The Pharma Innovation Journal 2022; SP-11(2): 298-301

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(2): 298-301

www.thepharmajournal.com
Received: 11-12-2021
Accepted: 20-01-2022

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Order of entry at milking and its relationship with milk yield, udder health and milk composition in jersey crossbred cows

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Abstract
In dairy cows, order of entry into the milking parlour is fairly consistent. Dairy cows organise themselves into a specific and highly repeatable order for entering the milking area. Primiparous cows have significant relation between milk yield and entrance order into the milking parlour. The aim of present study was to investigate order of entry of cows at milking and its association with udder health, milk yield and milk compositions in Jersey crossbred cows in tropical climate. The experiment was conducted on Jersey crossbred cows maintained at organized dairy farm at ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal, India and order of entry at milking were studied during milking time and its relationship with udder health and milk yield and compositions. Entry order pattern at milking reveals Kendall's concordance (K_w) value ranges from 0.56 to 0.89 that mean there was some agreement with in the animals of same batch for entering into the milk parlour. Entry order had no significant impact on milk yield and udder health. However, cows having mid entry into the parlour had better udder health as compared to early and late entry ordered cows. Cows of early entry order had higher milk yield as compared to animals entered mid and late levels. Milk composition showing no significant difference among entry order levels except fat per cent.

Keywords: entry order, Jersey crossbred cow, milk yield, milk composition

Introduction

Performance of dairy animals is affected by exogenous factors which mainly includes individual condition (gestation, sex, age, temperament, lactation stage, breed, etc.) and social state (dominance order, milking order, competition, aggression, etc.). In dairy cows, order of entry into the milking parlour is fairly consistent. Dairy cows organise themselves into a specific and highly repeatable order for entering the milking area (Dietrich *et al.* 1965) [5]. Primiparous cows have significant relation between milk yield and entrance order into the milking parlour. Some cows are very consistent in this choice; they also exhibit a strong choice of side preference in milking area and if it is not followed has serious impact on their milk yield and milking behaviours (Tanner *et al.* 1994; Hopster *et al.* 1998) [19, 9]. Cows showed a clear preference of a side in milking parlour. Grouping as well as health status could be important while studying cow entrance order in milking parlour. Lame cows tend to enter the milking parlour towards the end of the milking operation (Phillips and Rind, 2001; Main *et al.* 2010) [13, 11]. Entry order is affected by social dominance (Arave and Albright, 1981; Hillerton *et al.* 2002) [2, 8] or novelty feed in the parlour (Ceballos and Weary, 2002) [3], it may also be determined by stress from entering the milking parlour (Wilkes *et al.* 2008) [21] also if primiparous cows are grouped with multiparous cows then primiparous cows enter the milking parlour at the last (Hopster *et al.* 1998) [9].

Sometimes cows show a side preference due to a natural laterality or neurological development (Tanner *et al.* 1994; Albright and Arave 1981) [19, 2]. Behaviour at milking could be measured as parlour entry order. Milking in unknown parlour can induce stress reaction (Macuhova *et al.* 2008) [10]. Majority of cows (55.7%) choose consistently a specific side in the milking parlour (Paranhos da Costa and Broom, 2001) [12]. In dairy cows, order of entry into the milking parlour is fairly consistent. There are very less researches done and there is very scanty information available on entry order pattern in milking byre and its association with udder health, milk yield and composition in Jersey crossbred cows under tropical condition. Therefore, present study was designed to assess the order of entry in milking byre within the group of milch cows and its association with udder health, milk yield and composition in

Jersey crossbred cows at tropical lower Gangetic region.

Material and Methods

Location of the study

The present study was carried out on Jersey crossbred cows belonging to 1st to 8th lactations and maintained at organized dairy farm at ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal. 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. The observations were collected in groups of stock both morning and evening period before entering milking parlour from their respective sheds.

Management of Cows

All investigational animals were kept under loose housing system. All the feeding management practices and the feed ingredients were similar for the entire lactating herd. Concentrate mixture, seasonal green fodder (ad libitum) and straw were provided to complete the nutrient necessity of all the lactating animals.

Recording of parameters

Entry order pattern was observed at the entrance gate of the milking parlour before milking operations was done at milking byre of cattle yard, organized farm at ERS (Eastern regional station)- NDRI. The entry order pattern of cows was noted down during entering the milking byre from their respective shed without disturbing them by using CCTV recordings and manual observations.

Entry order in milking parlour

In this parameter, first of all the animals in batches were released from the respective sheds and cows walked through an alley before entering into the milking parlour on weekly interval basis as depicted by (Fig.1).

Milk yield

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

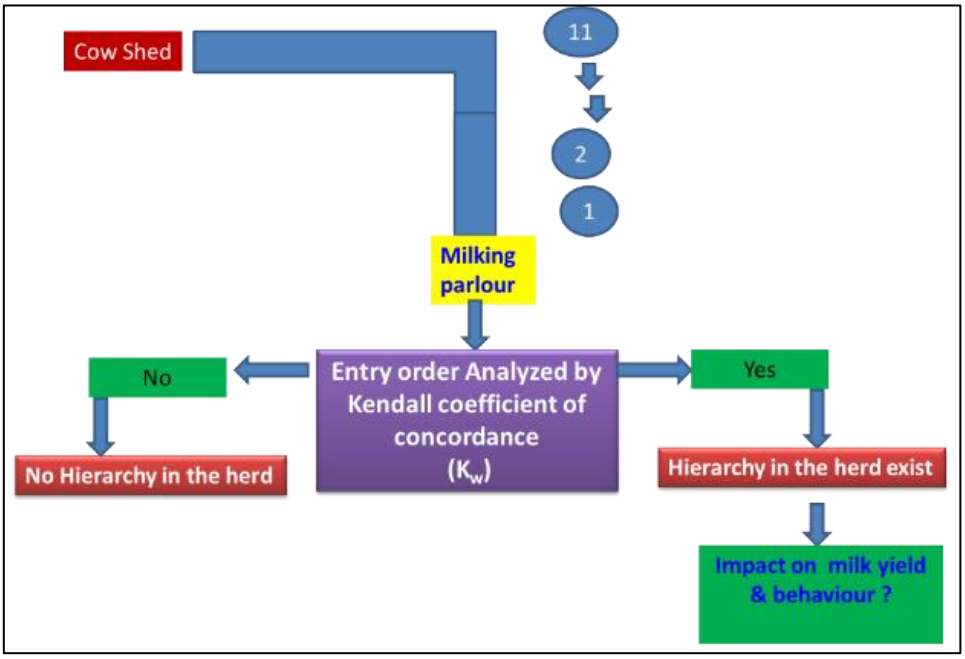

Fig 1: Flow chart of entry order pattern in milking parlour

Milk Compositions and Udder Health

Milk composition i.e., milk fat (%), SNF (%) &protein (%) of each animal under the experimental study was recorded at weekly intervals. It is being estimated by using Milkoscreen equipment (indiFoss, Indifoss Analytical Pvt Ltd). Somatic cell count (SCC) was assessed by methods described by Schalm *et al.* (1971) [17] and Modified California Mastitis Test (MCMT; 0-4) as per technique described by Devi (1989) [4].

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 were analysed using SPSS software (2007, 16.0 versions). The statistical methods used to analyse the data were General Linear Model, Kendall's coefficient of concordance and Spearman correlation (R_s). The level of significance was considered at 5% ($P<0.05$) and 1% ($P<0.01$).

Results and Discussion

Entry order pattern of milking animals during the study period

Animals had entered into the milking parlour in batches. Out of all the batches observed during study period 5 batches was taken for analysis and in each batch (4-12 animals were present). These batches are analyzed to see the agreement between the animals within the batch during the entry into the milking parlour.

Five (5) batches of animals were analyzed (Table 1) to investigate the agreement between the animals while entering into the milk parlour by using Kendall's coefficient of concordance and again these values were evaluated using Spearman rank correlation coefficient. Data analysis revealed that Kendall's concordance (K_w) ranges from 0.56 to 0.89 that mean there was some agreement with in the animals of same

batch for entering into the milk parlour. It also means that some hierarchy also existed because of these animals had shown nearly same entry order pattern into the milking byre.

Table 1: Kendall's coefficient value of entry order during milking of Jersey crossbred cows

Batch	No. of times Cows judged for entry order	No. of animals in the batch	Kendall's W	Average Spearman correlation (R_s)
1	8	12	0.636	0.60
2	10	10	0.889	0.88
3	14	9	0.747	0.71
4	4	8	0.622	0.56
5	13	4	0.564	0.35

Our findings are further corroborated by Grasso *et al.* (2007) [7] findings which showed that Kendall's coefficient of concordance value of 0.36 for Friesian primiparous and multiparous cows, which indicated that both primiparous and multiparous Friesian cows had a consistent order of entry into the milking parlour. Multiparous cows showed the correlation of milk yield with entrance order and SCC were not significant conversely primiparous cows showed milk yield was significantly correlated with entrance order (r_s = 0.22; P<0.05) and with SCC (r_s = 0.25; P<0.01). Positive correlation observed in primiparous animals between milking order and milk production was not very high (0.22). Low productive animals tend to enter later because they perceive milking as stressful event, as also suggested by the correlation between milk production and SCC was also in accordance with study by Rathore (1982) [15].

Entrance order is positively correlated with the social rank. This would mean that entrance was in relation with the motivation for food ingestion (Reinhardt, 1973) [16]. Other studies showed that the primiparous, transferred to a group of multiparous, enter last into the milking parlour (Soch *et al.* 1997) [18], confirming that cattle have a firm position in the hierarchic scale within the group and respect an order for feeding and milking. Dietrich *et al.* (1965) [5] reported that dairy cows organise themselves into a specific and highly repeatable order for entering the milking area. Although entry order may be affected by social dominance (Albright and Arave, 1997; Hillerton *et al.* 2002) [1, 8] or novelty feed in the parlour (Ceballos and Weary, 2002) [3]. However, further studies are required in Jersey crossbred cows in tropical climate for establishing the relationship of entry order with social dominance and herd hierarchy.

As per study done by Hopster *et al.* (1998) [9] on 24 milking animals divided into 3 groups of 8 animals each i.e., C-cows (not showing side preference in milking parlour), H-cows (habitual side in milking parlour) and N-cows (non-habitual side of milking parlour) shows that N-cows used significantly more time (p<0.05) to enter the milking parlour (86s) than H-cows (20s) and C-cows (31s). When feeding is done during milking operation then it shows that N-cows paused significantly more (p<0.05) often (0.89 time per minute) in comparison to H-cows (0.49) and C-cows (0.51). No difference in milk production between treatment groups could be detected. Wasilewski (1999) [20] recommends that a milking order is not a species-specific feature of the social organization of cattle, but seems to be a more common characteristic among dairy animals that may be considered more as a dynamic than a static phenomenon. Cow entry behaviour and exit pace in a milking parlour for Friesland, Jersey and crossbred cows shows percentage of cows stopping before entry at the platform varied between 20-40% whereas animals of Jersey breed presented the lowest frequency (20%) and highest (40%) in crossbred (Dodzi and Muchenje, 2011) [6].

Relationship of entry order with udder health, milk yield and milk compositions

To study the relationship, animals in each batch were divided into three groups i.e., early entry (top 30% of animals within the batch), mid entry (next 40% of animals within the batch) and late entry (remaining 30% of animals within the batch). After classifying the observations, analysis was done to study the effect / relationship of entry order on udder health and milk yield and compositions.

Table 2 showed Mean ± SE values of udder health (SCC, MCMT scores) and milk yield of animals having different entry order pattern into the milk parlour. Data analysis revealed that entry order had no significant impact on milk yield and udder health. However, cows having mid entry into the parlour had better udder health i.e., less no. of somatic cell (million no. / ml) and MCMT scores (0.49 ± 0.03 and 2.12 ± 0.06, respectively) as compared to early and late entry ordered cows. Cows of early entry order had higher milk yield as compared to animals entered mid and late levels.

Cows that enter the milking parlour early were more dominant and dominance was related to body weight, lactation number and milk production (Phillips and Rind, 2002) [14]. More productive subjects tend to enter later because they perceive milking as stressful event, as also suggested by the correlation between milk production and SCC in accordance with study by (Grasso *et al.* 2007; Rathore, 1982) [7, 15].

Table 2: Least squares mean (±SE) of udder health of Jersey crossbred cows having different entry order in the milking parlour

Parameters	Entry order		
	Early entry	Mid entry	Late entry
Somatic cell count / ml (x10^6)	0.59 ± 0.04	0.49 ± 0.03	0.50 ± 0.06
Somatic cell count / ml (Log 10 value)	5.57 ± 0.04	5.49 ± 0.02	5.53 ± 0.05
Modified California Mastitis Test (0-4)	2.32 ±0.09	2.12 ± 0.06	2.15 ± 0.14
Morning Milk yield (Kg) /day	5.25 ± 0.11	4.92 ± 0.09	4.96 ± 0.10
Evening Milk yield (Kg) /day	2.70 ± 0.06	2.57 ± 0.05	2.61 ± 0.05
Total Milk yield (Kg) /day	7.95 ± 0.17	7.49 ± 0.14	7.57 ± 0.15

Table 3: Least squares mean (± SE) of milk composition of Jersey crossbred cows having different entry order in the milking parlour

Parameters	Entry order		
	Early entry	Mid entry	Late entry
Fat (%)	4.86 ± 0.03[a]	4.97 ± 0.02[b]	4.93 ± 0.04[a]
Solids not fat (%)	9.13 ± 0.01	9.16 ± 0.01	9.15 ± 0.01
Protein (%)	3.91 ± 0.02	3.94 ± 0.01	3.92 ± 0.02

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

Table 3 showed Mean ± SE values of milk compositions of animals having different entry order. Data analysis revealed that milk composition showing no significant difference among entry order levels except fat per cent. It was higher in animals having mid entry into the parlour as compared to early and late entry animals. Other two components i.e., SNF% and Protein % are also higher in mid entry animals but not having any significant differences with early and late entry animals.

Conclusion

This investigation revealed that entry order is fairly consistent every time they enter the milking parlour and that shows there are some hierarchical and dominance factor between the dairy animals. Present findings indicated that detailed investigation is required on entry order of cows and its relationship between this trait with milk yield and milk composition.

Acknowledgments

Authors have sincere gratitude toward the Director, ICAR-National dairy Research Institute, Karnal and Head, ERS, Kalyani for providing all facilities for this study and all who assisted in direct / indirect ways towards completion of this study work.

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