; Sahu *et al.,* 2019). In tropical climatic conditions environmental features are the most important elements for the declined milk yield of cows. Environmental features such as temperature, relative humidity, solar radiation and air movement and their relations frequently limit the performance of dairy cows (Mandal *et al.,* 2002; West, 2003; Upadhaya *et al.,* 2009).

Thus, the impact of shelter comfort was not only limited to the performance and behaviours in living byre, but also its effect was prolonged up to their expressivity of behaviour in milking byre. Hence, it also indicates that behavioural rhythm of dairy cows might possibly be transformed in favourable directions through shelter management interventions during different seasons. Provision of proper micro-environmental (temperature, humidity, ventilation *etc*.) situations through relaxed housing designs improved milk yield and also modulated milking behaviours in Jersey crossbred cows during different seasons (Kumar *et al.,* 2020). In case of Holstein cows, heat stress declined the daily milk yield by 21% as the Temperature-Humidity Index (THI) values went from 68 in the spring to 78 in the summer. Lesser milk yields were noted for confined Holstein cows in Mediterranean weather conditions during spring as compared to summer (Bouraoui *et al.,* 2002). Our findings from this study (Table 2) were in line with the findings of Gangwar (1982) which suggested that milking time was higher in all the temperament scored Murrah and Nili-Ravi buffaloes during the hot-dry summer than during the other seasons. It was concluded that animals become more hostile

Table 1: Least square (mean±SE) of milking behavioural parameters of Jersey crossbred cows in different seasons.

Parameters	Rainy		Winter		Summer		Overall mean	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Temperament score (1-5)	2.15^{A}	0.03	1.91^{B}	0.03	2.09^{A}	0.03	1.98	0.02
No. of stepping/milking	1.51^{A}	0.04	1.11^{B}	0.03	1.52^{A}	0.04	1.25	0.02
Incidence of defecation/milking	0.58^{A}	0.02	0.51^{A}	0.02	0.61^{B}	0.03	0.53	0.01
Incidence of urination/milking	0.70	0.02	0.71	0.02	0.71	0.02	0.68	0.01
Incidence of vocalization/milking	0.05	0.01	0.05	0.01	0.06	0.01	0.09	0.01
Exit score (1-3)	1.21^{A}	0.02	1.12^{B}	0.02	1.18^{A}	0.02	1.14	0.01
Flight speed (m/s)	0.48	0.01	0.47	0.01	0.47	0.01	0.47	0.01

Row-wise means with different superscripts differ significantly (^{A,B} Significant P<0.01).

Table 2: Least square (mean±SE) of production parameters of Jersey crossbred cows in different seasons.

Parameters	Rainy		Winter		Summer		Overall mean	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Milking duration (seconds)	210.52^{A}	2.63	259.82^{B}	2.33	246.82^{C}	2.78	249.68	1.92
Milk flow rate (g/minute)	923.02^{A}	10.26	1040.30^{B}	9.08	986.72^{C}	10.84	1015.05	6.51
Morning milk yield (kg)	4.47^{A}	0.08	6.18^{B}	0.07	5.70^{C}	0.09	5.49	0.05
Evening milk yield (kg)	2.16^{A}	0.05	3.18^{B}	0.04	2.89^{C}	0.05	2.79	0.03
Total milk yield (kg)	6.63^{A}	0.13	9.36^{B}	0.11	8.58^{C}	0.13	8.27	0.08

Row-wise means with different superscripts differ significantly (^{A,B,C} Significant P<0.01).

and excited as the temperature and thermal stress increases which leads to a decrease in milk production and milk flow rate in hot-dry summer. In Jersey crossbred cows, as observed in the present study (Table 2) milk yield and milk flow rate was higher in winter, followed by summer and lowest in rainy season where stress conditions were more in later seasons. The said diverse effect among breeds and crossbred components was much more prominent on high yielders as compared to low yielders within tropical environments because of high air temperatures and relative humidity (Bryant *et al.,* 2007; Martello *et al.,* 2010; Mandal *et al.,* 2016).

CONCLUSION

This investigation revealed that seasons significantly influence milking behaviour. In winter cows showed more docile temperament as compared to summer and rainy seasons because winter dairy animals get more favourable environment as compared to other seasons which simultaneously helped them to perform as per their efficacy.

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Conflict of interest: None.

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