Animal welfare, etológia és tartástechnológia

Animal welfare, ethology and housing systems

Volume 5 Issue 3

Gödöllő
2009

THE BEHAVIOUR OF COWS IN RESPONSE TO RUBBER MATS IN MILKING PARLOUR STALLS

Richard Gudaj

Animal Biology and Welfare Writtle College, Chelmsford, Essex, CM1 3RR, United Kingdom

rgudaj@op.pl

Abstract

Lameness in cattle is a major health problem, because the disease causes substantial pain and discomfort and lasts for a lengthy amount of time. One of the ways to give cows more relief from hard surface is allowing them to walk on the softer flooring. This kind of surface is commonly used in the cubicles and walkways. Cows spend a relatively long time in the milking parlour and are at risk of damaging their hooves by contact to hard and slippery surfaces. Introducing rubber mats in the milking parlour is integration in the environment which is well known to animals. As a reaction to a novel object this can cause a disturbance of every day habits. Rubber mats, as a softer surface can cause a competition for a desired resource and then increase of aggressive behaviours within the animal. The objective of this research was to evaluate cows' response to rubber mats introduced in the milking parlour stalls. The observation was focused on measuring the changes in time taken to fill parlour stalls. Saving in time was predicted to be the main benefit of introducing the mats, the second measurement estimated changes in aggressive behaviour. The ethogram included the observation of pushing and head butting was performed to estimate the occurrence of aggressive behaviours in the waiting area just before entering the stalls. Results from this study provide evidence to suggest that introducing the rubber mats decreased time taken to fill parlour stalls. There was a very significant decrease in the time taken to fill those stalls with mats than the stalls without rubber mats present. The difference in time required to fill parlour stalls between the last and the first week of the research indicated a saving in time of 40.33 (confidence limits 31.31 - 49.34) seconds per milking. There was no significant difference in occurring pushes and head butts between sides with rubber mats and without rubber mats, however, there was an increase in aggressive behaviour during the study. In conclusion, it is presumed that due to the rubber flooring cows were more excited and motivated to fill parlour stalls quicker whether mats were present or not. Using the rubber mats is a benefit in saving time and giving relief to cows' hooves without compromising animal welfare.

Introduction

Lameness is a very important factor in dairy cattle, because of its huge impact affecting health and decreasing productivity (*Enting et al.* 1997). The disease is second only to mastitis in terms of its detrimental effect on herd productivity (*Esslemont and Kossaibati*, 1996). *Vermunt and Greenough* (1994) recommend that in order to relieve their feet and help reduce the prevalence and incidence of lameness, cows being kept on hard surfaces for long periods of time should be given access to areas covered with a softer surface.

The aim of using rubber mats in dairy farming is to improve the condition of hooves (*Vanegas et al.* 2006). The reason for this is because hard surfaces have a negative impact on cows' claws which causes undesired wearing, pain and disorder of hooves (*Manske et al.* 2002). It is documented, that the majority of cows prefer to stand and walk on soft rubber flooring, rather than on concrete floors (*Telezhenko et al.* 2004), because of its optimal softness (*Irps*, 1983) and friction (Watson, 2007). When cows stand on this kind of flooring there is a risk that there can be an occurrence of aggressive behaviour, because cows compete for a limited 'desired' resource. The same reaction can be found according to food, water or resting areas (*Bouissou et al.* 2001). What is more, when cows are housed in groups, and animals are overstocked there is an increase of aggression and avoidance behaviour as well (*DeVries et al.* 2004). These dependencies are commonly reported during milking (*Fregonesi and Leaver*, 2002). In the time of milking there is also a risk that cows can damage their claws on hard and slippery surface (*Blowey*, 1993). To the author's knowledge until now there was no documented research focused on the rubber mats in the milking parlour.

Aims of the study

This study was focused on cows' response to rubber mats by estimating changes in aggression, and in time taken to fill parlour stalls. Occurrence of aggression has a negative influence on milk ejection (*Gygax et al.* 2008) and is an indicator of poor animal welfare. Time is an applied issue, and increasing parlour throughput has an impact on improving milking efficiency.

The effects of introducing the rubber mats in the milking parlour were studied. The aim of this research is to evaluate a cow's behaviour and their daily activity pattern after using of rubber mats flooring in parlour stalls. Aggressive behaviour and time needed to fill parlour stalls by cows were studied after introducing a rubber mat on the left hand side, right hand side and both sides of the parlour.

The following general hypothesis was tested: The introduction of the rubber mats will have an effect on the behaviour of cows.

To specify the hypothesis, the study was undertaken firstly, to determine whether there will be a decrease in the time taken to fill parlour stalls by cows after introducing the rubber mats. The research predicted that there will be a decrease in cows' aggressive behaviour before entering the stall with the rubber matting present. Lastly, there was also a prediction that rubber mats as a novel object for cows will have an impact on increasing the time required to fill stalls and the occurrence of a greater number of aggressive behaviours in the habituation time.

To carry out this research, a Holstein Friesian herd was recorded by over 13 weeks in a milking parlour, and observations from a time-lapse video recorder were gathered. Cows were observed in front of the gates of the parlour stalls from the place where measurements of behaviour were accounted. Time needed to fill parlour stalls was measured from opening the gate to fill stalls by the last cow.

Materials and Methods

Study Design

526 Holstein-Friesian milking cows with an average herd milk yield of about 10.000 litres from Terling Hall Farm, Terling, Essex, UK, were used to evaluate cows response to rubber mats in parlour stalls. The research took place between August and December 2007. The data was collected by PhD student Nicola Blackie as a part of PhD thesis focused on detection of lameness and cows' gait patterns.

Cows were milked three times per day:

4 am – 7.30 am

12.30 pm – 4 pm

7 pm – 10.30 pm

There was an exception in milking – heifers, high and medium milking cows were milked three times per day. However, the rest of the groups were milked two times per day – in the morning and in the afternoon.

Bou-Matic rotating rapid exit parlour was used (*Fig. 1*). A parlour waiting area (8x14m) with a pushing bar was located opposite two entrances to stalls. A high lift backing gate was used to urge the cows forward into the milking parlour as required. Every side of the parlour included 15 positions for cows each. After passing a narrow gate cows moved to the front and took a position perpendicularly to the main alley, with heads out of the parlour. The release of cows occurred simultaneously out of both sides by rotated bars.

Then cows had to leave stalls after milking turning 90°. Cows were not fed concentrate in the parlour during milking.

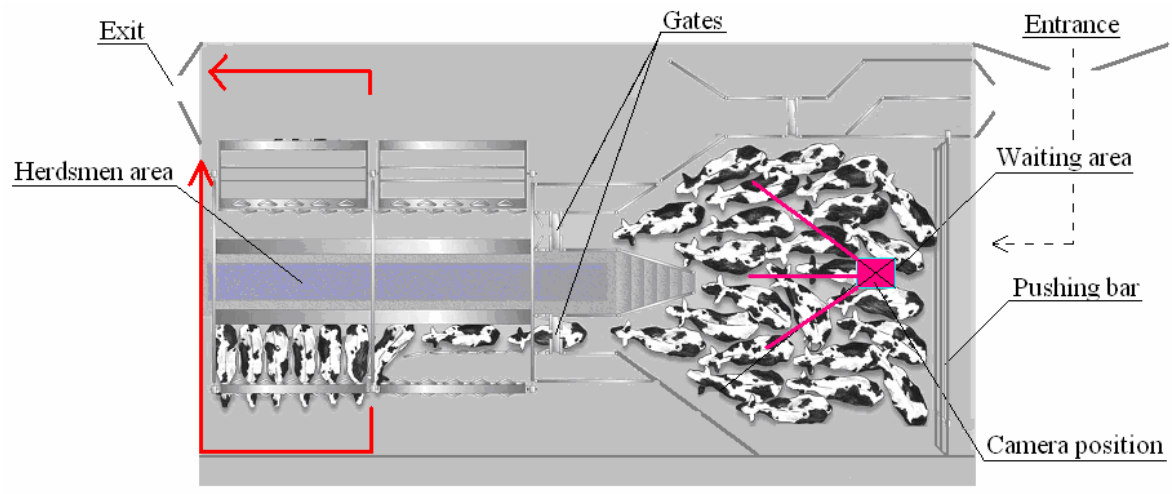

***Figure 1*. View of the milking parlour used during the study with rubber mats (*Bou-Matic*, 2008).**

In the research "rubba roll" rubber walkways (11m x 1m x 1.58 cm) manufactured by 'KSM Agriculture' company were used (*Picture 1*). The mats covered a main alley of parlour sides and did not cover the front parts of stalls.

***Picture 1*. Example of position of the rubber mat in the parlour stall during the study (Author's photo)**

During the first week of introducing the rubber mat on the left hand side, another mat was placed in front of the entrance on the left hand side (*Picture 2*). The main purpose of that was to make cows familiar with the mat and to reduce the shock of stepping on the mat just after passing the gate.

Picture 2. **Position of the mat on the left hand side in the holding area to reduce the impact of changing the surface during filling parlour stall (Author's photo)**

Behavioural data

The research includes four periods (*Fig. 2*):

Week 1 – control week – without mats

Weeks 2, 6, 7 – experimental weeks – mats on the left hand side

Weeks 8, 11, 12 – experimental weeks – mats on the right hand side

Week 13 – experimental week – mats on both sides

The first week of the second period (Rubber Left) of research was named as a 'habituation' (time/week/period) and was accounted separately. That week was distinguished to observe changes in cows' responses to the novel object just after introducing the rubber.

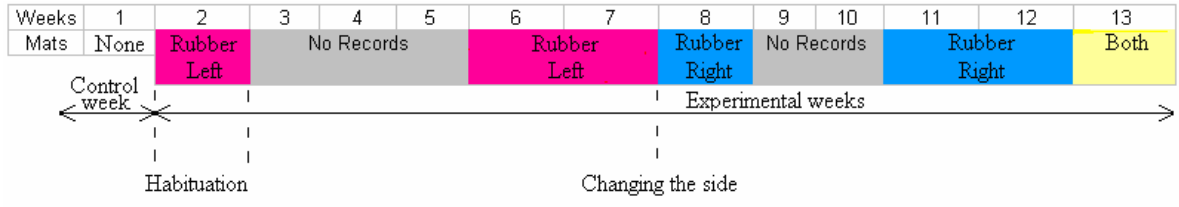

***Figure 2*. Weeks of records and changing position of mats in the milking parlour during the study.**

To quantify the response of cows after using the rubber mats in parlour stalls video records were used. The animals were videotaped using a time-lapse video recording system (Sanyo camera model VCC-6572P, Hitachi video monitor model VM-902K and Mitsubishi Time Lapse Security Video Cassette Recorder model HS- 1024E (B)). The camera was positioned approximately 4.5 m above the parlour's holding area. The cows were recorded 24 hours a day and cows were milked three times a day. However, data was collected during milking two times a day. Firstly, from 4 am to 7.30 am and the second time from 12.30 pm to 4 pm. Research does not include extra milking which was performed from 7 pm to 10.30 pm, because there was a significant higher participation of herdsmen in cows' movement.

6 production groups were distinguished according to stage of lactation and health status. However, during the study one of the group, because of stage of lactation and management purposes, was separated and moved to other groups. From the third part of research with rubber mats on the right hand side, cows from the high-medium group were moved to high and medium milking group. The last group (others) included cows with mastitis and other cured cases. Milk from these cows was not collected, so there is no data available about number of these animals. All the animals had been dehorned. Heifers were familiar with the milking parlour.

Behaviour of all cows was recorded, however only groups of heifers, high, medium and low milking cows were selected for analysing. Medium, fresh calvers and other group of cows were rejected from the study, because these groups did not represent all independent variables in every milking, but the first four groups did. In conclusion, to make research more statistically representable and to have objective variables, two milkings per day and four groups were chosen.

Filling the parlour stalls was calculated as the mean of the time taken from opening the gates, entering, to the moment of taking position in stalls by the last 15th cow. However, separate data was collected for the situation when stalls were not filled fully by 15 cows. A particular number of cows were noted separately for every each case when there were less than 15 cows in the stalls. Other separate measures were taken in the case of herdsmen or no herdsmen participation in filling the stalls. A description of cow's behaviour was analysed from opening the gates to taking position by the last 15th cow in a stall as well.

The observation was focused on the area close to the gates, when at least two cows could interact. Cow interactions were based on the ethogram described by *Bouissou et al*. (2001):

Pushing – pressing body against body; when one cow was moving forward and was blocked by another cow entering stalls.

Head butting – a blow with the forehead directed at another cow without any retaliatory action on the part of the struck animal.

Data Processing

Records

The data gathered from the records concerning time of filling parlour stalls by cows and their behaviour were put into Excel (Microsoft Office 2003). After that GenStat® *11th edition* general statistical software was used to calculate all collected data, from which graphs and tables were made to see if time and behaviour differ significantly.

Statistics

Time related factors were compared with an independent sample T-test. This test was used because for all factors, two groups were compared and data was normally distributed. The charts show the means of the time and distribution of pushes and head butts in the habituation time and the standard errors of the means (S.E.M.). The P-values for particular measurement are included in the text.

Results of pushing and head butting behaviour were not normally distributed. There was need to use Kruskal-Wallis one-way analysis variance for multiple samples, if there were more than two samples of independent data to check data differed significantly or not significantly. When particular data differed significantly ($p<0.05$) Mann-Whitney U (Wilcoxon rank-sum) test was used to make proper accurate comparison of factors. After that summary of contents of variables was performed do estimate median, lower quartile and upper quartile.

The boxplot charts present non-parametric data of pushes and head butts and the ends of the whiskers show the minimum and maximum values of the data set (upper and lower inner fence) (*Fig. 3*). The upper inner fence is described as the maximum value if this is less than upper quartile plus 1.5 times the IQR (the interquartile range). This can also be described as the maximum data value that is still smaller than the upper quartile plus 1.5 times the interquartile range.

The lower inner fence is defined in the same way (*Alvey and Galwey*, 1982). Green crosses show all extreme values outside 1.5 and 3 times the interquartile range. Values more extreme than 3 times the above mentioned range are marked as red crosses.

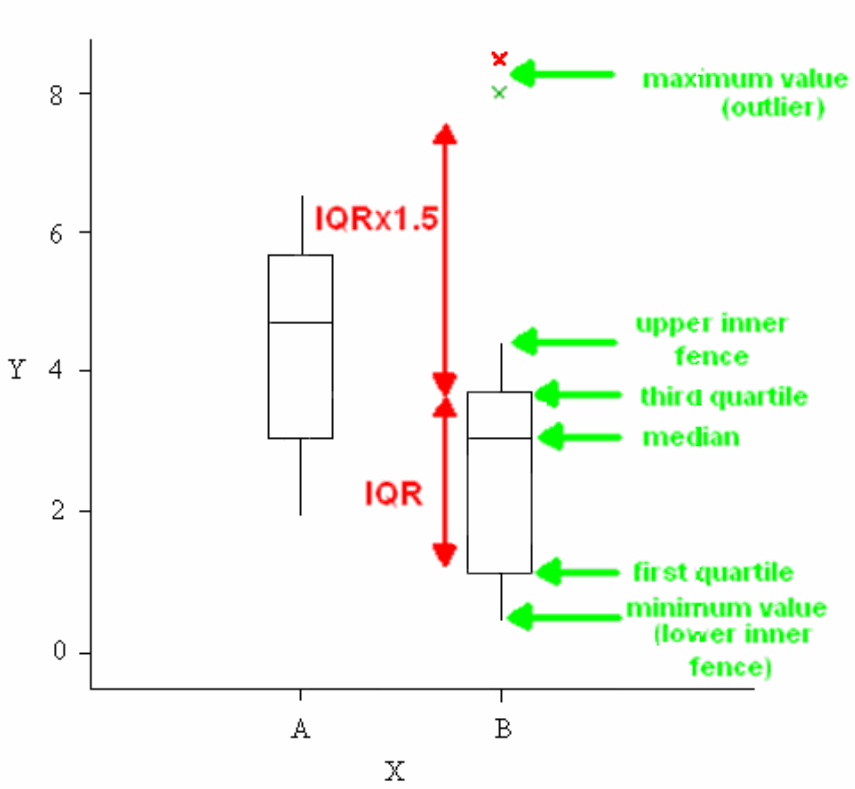

***Figure 3*. Schematic boxplot used for presentation a non-parametric data of pushing and head butting in the study (*Payne*, 2005).**

Time measured in the research was standardized to the unit – 'per 15 cows'. The reason for this was variation in the number of cows filling stalls. In the case when there were less (than 15) animals to fully fill stalls, herdsmen usually opened the pushing gate and animals from different groups were mixed together. In the same moment there was more time needed to fill parlour stalls. That is way only full filled stalls were measured. Assessing of behaviour was based on units – 'per 10 cows'. There was no negative interaction between filling stalls by 15 cows or less.

For the purpose of describing the results in the most understandable way phrases used in the text are described:

Herdsmen participation – participation of one (or both) herdsmen in improving the flow of the parlour by promoting faster filling of the stalls by cows.

No herdsmen participation (Voluntary) – voluntary, free movement of cows to fill parlour stalls.

No Mats – parlour's stall without mat inside.

Mat – parlour's stall with mat inside.

Control week (None) – the first week of the research with no mats on both sides.

Habituation (time/week/period) – the first week with rubber mat present (on the left hand side).

Results

No mats vs. Mats

Data collected in this study provides evidence to suggest that introducing the rubber mats decreased time taken to fill parlour stalls. There was very significant decrease in time needed to fill parlour between stalls with no mats and with rubber mats present (183.0 vs. 170.0 ± 4.54, mean no mats vs. mats, ± S.E.D., respectively, $p < 0.01$).

There was no significant difference in pushing between stalls with no mats and periods with rubber mats present (1.33 (0 – 2.0) vs. 1.33 (0 – 2.0), median (interquartile range) no mats vs. mats, respectively).

There was no significant difference in occurrence of head butting between stalls with mats and without mats (0.0 (0 – 1.33) vs. (0.0 (0 – 1.33), median (interquartile range) no mats vs. mats, respectively).

Voluntary vs. Herdsmen Participation

The cows needed less time after introducing the rubber mats for voluntary filling parlour stalls, but this difference was not significant (179.4 vs. 169.5 ± 6.11, mean no mats with voluntary filling vs. mats with voluntary filling, ± S.E.D., respectively). The cows required significantly less time to fill stalls after introducing the rubber mats in stalls when filled with herdsmen participation (186.9 vs. 172.1 ± 6.83, mean no mats with herdsman participation vs. mats with herdsman participation, ± S.E.D., respectively; $p < 0.05$).

There was no significant difference in pushing behaviour between stalls with and without the mats for filling stalls without herdsmen participation (1.33 (0 – 2.67) vs. 1.33 (0 – 2.67), median (interquartile range) no mats vs. mats, respectively). There was not significant increase in the occurrence of pushes between stalls with and without the mats during participation of herdsmen (0.67 (0 – 1.33) vs. 1.33 (0 – 2.0), median (interquartile range) no mats vs. mats, respectively).

There was no significant difference in occurrence of head butting between stalls without mats and with mats for filling stalls without herdsmen participation (1.33 (0 – 2.67) vs. 1.33 (0 – 2.67), median (interquartile range) no mats vs. mats, respectively).

There was also no significant difference in head butting between stalls without mats and with mats for filling stalls with herdsmen participation (0.67 (0 – 1.33) vs. 1.33 (0 – 2.0), median (interquartile range) no mats vs. mats, respectively).

Periods

Comparison of periods with mats in a different configurations shows the general changes in time taken to fill parlour stalls during the study. There were no significant differences in time required to fill parlour stalls between control week (No Mats) (a) and the next two experimental periods (Rubber Left (a) and Rubber Right (a)) (*Fig. 4*). However, time needed to fill parlour stalls in the first three periods was highly significant longer then in the last period with mats on both sides (189.6 and 181.0 and 174.6 vs. 149.3 ± 8.58, mean of no mats, mats on the left hand side, mats on the right hand side vs. mats on both sides ± S.E.D., respectively; $p < 0.001$).

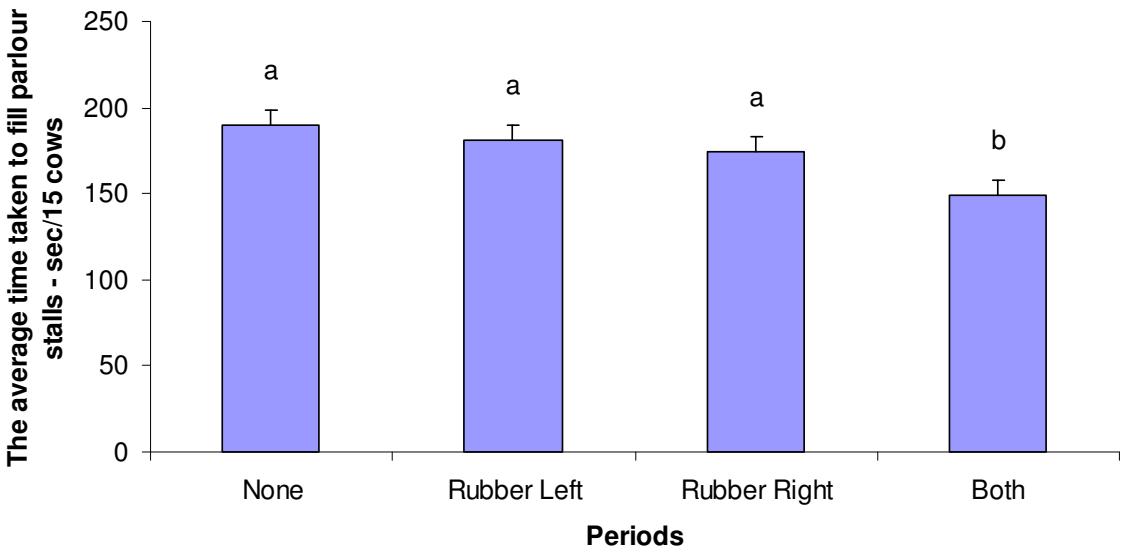

***Figure 4*. Periods and changes in time required for cows to fill parlour stalls with either rubber mats or concrete floors**

There was an increase in the occurring of pushing behaviour during the study (*Fig. 5*). There was a highly significant increase between the first period with no mats and the rubber mat on the left hand side in a second week (0.67 (0 – 1.33) vs. 1.33 (0 – 2.0), median (interquartile range) no mats period 1 vs. mats on the left hand side period 2, respectively, $p < 0.001$).

There was also a very significant increase in pushing between the first period and the period with mat on the right hand side (0.67 (0 – 1.33) vs. 1.33 (0 – 2.0), median (interquartile range) no mats period 1 vs. mats on the right hand side period 3, respectively, $p < 0.01$). There was a highly significant increase in pushing between the first period and period with mats on both sides (0.67 (0 – 1.33) vs. 1.33 (0 – 2.67), median (interquartile range) no mats period 1 vs. mats on both sides, respectively, $p < 0.001$). There was no significant difference between period with rubber mat on the left hand side and rubber mat on the right hand side (1.33 (0 – 2.0) vs. 1.33 (0 – 2.0), median (interquartile range) mats on the left hand side vs. mats on the right hand side, respectively). However, there was significant difference between period with rubber mat on the left hand side and rubber on both sides (1.33 (0 – 2.0) vs. 1.33 (0 – 2.67), median (interquartile range) mat on the left hand side vs. mats on both sides, respectively, $p < 0.05$). There was a very significant difference between the period with rubber mat on the right hand side and rubber mats on both sides (1.33 (0 – 2.0) vs. 1.33 (0 – 2.67), median (interquartile range) mat on the right hand side vs. mats on both sides, respectively, $p < 0.01$).

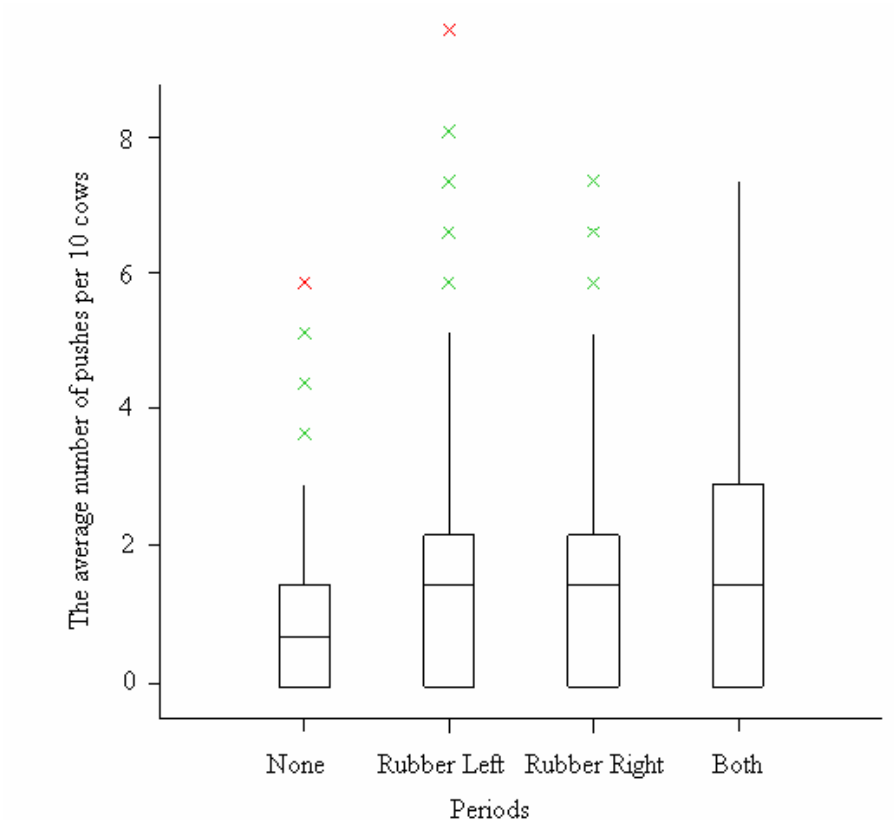

***Figure 5*. Periods and changes in occurrence of pushing behaviour of cows during filling parlour stalls with either rubber mats or concrete floors**

There was no significant difference in head butting between the first period with no mats and the second one with mat on the left hand side (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) no mats vs. mat, respectively) (*Fig. 6*). There was a significant difference between the first period with no mats and period with a mat on the right hand side (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) no mats vs. mat on the right, respectively, $p < 0.05$). There was a significant difference between the first period with no mats and the last period with the mat on both sides (0.67 (0 – 1.33) vs. 6.67 (0 – 1.33), median (interquartile range) no mats vs. mats on both sides, respectively, $p < 0.05$). There was no significant difference between the second period with a mat on the left hand side and the third period with a mat on the left hand side (0.0 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) no mats vs. mats, respectively). However there was very significant difference in the occurring of head butting between the second period with the rubber mat on the left hand side compared with the last period with mats on both sides (0.0 (0 – 1.33) vs. 6.67 (0 – 1.33), median (interquartile range) a mat on the left vs. mats on both sides, respectively, $p < 0.01$). There was also a highly significant difference between the third and the last period (0.0 (0 – 1.33) vs. 6.67 (0 – 1.33), median (interquartile range) a mat on the right vs. mats no both sides, respectively, $p < 0.001$).

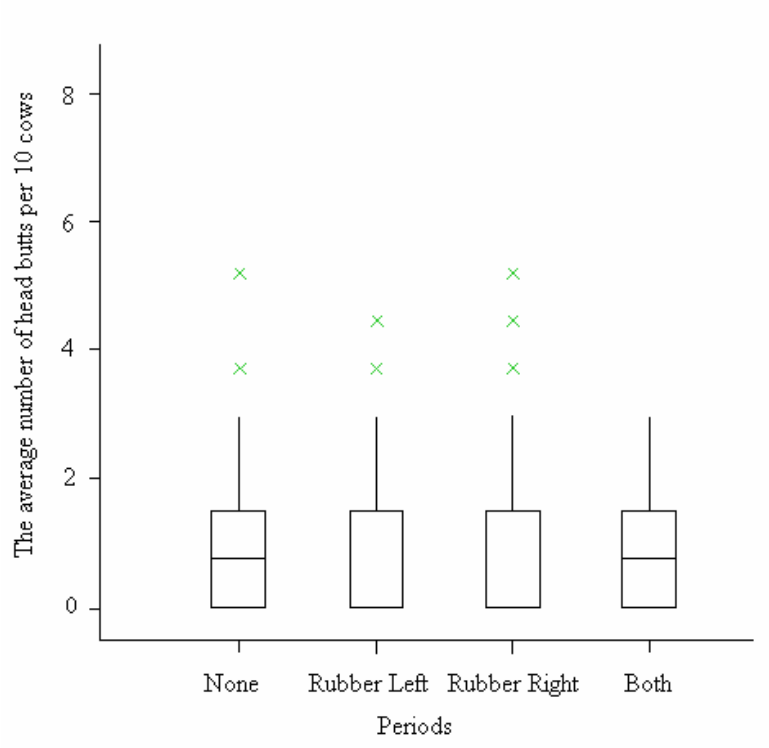

***Figure 6*. Periods and changes in occurrence of head butting behaviour of cows during filling parlour stalls with either rubber mats or concrete floors**

Habituation

The cows tended to be faster during habituation week compared with the control week, but this difference was not significant (189.6 vs. 171.1 ± 10.54, mean 1 week no mats vs. mean 2 week mats on the left hand side, ± S.E.D., respectively).

Time taken to fill parlour stalls on the left hand side in a habituation week (Week 2 Rubber Left) did not differ significantly to the time needed on the same side in the control week (Week 1 None) (208.9 vs. 193.8 ± 17.13, mean 1 week left hand side of the parlour vs. mean 2 week left hand side of the parlour, ± S.E.D., respectively).

The cows tended to fill parlour stalls on the right hand side faster, but this difference was not significant (Week 1 None) (171.3 vs. 149.1 ± 12.09, mean 1 week right hand side of the parlour vs. mean 2 week right hand side of the parlour, ± S.E.D., respectively).

There was a highly significant increase in pushing behaviour between control week and habituation week (0.67 (0 – 1.33) vs. 1.33 (0 – 2.67), median (interquartile range) no mats control week vs. mats habituation week, respectively, $p < 0.001$) (*Fig. 7*).

There was no significant difference between the control week and the habituation week of the study in accordance to the occurrence of head butting (0.67 (0 – 1.33) vs. 0.67 (0 – 1.33), median (interquartile range) no mats vs. mat on the left, respectively).

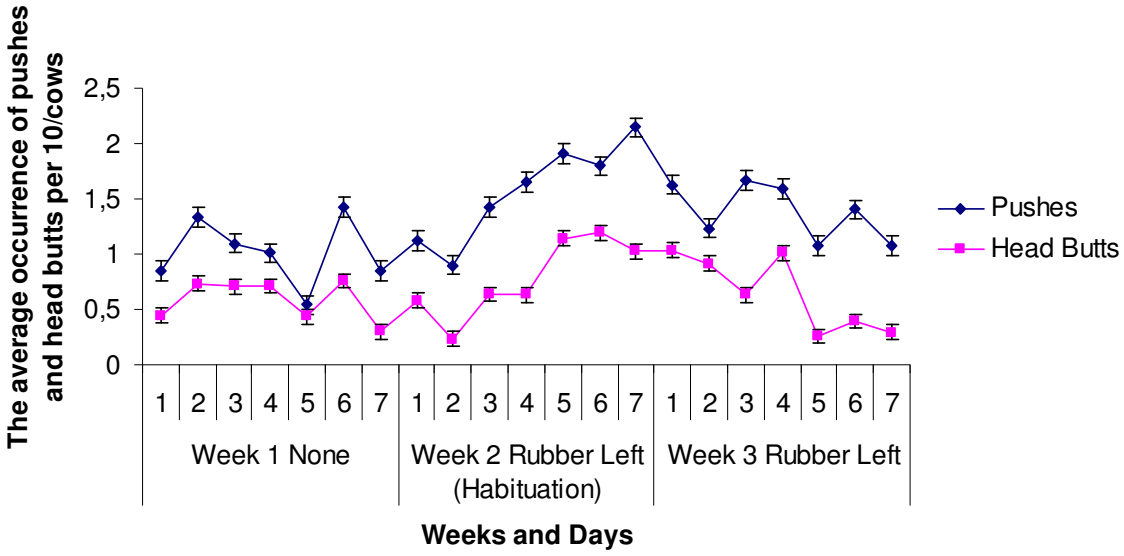

***Figure 7*. Changes in occurrence of pushing and head butting behaviour of cows during filling parlour stalls with either rubber mats or concrete floors**

Groups

Heifers needed highly significant longer time needed to fill parlour stalls and this result was highly significant longer than time of high, medium and low milking cows (207.5 vs. 163.0 and 158.2 and 151.6 ± 6.80, mean of heifers vs. high, medium and low milking cows ± S.E.D., respectively; $p < 0.001$) (*Fig. 8*). There were no significant differences between high, medium and low milking cows, however time required to fill parlour stalls was positively correlated to the milk yield.

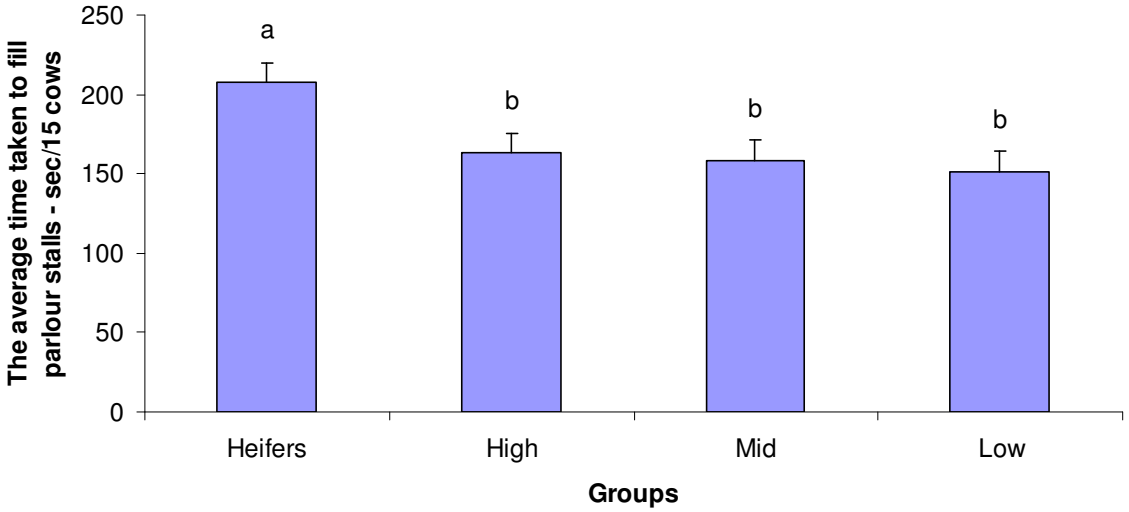

***Figure 8*. The average time taken to fill parlour stalls by groups of cows during the research**

High milking cows were the most aggressive during the research compared with other groups (*Fig. 9*). High milking cows showed highly significant more pushing behaviours compared to heifers (1.33 (0.67 – 2.67) vs. 1.33 (0 – 2.0), median (interquartile range) pushing of high milking cows vs. heifers, respectively, $p < 0.001$). High milking cows showed very significantly more pushing behaviours compared with medium milking cows (1.33 (0.67 – 2.67) vs. 1.33 (0 – 2.0), median (interquartile range) pushing of high milking cows vs. medium milking cows, respectively, $p < 0.01$). High milking cows were also highly significant more aggressive compared with low milking cows (1.33 (0.67 – 2.67) vs. 0.67 (0 – 2.0), median (interquartile range) pushing of high milking cows vs. low milking cows, respectively, $p < 0.001$). Heifers were very significantly more aggressive compared with low milking cows (1.33 (0 – 2.0) vs. 0.67 (0 – 2.0), median (interquartile range) pushing of heifers vs. low milking cows, respectively, $p < 0.01$). Heifers were highly significant more aggressive compared to medium milking cows (1.33 (0 – 2.0) vs. 1.33 (0 – 2.0), median (interquartile range) pushing of heifers vs. medium milking cows, respectively, $p < 0.001$).

There was no significant difference between medium milking cows and low milking cows (1.33 (0 – 2.0) vs. 0.67 (0 – 2.0), median (interquartile range) pushing of medium milking cows vs. low milking cows, respectively).

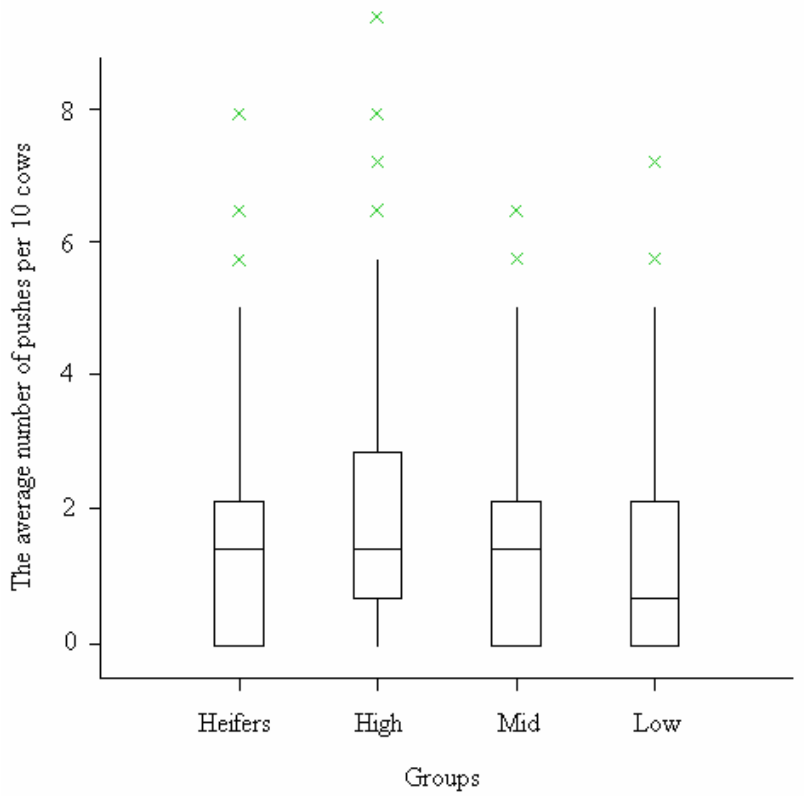

***Figure 9*. Occurrence of pushing behaviour among the groups of cows during filling parlour stalls.**

High milking cows showed the most aggressive behaviour compared to the rest of cows from other groups (*Fig. 10*). High milking cows expressed head butting behaviour highly significant more often compared to the heifers (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) high milking vs. heifers, respectively, $p < 0.001$), medium milking cows (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) high milking vs. medium milking, respectively, $p < 0.001$) and low milking cows (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) high milking vs. low milking, respectively, $p < 0.001$). The occurrence of head butts did not differ significantly between heifers and low milking cows (0.67 (0 – 1.33) vs. 0.67 (0 – 1.33), median (interquartile range) high milking vs. heifers, respectively) and between heifers and medium milking cows (0.0 (0 – 0.67) vs. 0.0 (0 – 1.33), median (interquartile range) high milking vs. heifers, respectively). Also the medium milking group did not differ significantly to low milking cows (0.0 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) high milking vs. heifers, respectively).

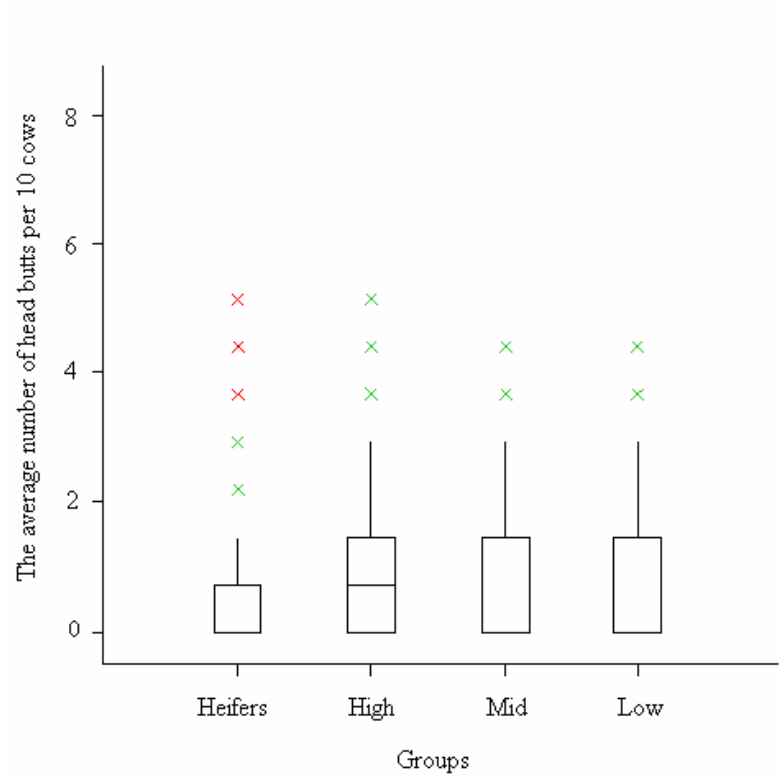

***Figure 10*. Occurrence of head butting behaviour among the groups of cows during filling parlour stalls**

First vs. Last Week (Saving of time)

Comparison of the first and the last week of the research showed highly significant decrease in time taken to fill stalls (189.6 vs. 149.3 ± 8.58, mean of no mats, mats on the left hand side, mats on the right hand side vs. mats on both sides ± S.E.D., respectively; $p < 0.001$) (*Fig. 11*). Table 5 shows the average time required to fill a parlour side with 15 cows during the research. The average time needed to fill parlour stalls in week 1 (189.61 sec) – the average time needed to fill parlour stalls in week 13 (149.28 sec) = 40.33 sec of saving per 15 cows.

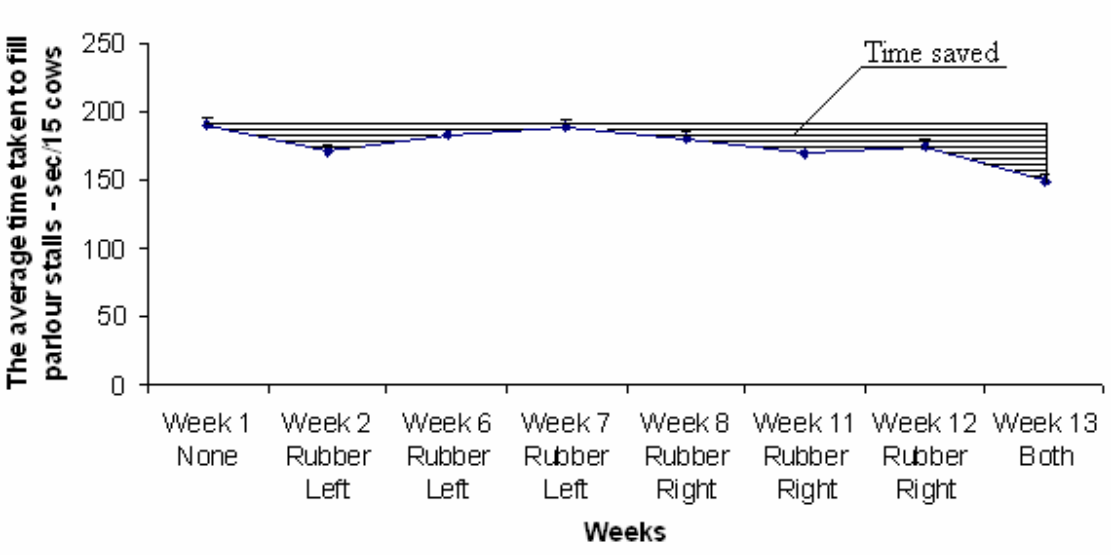

***Figure 11*. Saving in time taken to fill parlour stalls by cows between week 1 and week 13**

There was decrease in time needed to fill stalls. After introducing the rubber mats the cows required 40.33 (31.31 - 49.34)* seconds less to enter the parlour stall per one entrance, 867.09 seconds (14.5 minutes) less per one milking and 1734.19 seconds (29 minutes) less per one day, when milked twice daily (*Table 1*).

***Table 1*. Saving in time (in average) required to fill parlour stalls by cows between the first and the last week of the study**

	Per 15 cows	**Per 1 milking**	**Per 1 day (2 milkings per day)**
Number of enters	1	21.5	43
Number of cows	15	322.5	645
Saving (no mats vs. mats both sides), sec.	40.33 (31.31-49.34)*	867.09	1734.19

***= the confidence limit**

In total there was a highly significant increase in pushing behaviour between the first and the last week of the research (0.67 (0 – 1.33) vs. 1.33 (0 – 2.67), median (interquartile range) no mats vs. mats on both sides, respectively, $p < 0.001$).

There was a significant increase in occurrence of head butting between the control week and the last week with mats on both sides (0.67 (0 – 1.33) vs. 0.67 (0 – 1.33), median (interquartile range) no mats vs. mats, respectively, $p < 0.05$).

Impact of Facilities

Interestingly, the cows reacted in a different way according to the left and right side of the parlour (*Fig. 12*). Generally, the animals needed highly significant more time to fill parlour stalls on the left hand side than on the right hand side (201.0 vs. 153.2 ± 8.70, mean of filling stalls on the left hand side vs. mean of filling stalls on the right hand side, ± S.E.D., respectively; $p < 0.001$).

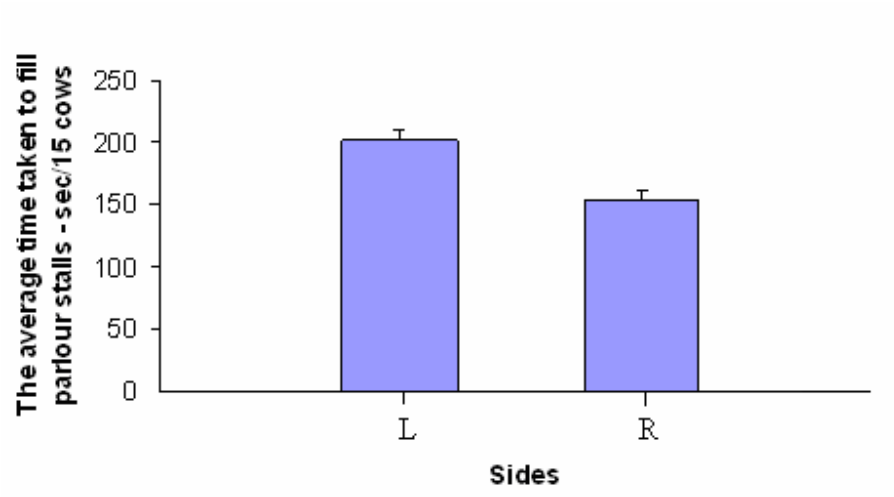

***Figure 12*. Difference in time taken to fill parlour stalls between left and right side during filling parlour stalls**

There were highly significantly more occurrences of pushing on the left hand side compared to the right hand side (1.33 (0 – 2.67) vs. 1.33 (0 – 2.0), median (interquartile range) left hand side vs. right hand side, respectively, $p < 0.001$) (*Fig. 13*).

There were significantly more incidences of head butting on the left hand side than on the right hand side during the study (0.67 (0 – 1.33) vs. 0.0 (0 – 1.33), median (interquartile range) mats on the left vs. mats on the right, respectively, $p < 0.05$) (*Fig. 14*).

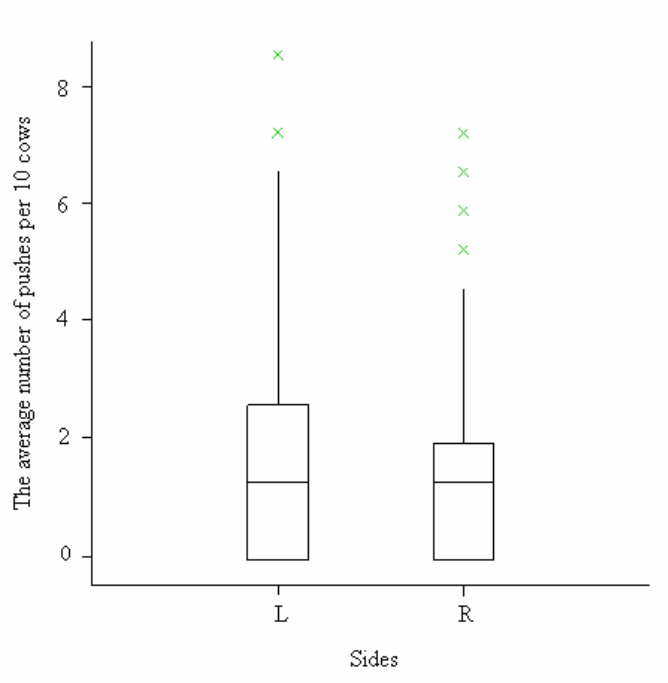

***Figure 13*. Difference in incidences of pushing behaviour between left and right side during filling parlour stalls**

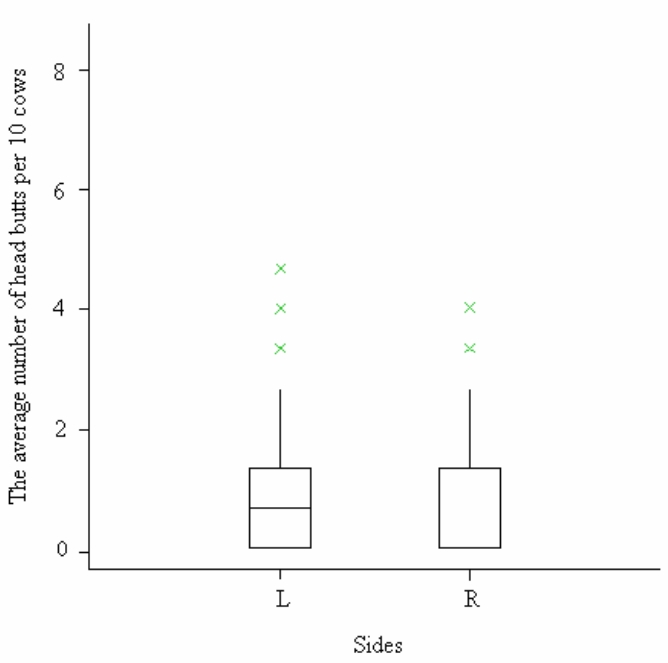

***Figure 14*. Difference in incidences of head butting behaviour between left and right side during filling parlour stalls**

Changes on the Left and Right Side

There was no significant difference in time needed to fill stalls on the left hand side between stalls with and without the mats (204.5 vs. 197.3 ± 7.32, mean no mats on the left hand side vs. mean mats on the left hand side, ± S.E.D., respectively). However, there was a highly significant decrease in time on the right hand side between stalls without mats and with mats present (162.1 vs. 144.7 ± 5.12, mean no mats on the right hand side vs. mean mats on the right hand side, ± S.E.D., respectively; $p < 0.001$).

There were no significant differences in pushing between periods with no mats and periods with rubber mats present on the left hand side (1.33 (0 – 2.67) vs. 1.33 (0 – 2.67), median (interquartile range) no mats vs. mats, respectively). There was also no significant difference in pushing between periods with no mats and with rubber mats present on the right hand side (1.33 (0 – 2.0) vs. 1.33 (0 – 2.0), median (interquartile range) no mats vs. mats, respectively).

The same tendency was observed with no significant difference in occurrence of head butting on the left hand side (0.0 (0 – 1.33) vs. (0.0 (0 – 1.33), median (interquartile range) no mats vs. mats, respectively) and right hand side (0.0 (0 – 1.33) vs. (0.0 (0 – 1.33), median (interquartile range) no mats vs. mats, respectively).

Discussion

The results reported in this study indicate that the introduction of the rubber mats had an effect on the behaviour of cows. The introducing of the rubber mats affected in changes in time, pushing and head butting. As it was predicted in the hypothesis there was a very significant decrease in time needed to fill the parlour between stalls with no mats and with rubber mats present. Generally, there was no significant difference in the occurrence of aggressive behaviour between stalls with mats and without mats, which was hypothesized to be decreased. Habituation period had only an impact on occurring highly significant more pushes compared with control week and there was no significant difference in time and head butts.

Decrease in time between time required for filling stalls without mats and with mats present, shows preference for rubber flooring. Presumably, cows felt more comfortable and confident entering stalls with rubber matting. This finding is similar to *Telezhenko et al*. (2007) and *Van der Tol et al*. (2005) who found preferences to stand and walk on soft rubber surface than on concrete flooring. Sides of the parlour and participation of the herdsman had the main impact on differences in time needed to fill parlour stalls.

The cows filled parlour stalls highly significant quicker on the right hand side than on the left hand side. There was also highly significant decrease in time taken to fill stalls between periods without and with mats present on the right hand side. There were highly significantly more pushes and there were significantly more head butts on the left hand side. This is a prove the left hand side was not comfortable for cows and they preferred the right side of the parlour. It can be presumed that the exit gate which was in the back of the parlour could affect these differences. The gate was on the right hand side, so presumably cows preferred to choose that side of the parlour. Between entering and leaving the stalls, cows entering stalls on the right hand side had to turn twice, however cows on the left hand side had to turn four times.

No significant difference in aggressive behaviour between stalls without and with mat confirmed that cows filled stalls in the same unchanged aggression pattern and there was no negative impact this kind of flooring. Increase in aggressive behaviour during the study confirms desire of cows for softness and more comfortable surface. Another hypothesis can be that it was an example of competition for desired resource.

Conclusions

The installation of rubber mats was associated with a decrease in the time taken to fill the milking parlour and also with an increase in head butts and pushing between cows immediately waiting to enter the stalls. This might reflect an increased motivation to enter stalls when mats were present, which would indicate benefits to cow welfare in addition to significant management benefits associated with reduced milking time.

Acknowledgements

The rubber matting for this trial was kindly provided by Kit Speakman Marketing Ltd (KSM).

Kit Speakman Marketing Ltd (KSM)

Little Braxted Hall

Little Braxted

Essex CM8 3EU

Tel: +44 (0) 1376 515164

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