Entrance order
and side preference
of dairy cows
in the milking parlour

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ABSTRACT

Sixty-seven multiparous (group M) and 79 primiparous (group P) Friesian cows were used to assess
the consistency of the order of entry and the preference for a determinate side into the milking par-
lour. The Kendall’s coefficient of concordance showed a constancy of the entrance order into milking
parlour for both primiparous and multiparous subjects (0.36, P<0.001). In primiparous cows milk yield
was significantly correlated to entrance order (rs=0.22, n=79, P<0.05) and tended to be correlated to
SCC (rs=0.25, n=43, P<0.10). In group M, 19 cows out of 67 (28.3%) preferred the right side of the
milking parlour, whereas the other 48 (71.7%) showed no preference for one of the two sides. In group
P, 8 out of 79 (10.1%) cows chose the right side, 10 the left side (12.7%) and the remaining 61
(77.2%) indifferently used the right or left positions of the milking parlour. We conclude that manage-
ment practices that disturb entrance order and/or side choice should be avoided in order to minimise
stress during farming routines.

Key words: Dairy cows, Behaviour, Milking order, Side preference.

RIASSUNTO

ORDINE DI ENTRATA E PREFERENZA PER UN LATO DELLA SALA DI MUNGITURA
IN VACCHE DI RAZZA FRISONA ITALIANA

Scopo del lavoro è stato quello di mettere in evidenza eventuali relazioni fra il comportamento in sala di
mungitura e alcuni aspetti relativi alla produzione del latte. La ricerca è stata condotta su 146 vacche di
razza Frisona italiana, di cui 79 primipare (gruppo P) e 67 pluripare (gruppo M), utilizzate per verificare:
(a) se l’ordine di entrata in sala di mungitura rappresenta una costante e se risulta correlato con il livel-
lo produttivo; (b) se le bovine manifestano una preferenza per le poste del lato sinistro o per quelle del
lato destro dell’impianto di mungitura. I risultati ottenuti hanno evidenziato che sia le primipare che le
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pluripare tendono ad entrare in sala di mungitura secondo un determinato ordine (coefficiente di concordanza fra ranghi W di Kendall = 0,36; P<0,001); solamente nelle primipare, però, l’ordine di ingresso in sala è correlato significativamente con il livello produttivo (r=0,22; P<0,05) e sembrerebbe in relazione con il numero di cellule somatiche (r=0,25; P<0,10). Relativamente alla preferenza espressa dalle bovine nell’occupare le poste di un determinato lato durante la mungitura, è emerso che, tra le pluripare, 19 soggetti su 67 (28,3%) hanno preferito il lato destro, mentre per le restanti 48 (71,7%) è risultato indifferente utilizzare le poste del lato destro o quelle del lato sinistro. Considerando il comportamento delle primipare, 8 su 79 (10,1%) hanno scelto il lato destro, 10 (12,7%) il lato sinistro e le rimanenti 61 (77,2%) non hanno mostrato preferenza. Lo studio richiama l’attenzione sull’importanza che la valutazione delle risposte fisiologiche e comportamentali che gli animali forniscono in relazione alle differenti tecniche di allevamento può rivestire al fine di evitare l’instaurarsi di condizioni in grado di influire negativamente sul benessere, come interferire con l’ordine di entrata e con la preferenza per un determinato lato della sala di mungitura.

Parole chiave: Vacche da latte, Comportamento, Ordine di mungitura, Preferenza.

Introduction

The performance of dairy cattle may be affected by endogenous and exogenous factors (Hasegawa et al., 1997). Endogenous factors can be divided into individual conditions (breed, age, sex, lactation period, gestation, temperament, etc.) and social position (dominance order, milking order, competition, aggression, etc.). Exogenous factors regard the physical environment (season, climate, weather, temperature, humidity, wind, photoperiod, etc.) and social environment (stocking rate, age structure, sex ratio, etc.). The evaluation of animal response to external stimuli and their degree of adaptation to the environment is gaining scientific interest. In fact, it is a means to develop housing systems that allow the animals to reach a satisfactory welfare state.

Animals can perceive particular situations as pleasant or unpleasant in relation to previous subjective experiences (affective conditions, emotions, etc.). According to Duncan and Fraser (1997), animal welfare depends on individual perception rather than objective external situations (state of health, space allowance, etc.). Therefore, the response to environmental stimuli changes according to animal sensitivity.

In cattle, voluntary movements have been studied in different situations such as grazing, entering the milking parlour, squeeze chute or crushes, and consistent orders often occurred (Bouissou et al., 2001). In dairy cows, order of entry into the milking parlour is fairly consistent. Dietrich et al. (1965) reported that dairy cows organise themselves into a specific and highly repeatable order for entering the milking area. In addition, it has been shown that milking routine (moving animals from home pen to milking parlour, udder cleaning, milking, etc.) can affect cows’ welfare (Arave and Albright, 1981; Seabrook, 1984; Fraser and Broom, 1997). In particular, it has been demonstrated that some cows were very consistent in the choice of one side of the milking parlour, thus showing a clear side preference (Tanner et al., 1994; Hopster et al., 1998). These authors suggested that environmental factors which prevent the cow from choosing her preferred side may determine stress responses during milking. As reported by Paranhos da Costa and Broom (2001), the behaviour in this circumstance may be used to evaluate the cows’ reactivity and draw useful indications for management improvement. However, little is known about the consistency of the order of entry into the milking
parlour of primiparous and multiparous when they are kept in separate groups.

Thus, the present study was conducted to investigate the consistency of the entrance order into the milking parlour of primiparous and multiparous cows and the relationship between milking order and milk yield. In addition, the preference for a determinate side of the milking parlour has been considered.

Material and methods

Animals and behavioural recordings

The study was carried out on a commercial dairy farm rearing about 1,200 Italian Friesian cattle with 800 lactating cows. Animals were kept in separate groups according to their parity and stage of lactation. They were housed in an open-sided barn with cubicle beds in the lying area and equipped with self-locking stanchions. Pedometers were fitted at the metatarsus of a hind limb of each cow to allow daily activity monitoring for oestrous detection.

Animals were milked in a double-thirty-eight herringbone milking parlour. The milking system was provided with the automatic cluster detachment mechanism and equipment for measuring electric conductibility in the milk for indication of mastitis. The milking equipment was operated by the AFIMILK system (S.A.E. AFIKIM, Israel), that collects and checks all the data coming from the milking parlour, including the milking position of each cow and the time and duration of milking.

One hundred forty-six cows were involved in the study, divided into two groups: group M, composed of 67 multiparous, and group P, composed of 79 primiparous subjects. The cows were milked three times a day (6:00, 14:00 and 22:00 h) and at the beginning of the trial they were at a lactation stage of 100-130 days. Before each milking session, all cows of each milking group were taken together to a waiting area. During this period, cows were free to choose their position in relation to the entrance in the milking parlour, without any intervention of the stockman. The waiting area (approximately 115 m²) was in front of the milking parlour (Figure 1). Both sides of the milking parlour were identical and cows had access to each side of the parlour through pneumatically operated gates. For both groups, at the start of milking, the left gate was always opened first. Then, when the milking of the first batch of 38 cows started, the right gate was opened and

Figure 1. Layout of the milking parlour.
the remaining cows were allowed to enter the milking parlour.

For each cow, the entrance order into milking parlour, the side (left or right) where she was milked and the milk yield were recorded. These data were derived from the computerised identification of cows during a period of approximately 2 consecutive months, resulting in 170 milking sessions. During this period, the composition of both groups was kept constant. Therefore, the sequence in which the cows entered the milking parlour ranged from 1 to 67 for group M and 1 to 79 for group P.

Somatic cell count (SCC)

At the end of each experimental month individual milk samples were collected into 100 ml sterile plastic containers after cleaning and disinfecting the teats (ethyl alcohol) and discharging the first streams of the foremilk obtained from 43 primiparous and 42 multiparous cows. Somatic cells were measured according to IDF (1995) using a Foss Electric Fossomatic 90 cell counter. A mean value of the two measurements was calculated and log_{10} transformed data were used for correlation analysis.

Statistical analysis

Data were analysed with the Statistical Analysis System package (SAS, 1990). For each group, the consistency of the entrance order was computed using the Kendall coefficient of concordance (W). For each cow, the average value of milk yield per milking (kg) was calculated over 170 milking sessions. Within each group the correlations among mean milk yield, mean SCC and the mode of entrance order were calculated using the Spearman rank correlation coefficient. Finally, for each cow side preference in the milking parlour was assessed using the $\chi^2$ one sample test, using as expected frequencies for both left and right side of the milking parlour the value of 50% of all observations. Side preference was considered significant at P<0.01, which corresponded to an animal choosing a particular side (left or right) for more than 60% of the milking sessions.

Results

The Kendall's coefficient of concordance coefficient (Table 1) showed a constancy of the entrance order into milking parlour for both primiparous and multiparous cows.

For the multiparous cows the correlations of milk yield with entrance order and SCC were not significant. Conversely, in primiparous cows milk yield was significantly correlated to entrance order ($r_s=0.22$, n= 79, P<0.05) and tended to be correlated to SCC ($r_s=0.25$, n= 43, P<0.10). Mean milk production per ses-

| Table 1. Consistency of entrance order into the milking parlour of primiparous and multiparous cows assessed using Kendall’s W coefficient. |
| --- |
| Group | n. | W | $\chi^2$ | DF | P |
| Primiparous | 79 | 0.36 | 4739.6 | 78 | 0.001 |
| Multiparous | 67 | 0.36 | 4033.1 | 66 | 0.001 |

DF: degree of freedom.
sion and mean SCC were 10.26±0.18 kg and 274.774±30.814, 12.74±0.22 kg and 234.310±41.228 for primiparous and multiparous cows, respectively.

In group M, 19 cows out of 67 (28.3%) preferred the right side of the milking parlour, whereas the other 48 (71.7%) showed no preference for one of the two sides. In group P, the distribution of side preference was more homogeneous: 8 out of 79 (10.1%) cows chose the right side, 10 the left side (12.7%) and the remaining 61 (77.2%) indifferently used the right or left positions of the milking parlour. The degree of preference measured as proportion of milking sessions occurred in the preferred side for the primiparous and multiparous cows that expressed a preference (P<0.01, corresponding to a choice performed for more than 60% of the milking sessions) is depicted in Figure 2. Most of these animals (78 and 52% of primiparous and multiparous animals, respectively) showed a moderate degree of preference (60-65%).

Discussion

Although the Kendall coefficients were not very high (0.36), our results indicated that both primiparous and multiparous cows had a consistent order of entry into the milking parlour. This behaviour is considered a prominent feature of the social system of dairy cattle that could have implications in farming practice (e.g. speed of throughput of cows). However, Wasilewski (1999) suggests that a milking order is not a species-specific feature of the social organisation 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.

Hafez and Bouissou (1975) reported that entrance to the milking parlour should be considered as a voluntary movement, different from free movements as observed in pastures and forced movements as in weighting and other manipulations.

Reinhardt (1973) found that entrance
order is positively correlated with the social rank. This would mean that entrance is in relation with the motivation for food ingestion (concentrate). Other studies showed that the primiparous, transferred to a group of multiparous, enter last into the milking parlour (Soch et al., 1997), confirming that cattle have a firm position in the hierarchic scale within the group and respect an order for feeding and for milking.

The results obtained by Ceballos and Weary (2002) show that the mean entrance order of cows receiving feed was lower (cows entered first) than those that did not receive feed. The latency to enter the parlour was lower for the fed cows, and these cows were less likely to require pushing than cows that were not fed. These positive effects were observed for cows fed 0.3 kg per milking and those fed 0.6 kg per milking, with no differences between these feeding levels. According to Rushen et al. (1999), there are also negative experiences so that some subjects may be unwilling to enter a milking parlour voluntarily: routine procedures (e.g. injections), visual distractions that may cause animals to balk as they are entering, and even human contact that is unavoidable in the parlour.

The positive correlation observed in primiparous animals between milking order and milk production was not very high (0.22). However, it indicates that more productive subjects tend to enter later because they perceive milking as a stressful event, as also suggested by the correlation between milk production and SCC. Similar results were obtained by Rathore (1982). Other studies reported that milk yield is positively correlated with hierarchic rank, as well as live weight and age, in cattle and in buffaloes (Reddy and Tripathi, 1987; Stakelum et al., 1987; Shiv et al., 1996).

On the whole, our results on side preference were in agreement with those reported in previous studies. Hopster et al. (1998) observed that 1/3 of the cows make a not accidental choice, showing a clear preference for one of two sides. Other authors obtained similar results: Gadbury (1975) found this behaviour in the 39.5% of the animals and Tanner et al. (1994) in the 47% of the cows. Thus, in dairy herds a consider-able percentage of cows express a clear preference for a side of the milking parlour. This behaviour persists over time despite group dimension and composition changes, lactation phase and period of the year (Hopster et al., 1998). According to the last authors, side preference in dairy cows is a stable characteristic of each individual animal and large inter-individual differences can be found. These authors suggested that differences in side preference might originate from underlying factors associated with the way individual animals differ in their ability to adapt their behaviour to changes in the environment.

A possible reason of side choice in the milking parlour may be the different experience of the animals in two positions that would lead them to either choose the more attractive side or avoid the less agreeable one, according to an approach based on “animal feelings”. In fact, through choice test, it has been demonstrated that a cow, placed in front of a Y-shaped arm, prefers to enter where some food was previously received as a reward (Hosoi et al., 1995) and escape from the arm where restraint was experienced (Grandin et al., 1994). Other studies pointed out that cows have a good spatial memory and were able to remember the association between the position and the food received (Kovalcik and Kovalcikova, 1986; Bailey et al., 1989).

Among the factors that can potentially affect the side choice in the milking parlour are those concerning the milker-cow interactions during milking (Seabrook,
1984), milking technique (Zucs et al., 1992), aspects of the neurological development (Tanner et al., 1994) and the social behaviour (Hopster et al., 1998) and predictability of the daily routine (Albright and Arave, 1997).

According to Hopster et al. (1998), a high degree of consistency in the choice of parlour side may indicate that an animal should be able to choose its favourite side to feel comfortable during milking. Consequently, external or social restraint, preventing it from entering on its habitual side, might result in stress responses during milking comparable to those found when cows are milked in an unfamiliar environment (Bruckmaier et al., 1993). Hopster et al. (1998), examining the effects on the cows milked in the non-preferred side, found reluctance to enter on this side of the milking parlour, milk yield decrease, as well as acceleration of the cardiac rhythm. The authors attributed these results to either the absence of symmetry between the two sides of the parlour or to a different functioning of the milking cluster. Therefore, it is likely that factors such as the parlour’s design and milking machine functioning can affect the side choice. Other environmental conditions (e.g. noise and lighting levels) and management actions (e.g. feeding cows in the milking parlour, tubing for mastitis and fitting a kicking bar) should be also considered. In the study of Paranhos da Costa and Broom (2001), the asymmetry of the milking parlour may have induced the tendency of the majority of the cows to go to one side rather than to the other. Another possibility is that some cows have a side preference due to a natural laterality. Arave and Albright (1981) showed that cows tend to exhibit left-side laterality when lying-down.

Apparently, in the present research the two sides of the milking parlour were not different for any aspect, therefore our results cannot be attributed to the parlour’s structure. In a previous study, Hopster et al. (1998) observed that, in spite of the resemblance of the two sides, there were functional differences, such as the distance from the exit gate, that may have driven the animals to choose a determinate side.

Conclusions

In this study a consistent order of entry was found in both primiparous and multiparous cows. A significant correlation between entrance order and milk yield was observed only in primiparous animals. This result was attributed to the higher SCC observed in more productive subjects, which may determine stress during milking. In addition, a considerable percentage of cows expressed a clear preference for a particular side of the milking parlour. Management practices that disturb entrance order and/or side choice should be avoided in order to minimise possible stress during farming routines.

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