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The effect of training to the milking parlour on the behavioural response to milking and milk production in first lactation heifers

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Abstract

The objective of this study was to investigate the effect of training on the behaviour and milk production of heifers. Approximately three weeks prior to calving, heifers from two commercial farms were either trained over three days to the rotary milking parlour (TRAIN: n = 104) or left undisturbed in the paddock (CON: n = 113). Behavioural observations of heifers during the milking process were recorded over the first week of lactation. Behaviours recorded included the performance of flinching, stepping and/or kicking and the duration to attach the cluster. Individual heifer milk yields, milking durations, average milking flow rates and reattachment count of the cluster were recorded daily for the first six weeks of lactation. During the milking process, TRAIN heifers performed more leg lifts, a greater number of backward kicks and the number of times the milking cluster had to be reattached during each milking was greater than CON heifers. There was no difference in milk production measures between TRAIN and CON heifers. These results suggest that the method of training used in this study was not adequate to reduce the behavioural response of heifers to milking during the first week of lactation.

Keywords: behaviour; heifers; milk production; training

Introduction

The behavioural response of cows to the milking process can include flinching of the stomach muscles or udder, stepping or shifting of the cow's body weight from one foot to another and kicking. This repertoire of behaviours is commonly referred to as the flinch, step and kick (FSK) response (Willis 1983; Hemsworth et al. 1989). Hemsworth et al. (1987) suggested that several stimuli may cause cows to show the FSK response during the milking process, in particular the presence of a human. Heifers, especially during the first few weeks of lactation, may display a greater FSK response during milking as they usually have had limited previous experience with humans, the milking parlour and associated stimuli. Cows that constantly kick off cups, move around during milking, and display other adverse behaviours require more attention during milking, distract from the efficiency of the overall milking operation and have a higher potential to cause injuries to farm staff and themselves. Therefore, practical methods of intervention that could be conducted on-farm prior to calving that reduce the FSK response of heifers could potentially be beneficial for stock people and the well-being of the animal.

The quality of stockpersonship and the human-animal relationship are important for the welfare and performance of farm animals. Handling and exposure to the milking environment prior to calving was shown to reduce the frequency of adverse behaviours displayed by heifers during milking (Bremner 1997). Heifers handled by humans around the time of calving had a reduced FSK response than non-handled heifers during the milking process (Hemsworth et al. 1989) and brushing heifers weekly

prior to calving reduced the total number of kicks performed by heifers in the presence of a stock person during the milking process and increased milk letdown (Bertenshaw et al. 2008). Furthermore, the performance of stepping and kicking behaviours during the milking process has been linked with milk production measures; Breuer et al. (2000) and Waiblinger et al. (2002) found that the performance of FSK behaviours during milking was negatively associated with milk yield. Therefore, the objective of this study was to investigate the effects of training on the behaviour and milk production of heifers on two commercial dairy farms.

Materials and methods

Animals and experiential design

A total of 217 primiparous heifers were selected on two commercial dairy farms in the Waikato region, New Zealand. Farm 1 had a milking herd of approximately 600 Friesian cows including 106 heifers. Farm 2 had a milking herd of approximately 600 Friesian-Jersey cows including 111 heifers. The study was conducted between June and November 2010 and was approved by the Ruakura Animal Ethics Committee under the New Zealand Animal Welfare Act 1999.

Pre-calving training

On each farm, approximately four weeks prior to calving, all heifers were brought into the rotary parlour and Teatseal (Pfizer Animal Health, Mt Eden, Auckland) was inserted into each teat to help reduce the risk of post-calving mastitis. Heifers were brought into the yards and randomly allocated to one of two treatment groups: Training (TRAIN: n = 104)

Table 1 Description of flinch, step and kick score.

Score	Definition
1	No hind foot movement, heifer may flinch, shiver or do nothing at all.
2	Hind leg lifted no higher than teat height, step or shuffle of a hind leg.
3	Hind leg lifted higher than teat height, step or forward kick of a hind leg.
4	Backward kick of hind leg.

and Control (CON: n = 113). Training to the rotary milking parlour was conducted over three sessions, three weeks prior to calving. Each training session was conducted on different days over a period of a week. Training involved heifers walking onto the rotary platform and exiting after one rotation, with human assistance if necessary, and this was repeated three times during each training session. During training heifers were introduced to normal parlour operations; milking parlour movement, cleaning and its associated noises and gentle touching or rubbing around the back of the udder. The same three experienced handlers and one farm staff person were involved in the training process on both farms. The handlers were unfamiliar to the heifers at the time of training. Feed supplements, including grain, wheat bran pellets, palm kernel and molasses, were provided to the heifers during stand-off and on the rotary platform. Control heifers remained undisturbed in the paddock during these training periods. Trained and Control heifers were grazed together at all other times.

Post-calving

On each farm, heifers were brought to the parlour for milking within 24 hours of calving. The average heifer calving date across both farms was the 29 July. All heifers remained in the colostrum herd, which consisted of heifers and cows, for five days before being moved into the main milking herd. Behaviour data were collected over four weeks starting from when heifers were present in the milking colostrum herd. Observations were carried out during the morning milkings only.

Recording of heifer behaviour in response to the milking process began once the animal was in position in the bale on the rotary milking platform and the stock person had started the process of placing the milking cluster onto the teats. Behavioural recording for each heifer finished when the cluster was completely attached and the stock person moved onto the next animal. The observer stood approximately two metres away from the heifers during behavioural recording. The number of times each heifer lifted her left or right hind leg during milking cluster attachment was recorded. Flinching, stepping and/or kicking (FSK) behaviour was scored during milking cluster attachment using a four-point scale as described in Table 1. The highest

score observed for each heifer was the recorded score. Furthermore, the number of times each heifer performed a score of '4' was recorded. The time to attach the milking cluster, attachment duration, was recorded as the time from when the milking machine start button was pressed or the start cord pulled, until all of the heifer's milking quarters were cupped and the stock person's hands were no longer in contact with the milking cluster.

Four experienced observers were trained to collect behavioural data and between observer reliability was recorded one week prior to, and two weeks after, the beginning of the study. Reliability for FSK scores, calculated as a percentage of agreement between observers, was 91.4% and 96.6% prior to and during the observation period respectively. The total number of leg lifts scored was positively correlated between observers; $r = 0.95$ and $r = 0.96$, prior to and during the observation period respectively.

Both farms used the WestfaliaSurge milking system system (GEA Farm Technologies, Bönen, Germany) and associated DairyPlan C21 herd and parlour management software system (GEA Farm Technologies, Bönen, Germany). Individual heifer milk production data, milk yields, milking durations, average milk flow rates and reattachment counts of the milking cluster, were collected daily for the first 42 days of lactation.

Statistical analysis

Data were analysed using GenStat (Payne et al. 2010). Behaviour and milk production data were analysed using a mixed effects model, fitted by restricted maximum likelihood (REML), for each day in milk with farm as a random effect. Due to logistical reasons, behaviour data were collected over four weeks from heifers present in the milking colostrum herd at that time. Therefore, behaviour data were not collected from heifers that calved prior to or after that four week period. In total, behaviour data were collected on 63 TRAIN and 69 CON heifers. Milk production data were collected on all 217 heifers. Milk production data on Day 1 was used as a covariate, which is the equivalent to the number of days since training occurred, to adjust to a common day since training. A correlation coefficient was used to compare the behavioural responses of heifers and milk production measures.

Results

The behavioural response of heifers to milking cluster attachment during the first five days of lactation is shown in Table 2. On Day 2 of lactation, TRAIN heifers performed more ($P < 0.01$) leg lifts than CON heifers during milking cluster attachment. TRAIN heifers had higher ($P < 0.05$) FSK scores on Day 2 and 3 of lactation than CON heifers. Furthermore, TRAIN heifers performed a greater number ($P < 0.05$) of backward kicks and a score of 4

Table 2 Behavioural response of Trained (TRAIN) (n = 63) and Control (CON) (n = 69) heifers during milking cluster attachment over the first five days of lactation. SE = Standard error.

Days in milk	Number of leg lifts			Flinch, step and kick score			Maximum flinch, step and kick score			Time to attach cluster (s)		
	TRAIN	CON	SE	TRAIN	CON	SE	TRAIN	CON	SE	TRAIN	CON	SE
1	8.3	9.3	5.3	2.3	2.9	0.5	0.33	0.45	0.47	36.5	13.7	14.7
2	8.8 ^b	4.4 ^a	1.6	2.7 ^b	2.3 ^a	0.2	0.35 ^b	0.09 ^a	0.13	16.7	13.1	2.6
3	4.9	3.3	1.1	2.6 ^b	2.2 ^a	0.2	0.19	0.09	0.12	13.7	11.5	2.0
4	4.7	3.0	1.0	2.4	2.4	0.2	0.20	0.13	0.10	15.0 ^b	10.2 ^a	2.0
5	3.2	2.3	0.7	2.3	2.5	0.2	0.16	0.16	0.14	11.5	10.2	1.8
Mean	6.2 ^b	4.5 ^a	0.8	2.6	2.4	0.1	0.25	0.18	0.08	18.3 ^b	12.0 ^a	1.56

^{ab}Least square means within each behavioural measure with different superscripts differ at $P < 0.05$.

Table 3 Milk yield, milking duration and average milk flow rate of Trained (TRAIN) (n = 104) and Control (CON) (n = 113) heifers during the first six weeks of lactation. SE = Standard error.

Week of lactation	Milk yield (kg)			Milking duration (s)			Milk flow rate (kg/min)			P value		
	TRAIN	CON	SE	TRAIN	CON	SE	TRAIN	CON	SE	Milk yield	Milking duration	Milk flow rate
1	12.8	12.9	0.4	660	662	26	1.3	1.3	0.1	0.87	0.93	0.62
2	17.3	17.6	0.5	672	680	267	1.6	1.6	0.1	0.48	0.76	0.70
3	18.7	18.3	0.5	696	682	28	1.7	1.7	0.1	0.49	0.60	0.60
4	19.0	18.7	0.5	696	679	28	1.7	1.7	0.1	0.51	0.53	0.86
5	18.8	18.4	0.5	670	649	28	1.8	1.8	0.1	0.36	0.48	0.53
6	18.7	18.8	0.4	653	661	29	1.8	1.8	0.1	0.85	0.79	0.89
Mean	17.6	17.6	0.4	671	671	27	1.7	1.7	0.1	0.96	0.99	0.95

on the FSK scale than CON heifers on Day 2 of lactation. The FSK score was positively correlated with the milking cluster attachment duration on Days 2, 3, 4, and 5 of lactation ($r = 0.69$, $r = 0.71$, $r = 0.65$ and $r = 0.44$, respectively; $P < 0.05$). On Day 4 of lactation, the time to attach the milking cluster was longer ($P < 0.05$) for TRAIN than CON heifers (Table 2). The number of times the milking cluster had to be reattached on average during the first week of lactation was greater ($P < 0.05$) for TRAIN than CON heifers, but did not differ ($P > 0.05$) between TRAIN and CON heifers during Weeks 2 to 6 of lactation (Fig. 1).

Milk yields, milking durations and average milk flow rates did not differ ($P > 0.05$) between TRAIN and CON heifers during the first five days of lactation or the following five weeks of lactation (Table 3).

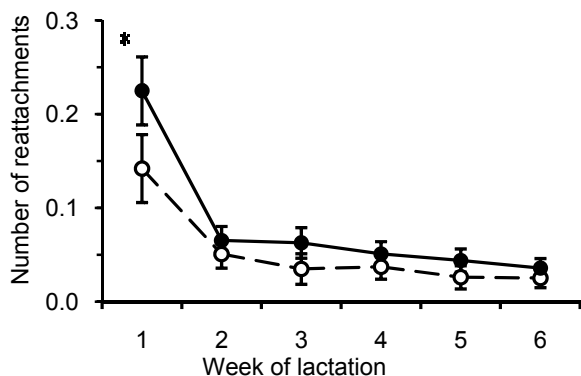
Discussion

In the present study, in contrary to our predictions heifers trained to the milking parlour prior to calving displayed more stepping and kicking behaviours during the milking process and were more likely to have the milking cluster reattached multiple times particularly during the first week of lactation.

Bremner (1997) found that heifers that were handled and trained to the milking parlour prior to calving kicked less during the milking process compared with control heifers that were not handled or trained; however heifers that were only trained but not handled, to the milking parlour prior to calving kicked more during the milking process than controls. Heifers that were handled at the time of calving displayed fewer FSK behaviours during the milking process (Hemsworth et al. 1989). Furthermore, heifers that were brushed once a week prior to calving kicked less in the presence of a stock person during the milking process (Bertenshaw et al. 2008). Therefore, handling of heifers by a stock person prior to or at the time of calving appears to be effective at reducing the behavioural response of animals to the milking process, but training to the milking parlour alone does not appear to be sufficient to reduce these behaviours.

It has been suggested that performance of FSK behaviours during the milking process is related to the fear of humans (Hemsworth et al. 1987). Waiblinger et al. (2002) found that stock person behaviour in the milking parlour was associated with the behavioural response of cows during milking and Breuer et al. (2000) found a moderate correlation between stock person behaviour and fear of humans

Figure 1 Number of times the milking cluster was reattached per milking for Trained (●) (n = 104) and Control (○) (n = 113) heifers during the first six weeks of lactation. Least square means accompanied with a * differ at $P < 0.05$.



in cows. Therefore, the quality or quantity of human interaction experienced by heifers during the training regime used in the present study may have increased the heifers' fear of humans or the milking process. However, Bremner (1997) found that heifers that were trained to the milking parlour prior to calving displayed more kicking behaviours during milking compared with heifers that were handled and trained prior to calving or heifers that were left undisturbed. Bremner (1997) suggested that as animals become familiarized with people and the milking process, behavioural reactivity such as kicking, initially increased until they become tamer and then reactivity consequently decreased. Furthermore, cows milked in the presence of a stock person that had previously aversely handled them, kicked less during the milking process (Rushen et al. 1999) and performed fewer leg movements (Munksgaard et al. 2001). It is therefore difficult to interpret the FSK response of heifers during milking; whether it represents a fear response to human presence and/or the novelty of the milking process or the level of training or habituation in response to the milking process.

The behavioural response of heifers to the milking process during the first week of lactation was not associated with any of the milk production measures recorded in the present study. Willis et al. (1983) found a positive relationship between the FSK response of cows during milking and milk yields. Conversely, Breuer et al. (2000) found a negative relationship between restlessness of cows during milking and productivity. Rousing et al. (2004) found that stepping, but not kicking behaviours, displayed during milking was positively associated with milk yields. Furthermore, a cow that was more likely to allow itself to be touched during a human approach test was also more likely to kick during milking (Rousing et al. 2004). Therefore, the performance of kicking and stepping behaviours by dairy cattle during the milking process may be motivated by different stimuli. Temperament may also influence how an animal responds to being milked.

Temperament is a term that can be used to describe a behavioural trait, such as fearfulness, which varies amongst individuals and is stable across time (Gibbons et al. 2011). Further research is needed to investigate whether the behavioural response of dairy cattle to milking is associated with fear to humans that can be modulated by handling or is a consistent behavioural response displayed by an individual.

Conclusion

In conclusion, heifers trained to the milking parlour were more restless during attachment of the milking cluster and the time to attach the milking cluster took longer than for Control heifers. The training protocol used in this study was based on what some farmers currently use, however these results suggest that this training protocol was not adequate to reduce the behavioural response of heifers to the milking process during the first week of lactation. More research is needed to investigate whether handling of animals rather than training to the milking parlour is a more effective method to reduce the behavioural reactivity of heifers in response to the milking process.

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