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Preference of side and standing in relationship with milking characteristics and temperament score of crossbred dairy cows in an 8 × 2 herringbone milking parlour

Ahmad FAHIM[1,*], Madan Lal KAMBOJ[2], Mukesh BHAKAT[2], Tushar Kumar MOHANTY[2], Rohit GUPTA[3]

[1]Department of Livestock Production Management, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India

[2]Indian Council of Agricultural Research–National Dairy Research Institute, Karnal, Haryana, India

[3]Krishi Vigyan Kendra, Jalandhar, Punjab, India

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Abstract: The aim of this study was to investigate the preference of side and standing in relationship with milking characteristics of crossbred cows in a double-sided herringbone milking parlour. Seventy-two crossbred cows were milked in an 8 × 2 low-line automated herringbone milking parlour having automatic cluster removal settings for 45 milking sessions. There was considerable variation among individuals in the consistency of side choice ($\chi^2 = 1.414$, $P = 0.234$). The consistency score of crossbred cows showed that many cows had a strong tendency to enter the parlour on the same side during consecutive milkings. The side preference was found to have significant ($P < 0.01$) effect on milk yield. The milk flow rate was affected significantly ($P < 0.01$) with increased machine-on time in consistent cows on the nonpreferred side. The temperament score was significantly higher on the nonpreferred side with a lower flow rate. Similarly, there was consistency for occupying the position on the milking platform based on milk yield and flow characteristics ($P < 0.05$). The study concluded that cows having consistency of side should be identified as any management practices that disturb the milking routine creates possible stress in these cows, leading to production losses.

Key words: Crossbred cows, consistency score, herringbone parlour, temperament score

1. Introduction

Cows in a loose-housing system are frequently exposed to various challenges that determine the strategies associated with individual characteristics. Management practices like handling, milking, movement, veterinary procedures, or social confrontations in a group are some of the common situations that a cow faces on a routine basis. There are often situations where an animal has a choice to prefer some environmental features that are assumed to fulfil their needs and desires. The expression of such preferences could be used to assess what is important to the animals and hence how to improve animal production and welfare (1,2). In milking routines, in a two-sided milking parlour, it is observed that dairy cows have to choose one of two sides to enter the parlour. A choice is also available for preference of standing as decided by their hierarchical status in a parlour with minimum disturbances. Previous studies have shown that some cows are consistent in their choice of a particular side of the milking parlour, showing their side preference (3,4). It is a general assumption that such cows are more disturbed when being milked on their nonpreferred side. Such a disturbance might also influence the welfare of the animal (5). It has also been reported that entry into the milking parlour is a prominent feature of the social system of dairy cattle (3,6,7) influenced by social rank (8), health (7,9,10), and productivity (11,12). Individual characteristics such as anxiety, fear, stress, and sensitivity can also influence their preferences (4,13). The present study was conducted to investigate these preferences in crossbred cows in a two-sided (2 × 8) automated herringbone milking parlour and their effects on milking characteristics and temperament scores of dairy cows.

2. Materials and methods

2.1. Experimental animals

The study was conducted on a crossbred cattle herd consisting of Karan Fries (Tharparker × HF) and Karan Swiss (Brown Swiss × Sahiwal) cows maintained at the Cattle Yard of the National Dairy Research Institute in Karnal (Haryana, India). During the study, 72 crossbred cows were taken for 45 milking sessions. These animals

* Correspondence: ahmadfahim300@gmail.com

were monitored through an automatic animal identification system consisting of a neck transponder, portal identification antenna, system controller, and ALPRO Windows kit. All the experimental animals were kept in a similar loose housing system in a modern dairy shed having provisions for concentrate feeding through automatic feed dispensers. The cows had free access to food and water at any time, except during milking sessions. Milking of animals was done in a DeLaval low-line herringbone milking parlour (2 × 8) having automatic cluster removal settings. The cows were driven by a herdsman a short distance within the centre to a holding area adjacent to the milking parlour. The time spent by each cow in the holding area before milking varied from 10 to 30 min. As the number of cows waiting for their turn of milking decreased, the holding area was decreased by the movement of a crowding gate, controlled electromechanically by the herdsman with minimum disturbances (Figure 1). Once the cows were in the milking parlour the routine was premilking udder washing, forestripping, cluster attachment, and postmilking teat spray.

For every cow, there was automatic recording of the side and position chosen via Herd Management Software (DeLaval ALPRO System). The cows had a choice to move either to the right (R) or left (L) side of the parlour. A cow standing in the parlour was classified into front (F), middle (M), or back (B) based on the position and cluster attachment (Table 1). The parameters studied were milk yield, machine-on time, average flow, and peak flow, which were recorded and stored in the database of the system via the software (ALPRO). Each cow's temperament score was recorded by scoring reactions during premilking udder preparation using the 5-point scale proposed by Tulloh (14).

2.2. Consistency score

The consistency score was calculated, being the ratio of the number of times that a given parlour side/position was visited twice in succession to the number of possible transitions between the choices in a series of successive milkings. For practical reasons, this ratio was multiplied by 100 (13).

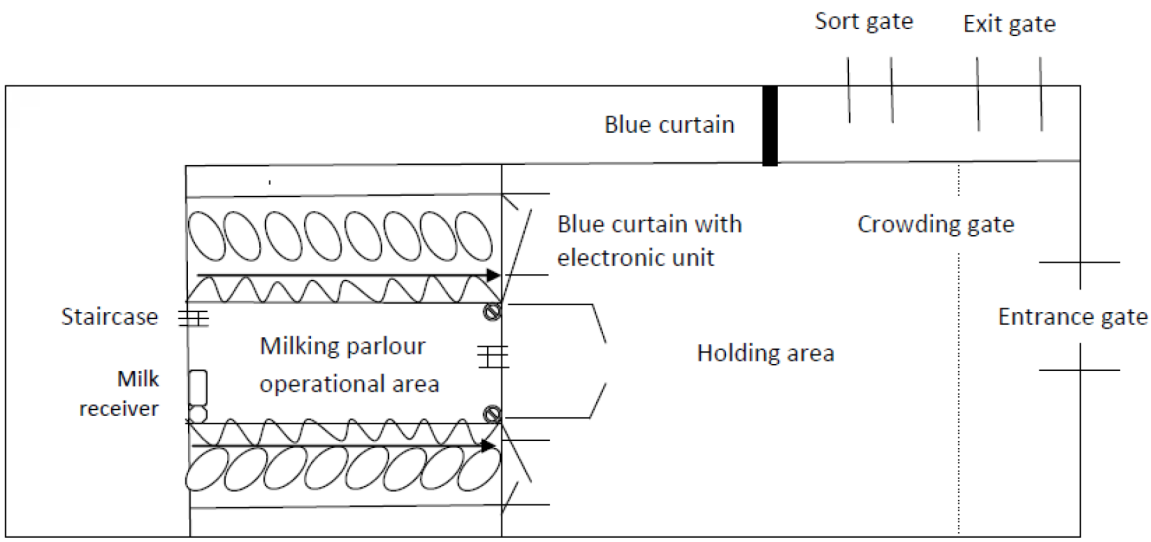

Figure 1. Bird's eye view of the automated herringbone milking parlour.

Table 1. Cows showing preference for standing positions in 2 × 8 herringbone milking parlour.

Preference	Stall position	No. of cows	Percentage of cows
		Consistency score > 70	
Front	1, 2, 9, 10	10	13.89
Middle	3, 4, 5, 6, 11, 12, 13, 14	42	58.33
Back	7, 8, 15, 16	07	9.72

For example, L-L-R-L-L-L-R-L-L produces eight possible transitions between L and R including four pairs of successive Ls. Thus,

$CS = (4/8) \times 100 = 50$

The consistency score provides information about the dynamics of repeated visits over a long period either for the side of milking or position of milking.

2.3. Statistical analysis

In order to meet the requirements of normally distributed data, the temperament score of cows was square-root transformed, whereas for others nontransformed data were used. The cows were divided arbitrarily into two groups: cows showing consistency in choice (>70% of the choices) and nonconsistent cows (≤70%). The preference for side and position was considered for the consistent group. For every variable in every consistency group and side preference, side comparisons were performed by paired t-test, using the means data file. The choices for the position of standing in the cows were compared using two-way ANOVA in SAS version 9.3.

3. Results

3.1. Preference in dairy cows

There was considerable variation among individuals in the consistency of side choice (Figure 2). The consistency score of crossbred dairy cows given free choice in a left- and right-sided milking parlour (2 × 8 herringbone milking parlour) showed that out of the 72 cows studied in detail, 27.78% of cows chose consistently (>70% of the choices) a specific side in the milking parlour, and left was preferred over right (60% of the consistent cows preferred the left side) ($\chi^2 = 1.414$, P = 0.234, df = 1). The other cows (72.22%) were nonconsistent and entered either side of the two-sided milking parlour. From this experiment, it was obvious that many dairy cows had a strong tendency to enter the parlour on the same side during consecutive milkings. This demonstration of side choice was in agreement with the few previous studies assessing this subject.

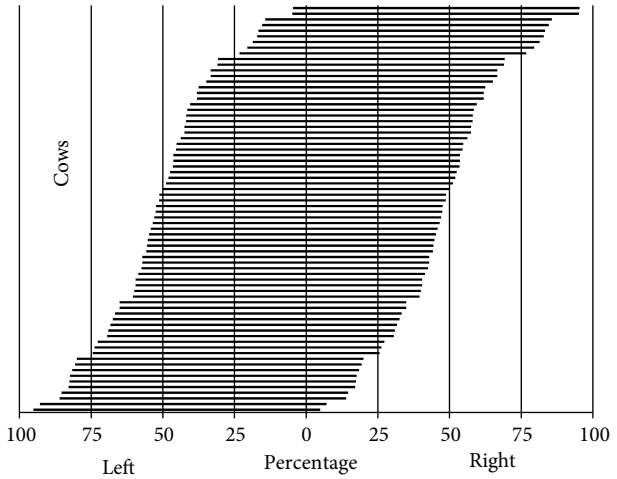

Figure 2. Each cow's percentage choice of the left and right side in the milking parlour (n = 72).

3.2. Effect of parlour side on milk yield, machine on-time, flow characteristics, and temperament score

The study showed that cows do exhibit choice of parlour side for being milked in a two-sided parlour. The side preference was found to have a significant (P < 0.01) effect on milk yield in both left- and right-consistent cows in comparison to cows that were nonconsistent in choosing the preferable side (Table 2). It was also found that left-consistent cows had significantly (P < 0.01) higher milk yield when they entered the left side of the parlour and took significantly lower machine-on time for milking. The cows with right consistency also differed significantly (P < 0.01) in milk yield when milked on their preferred side of milking. Significant (P < 0.05) differences were also found

Table 2. Milking characteristics in crossbred cows having left consistency (LC), right consistency (RC), and nonconsistency (NC) in 2 × 8 herringbone milking parlour (mean ± SE).

Parameters	LC (N = 12)		RC (N = 8)		NC (N = 52)	
	Left	Right	Left	Right	Left	Right
Milk yield (kg)	$5.89^{A} \pm 0.52$	$5.52^{B} \pm 0.48$	$7.70^{A} \pm 0.70$	$8.04^{B} \pm 0.68$	5.91 ± 0.23	5.86 ± 0.23
Machine-on time (min)	$4.72^{A} \pm 0.40$	$4.99^{B} \pm 0.44$	6.92 ± 0.62	6.69 ± 0.59	5.35 ± 0.20	5.32 ± 0.20
Avg. flow (kg/min)	$1.24^{A} \pm 0.04$	$1.13^{B} \pm 0.02$	$1.14^{a} \pm 0.03$	$1.20^{b} \pm 0.03$	1.11 ± 0.01	1.11 ± 0.01
Peak flow (kg/min)	$2.58^{A} \pm 0.07$	$2.35^{A} \pm 0.06$	$2.29^{A} \pm 0.08$	$2.39^{B} \pm 0.09$	2.24 ± 0.03	2.23 ± 0.03
Temperament score	1.28 ± 0.06	1.33 ± 0.06	$1.29^{a} \pm 0.09$	$1.23^{b} \pm 0.09$	1.39 ± 0.04	1.41 ± 0.04

Means with different superscripts in uppercase letters in a row differ significantly at P < 0.01 and those in lowercase letters at P < 0.05. Values in parentheses indicate number of animals.

in their temperament score, suggesting more comfort on their preferred side. This may be the possible reason for differences in milk yield in similar machine on-times. The nonconsistent cows were found to be similar in all aspects, whether they entered the left or right side of the milking parlour. However, the temperament score of such cows were higher in compared to consistent cows for similar yield.

3.3. Effect of parlour position on milk yield, machine on-time, flow characteristics, and temperament score

The effect of standing positions in the milking parlour on milking characteristics of crossbred cows is presented in Table 3. The cows with higher milk yield preferred to stand at front positions, followed by a preference for back positions in the milking parlour. Significant differences ($P < 0.05$) were observed in machine on-time, average flow, and peak flow rates based on the positions of cows standing in the milking parlour. No effect was seen if cows failed to secure their preferred position in the parlour. Likewise, their temperament score was not affected by position. The study showed that animals do exhibit preferences for milking in the milking parlour based on their milk yield and flow characteristics. The preference for a front position by high yielders shows their natural role as group leaders in a herd composed of dairy cows with similar body weights and conditions.

4. Discussion

Dairy cows entering a two-sided milking parlour and exhibiting a side preference is considered a prominent feature of their social system (3). In a study on the side preference in a milking parlour among a commercial herd, it was reported that 53.7% of cows did not show a side preference, whereas the other 46.3% showed a strong side preference (15). In another study, Hopster et al. (4) analysed data from 89 cows, collected automatically, and found that a strong side preference (>75% of the milking sessions) was shown by 25.8% of cows. Polikarpus et al. (16) reported that the side preference and milking order remained stable within days and across days, but were more variable within milking sessions. Previous researchers reported that a cow exhibiting a side preference in the milking parlour could be due to associative learning, choosing the side where the cow had previously received some reward and avoiding that where there was some source of punishment (17–19). Our results also suggest that side preference may be a stable characteristic of an individual dairy cow.

Cows are reluctant to enter the nonpreferred side of a milking parlour and show decrease in milk yield as well as acceleration of the cardiac rhythm (4). The reasons attributed to this were improper parlour design, milking machine dysfunction, variations in milking environment (e.g., noise and lighting levels), and other management conditions (feeding cows in the milking parlour, ease of escape, etc.). Other studies pointed out that cows have good spatial memory and are able to remember the position at which they received a reward (food) (18) and escape where restraint was experienced (20). Similarly, the milker–cow interactions during milking (21), milking technique, aspects of neurological development (15), and the social behaviour (4) and predictability of the daily routine (22) are among the factors that can potentially affect the side choice in the milking parlour. In the present study, the cows were exposed to a uniform milking environment, milking being carried out in a quiet manner without any alterations in the milking units, clusters, machine settings, or the milker engaged in milking operations. Furthermore, no food/concentrate was offered during milking in the milking

Table 3. Milking characteristics in crossbred cows based on their preference for standing position in 2 × 8 herringbone milking parlour (mean ± SE).

Parameters	Position of standing					
	Front (N = 10)		Middle (N = 42)		Back (N = 7)	
	Secured	Failed	Secured	Failed	Secured	Failed
Milk yield (kg)	$7.53^{b} \pm 0.42$	$7.33^{b} \pm 0.42$	$5.96^{a} \pm 0.30$	$5.90^{a} \pm 0.30$	$6.56^{ab} \pm 0.53$	$6.57^{ab} \pm 0.53$
Machine-on time (min)	$6.34^{b} \pm 0.30$	$6.50^{b} \pm 0.30$	$5.33^{a} \pm 0.27$	$5.29^{a} \pm 0.27$	$5.93^{ab} \pm 0.43$	$5.89^{ab} \pm 0.43$
Avg. flow (kg/min)	$1.23^{b} \pm 0.04$	$1.18^{b} \pm 0.04$	$1.13^{a} \pm 0.01$	$1.12^{a} \pm 0.01$	$1.10^{a} \pm 0.02$	$1.09^{a} \pm 0.02$
Peak flow (kg/min)	$2.55^{b} \pm 0.09$	$2.44^{b} \pm 0.09$	$2.27^{a} \pm 0.03$	$2.24^{a} \pm 0.03$	$2.19^{a} \pm 0.05$	$2.19^{a} \pm 0.05$
Temperament score	1.38 ± 0.07	1.39 ± 0.07	1.36 ± 0.05	1.36 ± 0.05	1.39 ± 0.12	1.41 ± 0.12

Means with different superscript in lower case letters in row differ significantly at $P<0.05$
Figure in parentheses indicate number of animals

system (herringbone milking parlour), which means certain cows have a tendency to remember the side of milking or they may have an inclination to a particular side.

Cattle do have a firm position in the hierarchic scale within the group with respect to feeding and milking (23). Reddy and Tripathi (24) reported a positive correlation of hierarchic rank, body weight, and age of cattle and buffalo with their milk yield. Similar results were reported by Mittal et al. (25) in free-grazing zebu cattle and Soltysiak and Nogalsky (26) in a group of 126 Polish Holstein-Friesian cows. On the contrary, Grasso et al. (3) reported that productive subjects tend to enter later because they perceive milking as a stressful event. This may be due to negative experiences in some animals caused due to routine procedures (e.g., injections), visual distractions, and even human contact that is unavoidable in the parlour (27). It is therefore advisable during milking procedures, in order to avoid aversive conditions that could affect the welfare of cows and milk yield, that dairy cows be milked in a quiet and predictable way (28–30).

The results from the present study showed that animal should be able to choose a favourite side and position to feel comfortable during milking. Consequently, external or social restraint, preventing the animal from entering according to its habitual side and position, might result in possible stress in consistent cows, leading to production losses. Therefore, this behaviour should be considered as a prominent feature of the social system of dairy cattle that could have implications in improving farming practices.

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