

## Assessing the animals' relationship to humans in tied dairy cows: between-experimenter repeatability of measuring avoidance reactions

S Waiblinger<sup>\*†</sup>, C Mülleder<sup>†</sup>, C Schmied<sup>†</sup> and I Dembele<sup>†</sup>

<sup>†</sup> Institute of Animal Husbandry and Animal Welfare, Department of Veterinary Public Health and Food Science, University of Veterinary Medicine, Veterinärplatz 1, 1210 Vienna, Austria

<sup>†</sup> IPR / IFRA Bamako, Mali

\* Contact for correspondence and requests for reprints: susanne.waiblinger@vu-wien.ac.at

### Abstract

Tests for assessing the animal-human relationship in tied dairy cows have been used in experimental research, but the reliability and feasibility of the measures in the on-farm context has not been studied yet. Therefore we investigated the between-experimenter repeatability of avoidance reactions in dairy cows housed in tie-stall systems. Nine farms in Austria with 15-60 tethered dairy cows were visited. Two to three out of four experimenters were testing the avoidance reaction of the individual cows in a balanced order. Cows were approached slowly from the front and the reactions recorded on an 11-point score. The avoidance reaction of each cow was assessed twice by each experimenter and averaged. Also, a farm value per experimenter was calculated (median). Repeatability between experimenters was assessed within farms and at farm level by calculating Spearman rank correlation coefficients. The average between-experimenter correlations within farms ranged from 0.37 to 0.88. At farm level, median of scores ranged from 2.5 to 6.75 and correlated moderately to highly between experimenters from 0.65 to 0.80. Testing the animals on all farms was relatively simple.

The between-experimenter repeatability within farms differed substantially and reasons for this merit further investigation. At farm level repeatability was moderate to sufficiently high. Due to the high feasibility, this measure seems to be promising and should be developed further.

**Keywords:** animal welfare, cattle, human-animal relationship, on-farm assessment, repeatability, tie stall

### Introduction

The animal's relationship with humans has been shown to have a major impact on animal health, production and welfare (for a review see: Hemsworth & Coleman 1998; Rushen *et al* 1999) and thus is an important parameter to include in on-farm welfare assessment (Winckler *et al* 2003).

For loose-housed dairy cows and buffaloes, information about validity and reliability of some on-farm measures exist (ie avoidance and approach reaction: Waiblinger *et al* 2002, 2003; De Rosa *et al* 2003; Waiblinger & Menke 2003; Brinkmann *et al* 2004; Rousing & Waiblinger 2004). In tie-stall systems, tests have been used in experimental research on dairy cows, where they could successfully differentiate between different handling treatments (Munksgaard *et al* 2001; Schmied *et al* 2004). The reliability and feasibility of these measures in the on-farm context have not been studied until now.

Measures to be included in an on-farm welfare assessment scheme have to be highly repeatable between different assessors. In measures of the animal-human relationship using the assessor as test person, the repeatability of the

assessment result of two assessors comprises both 1) the inter-observer reliability, ie the level of consensus between assessors measuring the same event at the same time and 2) the level of consistency in the animals' reaction to different persons. The combination of both leads to the repeatability between experimenters. The aim of the present paper was to investigate the between-experimenter repeatability of avoidance reactions of tied dairy cows.

### Materials and methods

#### Farms, animals and procedure

Nine farms in Austria with 15-60 tethered dairy cows (210 cows in total) were visited once. Two to three out of four experimenters dressed in green overalls were testing the avoidance reaction of the individual cows in a balanced order (E1: black male, 1.83 m, farm 1-9; E2: white female, 1.62 m, farm 1-9; E3: white female, 1.75 m, farm 3-6, 8, 9; E4: white male, 1.80 m, farm 1). That is, cows were divided into two or three groups, respectively, and each experimenter tested one of these groups first by assessing the avoidance reaction of the individual cows twice with a 10 to 20 min time-lag. Then, experimenters moved to the next

**Table 1** Spearman rank correlation coefficients for each pair of experimenters and on average within farms.

Farm	Number of cows tested	Average	E1/E2	E1/E3 (E1/E4 on farm 1)	E2/E3 (E2/E4 on farm 1)
1	60	0.37	0.33**	0.28*	0.49***
2	23	0.51	0.51*	-	-
3	18	0.74	0.76***	0.67**	0.78***
4	24	0.38	0.56**	0.11	0.47*
5	12	0.40	0.50 <sup>†</sup>	0.17	0.53 <sup>†</sup>
6	15	0.81	0.74**	0.78**	0.92***
7	28	0.61	0.61***	-	-
8	15	0.59	0.57*	0.57*	0.63*
9	15	0.88	0.90***	0.88***	0.85***
Average of all farms			0.61	0.53	0.70

<sup>†</sup>  $P < 0.1$ ; \*  $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ .

group. Cows were approached slowly from the front by the test person, who held the arm outstretched at an angle of about 45° in front of the body. The distance between the person's hand and the animal's nose was estimated at the moment of the cow's withdrawal. In case the cow accepted being touched, the duration she accepted stroking at the cheek was recorded up to a maximum of five seconds. The reactions were recorded on an 11-point scale: score 0: cow accepts being stroked for  $\geq 5$  sec, score 1: cow accepts being stroked for at least 3 up to 4 sec, score 2: cow accepts being stroked for at least 1 up to 2 sec, score 3: cow withdraws at a distance of up to 2 cm or at the moment of touching her head, score 4: distance of withdrawal  $\leq 10$  cm and score 5 to 11: distance of withdrawal 20 cm to  $> 60$  cm in 10 cm steps.

#### Data and statistical analysis

The two avoidance scores of each cow per experimenter were averaged. To assess between-experimenter repeatability on individual level, Spearman rank correlation coefficients were calculated for each farm separately for each experimenter pair and afterwards an average correlation coefficient was calculated per farm. At farm level, the median of the averaged individual avoidance scores as well as the percentage of animals with score  $\geq 6$  was calculated for each experimenter and farm and Spearman correlations were calculated.

#### Results

The average avoidance scores of cows to humans were quite low, ranging from 2.5 to 6.75 (Figure 1). The percentage of animals with score  $\geq 6$  ranged from 0.5 to 41.7 for E1, from 2.9 to 75 for E2 and from 0 to 41.7 for E3, with the highest percentage on farm 5 for all three experimenters.

The between-experimenter repeatability within farms differed markedly between farms. The average correlations between pairs of experimenters ranged from 0.37 to 0.88,

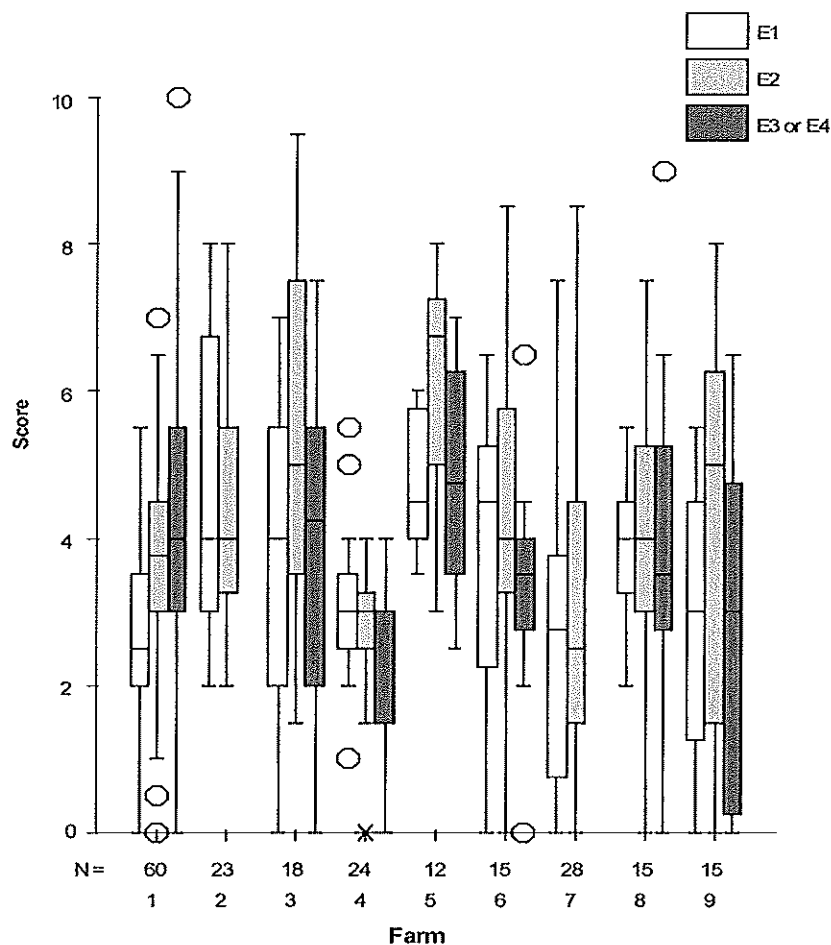
with few very low correlation coefficients of single experimenter pairs (Table 1). At farm level, medians of scores correlated moderately to highly between experimenters (E1/E2:  $r_s = 0.65$ ,  $P = 0.058$ ,  $n = 9$ ; E1/E3:  $r_s = 0.80$ ,  $P = 0.056$ ,  $n = 6$ ; E2/E3:  $r_s = 0.65$ ,  $P = 0.161$ ,  $n = 6$ ). When correlating the percentage of animals with score  $\geq 6$ , the coefficients changed only marginally (E1/E2:  $r_s = 0.63$ ,  $P = 0.070$ ,  $n = 9$ ; E1/E3:  $r_s = 0.82$ ,  $P = 0.050$ ,  $n = 6$ ; E2/E3:  $r_s = 0.72$ ,  $P = 0.111$ ,  $n = 6$ ).

#### Discussion

The between-experimenter repeatability within farms differed substantially, ranging from low to high ( $\geq 0.8$ ; Martin & Bateson 1993) levels. Further, at farm level correlations were quite high for one pair of experimenters and still moderately for the other two pairs. Due to the limited number of farms in our study, these values of repeatability are encouraging. They are in line with results regarding repeatability of avoidance reactions in loose-housed dairy cows and buffaloes (De Rosa *et al* 2003; Waiblinger & Menke 2003). In our study the repeatability on individual levels did not show a distinct pattern, such as low repeatability for a special pair of experimenters on all farms, but on some farms correlations were quite high and on others they were lower for all three pairs. Thus, the partly unsatisfactory repeatability seems to be more a result of inconsistency in cows' reactions to different test persons than a result of errors in experimenters' assessment of avoidance reaction (inter-observer reliability). Rousing and Waiblinger (2004) also found a high inter-observer reliability, but only a moderate consistency in cows reaction to different humans. Reasons for this difference between farms are unclear and need further investigation. Cattle differ in their reaction to people according to previous handling and generalise to other humans (Waiblinger *et al* 2006). Possibly, they generalise their experience with different people to observers with similar characteristics. Alternatively, subtle differences in the behaviour of observers have different impacts on

Figure 1

Box-whisker-plots of avoidance scores for the experimenters E1, E2 (both on all farms), E3 (farms 3, 4, 5, 6, 8, 9) and E4 (farm 1).



cows' reactions on different farms according to former experience.

When testing the repeatability of cows' reactions to different people, repetition of tests inevitably occurs. Multiple testing may change the reaction due to habituation or frustration (Waiblinger *et al* 2006), but we tried to minimise putative effects on the results (by balanced order, testing an animal twice per experimenter to reduce the influence of the first test). The results being in line with earlier studies support the notion of a low influence.

Interestingly, the between-experimenter repeatability within farms did not sufficiently predict the repeatability at farm level. The pair of experimenters E1/E3 showed the lowest correlation at individual level, but the highest at farm level. Although this has to be interpreted carefully due to the small sample size for correlations at farm level, the farm is the unit of interest for application and thus repeatability at this level is most important.

The test can be performed easily and quickly with a large number of animals. Additional time may be saved by testing each animal only once, but this has to be tested first.

## Conclusion and animal welfare implications

The between-experimenter repeatability was not consistently satisfactory within farms and the reasons for this merit further investigation. Nevertheless, due to the high feasibility and moderate repeatability at farm level, the measure seems to be promising and should be developed and investigated further on a larger number of farms. A test providing reliable information about the cow-human relationship in tie-stall systems would be the first step in improving this aspect and thus animal welfare on farms.

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