BRIEF COMMUNICATION: Effects of handling during calf rearing on behavioural and physiological responses of one year-old dairy heifers

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INTRODUCTION

Interaction with humans is a daily part of most farm animal's lives. The nature of these interactions is an important factor contributing to animal welfare and productivity. Exposure to negative handling can increase fearfulness in animals, which can cause problems such as increased handling time, poor meat quality and injuries to animals and to handlers. There is substantial evidence that fear of humans decreases productivity and severely impairs farm animal welfare (Hemsworth, 2003; Waiblinger *et al.*, 2006).

In beef and dairy cattle, fear of humans has been measured as the distance the animal maintains from an approaching person and how the animal approaches or responds towards a stationary human. Other measures include responses to handling and/or restraint and flight speed when an animal is released from a restraint (Waiblinger *et al.*, 2006).

Previously, the animals in this study were exposed to different types of handling during rearing as calves. At three months of age, calves that received routine on-farm handling, showed greater reactivity in a crush and responses towards humans, compared to calves that received either negative or positive handling (K.E. Schütz, Unpublished data). The aim of this study was to examine if the calves response towards humans and to restraint, were still different at one year of age.

MATERIALS AND METHODS

Ethics

The protocol and conduct of this study were approved by the Ruakura Animal Ethics Committee, Hamilton, New Zealand.

Animals and procedure

The study was undertaken at the AgResearch No.1 Dairy, Hamilton, in November 2009. Seventy, non-pregnant, one year-old Holstein Friesian heifers with an average live weight of 324 kg, were used. Previously, from one to five weeks of age, animals were exposed to one of the following three handling treatments twice daily for five minutes per session:

1. Positive (n = 20); handled in a gentle manner with soft voices, slow movements and patting,
2. Negative (n = 20); handled in a rough manner with rough voices, rapid movements and pushing or
3. Control (n = 30); handled as routine calf rearing practice with minimal contact.

Prior to testing for the present study, animals were familiarised with the facility and then exposed to two restraint tests, three days apart.

Restraint tests

Handling ease was measured as the force required to move each heifer down a 12 m long race and into a crush (Technipharm International Ltd, Rotorua, New Zealand) using a 1 to 4 scoring system where 1 = Light push with hands/touches animal, 2 = Forceful push with hands, 3 = pushing with hands and legs, and 4 = Pushing using hands, legs and body weight to move animal forward. All scores included use of voice.

Once in the crush, animals were restrained in a head bale for approximately two minutes. During this time, struggling behaviour was recorded using a load cell attached to the head bale at approximately neck height. It measured the force exerted against the head bale. Voltage outputs were logged by a LabJack U3-LV USB acquisition device (LabJack Corporation, Lakewood, CO, USA) connected to a PC using AzeoTech® DAQFactory® Express software (AzeoTech Inc, Ashland, OR, USA). The number of times the animal struggled, termed a bout, the average force (kg) applied to the head bale while struggling and the average duration of each struggling bout (sec) were recorded and analysed. This equipment also recorded the exit speed as seconds to cover 1.6 m when the animals were released from the head bale. During the second two minute restraint, heart rate was measured for ten animals per treatment group using Polar monitors (RS800, Polar Electro Oy, Helsinki, Finland).

Animals were habituated to wearing the equipment and surcingle prior to testing. Equipment was fitted the day prior to testing. On the test day, animals were restrained in the crush briefly to start heart rate recording then moved into a yard to settle for five minutes and obtain baseline measurements for 15 minutes before testing. Data was extracted using Polar ProTrainer 5 software (Professional Equine Edition; Version 5.35).

TABLE 1: Mean ± standard deviation for flight distance (mean ± standard deviation) in the paddock, handling ease score (0 (Easy) to 4 (Hard)), number of struggling bouts, mean duration of struggling bouts, average force applied to the head bale and exit speed from restraint during two tests for one year-old heifers that had received Positive, Negative or minimal (Control) handling during calf rearing from one to five weeks of age. Bold text indicates significance at P <0.05.

Characteristic	Test	Handling treatment during rearing			P value
		Positive	Negative	Control	
Number of animals		20	20	30	
Flight distance (m)	First[1]	1.4 ± 0.8	1.6 ± 0.9	3.3 ± 1.3	**<0.001**
	Second[2]	1.3 ± 0.7	2.0 ± 0.9	3.6 ± 2.3	**<0.001**
Handling ease score	First[3]	0.8 ± 0.2	0.6 ± 0.2	0.2 ± 0.8	0.090
	Second[4]	1.4 ± 0.2	1.2 ± 0.2	0.6 ± 0.2	**0.016**
Number of struggling bouts	First[3]	2.9 ± 0.5	2.4 ± 0.4	4.5 ± 0.6	0.081
	Second[4]	1.3 ± 0.2	1.3 ± 0.2	2.3 ± 0.2	**<0.001**
Mean duration of struggling bouts (sec)	First[3]	0.6 ± 0.2	0.4 ± 0.1	0.4 ± 0.1	0.430
	Second[4]	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	**0.002**
Force applied to head bale (kg)	First[3]	2.0 ± 0.4	1.5 ± 0.3	2.0 ± 0.3	0.450
	Second[4]	0.8 ± 0.1	0.9 ± 0.1	1.1 ± 0.1	**0.041**
Exit speed (sec/1.6 m)	First[3]	3.3 ± 0.3	4.5 ± 0.3	2.2 ± 0.3	**<0.001**
	Second[4]	5.4 ± 0.6	5.4 ± 0.6	2.3 ± 0.5	**<0.001**

[1]Day before first restraint test.
[2]Day after second restraint test.
[3]Number of animals in groups were reduced to Positive, n = 18; Negative, n = 19; Control, n = 29.
[4]Number of animals in groups were reduced to Positive, n = 18; Negative, n = 19; Control, n = 26.

Flight distance

Flight distance was recorded by the same observer in the paddock the day before the first restraint test and the day after the second restraint test. The observer approached each animal at a steady pace of approximately 1 m/sec from approximately 10 m. When the animal moved both front hooves, the distance between the observer and the animal and whether the observer was able to touch the animal were recorded.

Statistical analysis

One-way ANOVA was used to compare treatment differences in the change in heart rate, flight distance and struggling. Struggling data was log transformed prior to analysis. Exit speed was analysed using a restricted maximum likelihood (REML) procedure. A Kruskal-Wallis test was used to analyse treatment differences in the number of animals touched by the observer during flight distance testing. Due to equipment failure, two animals were not included in the heart rate analysis. The animals included for analysis of struggling were reduced to 18 Positive, 19 Negative and 29 Controls during the first restraint and 18 Positive, 19 Negative and 26 Controls after the second restraint.

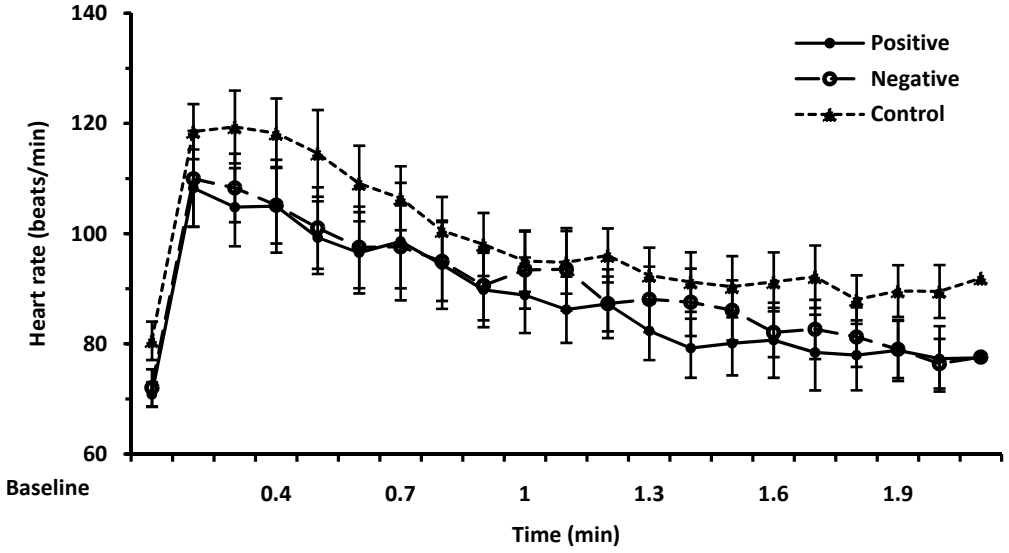
RESULTS AND DISCUSSION

Controls had greater flight distances compared to Positive and Negative groups in the first and second test (Table 1). No differences in heart rate, struggling, exit speed or flight distance were found between Positive and Negative handling groups at one year of age. Therefore, the animals that received routine on-farm handling as calves showed more avoidance behaviour towards a human than animals that received positive or negative handling. We also found in a previous study that flight distance and avoidance behaviour did not differ between calves handled positively or negatively at three months of age, but animals that received routine on-farm handling showed greater flight distances and more avoidance behaviour (K.E. Schütz, Unpublished data)

More animals from the Positive group were touched in both flight distance tests and therefore had a flight distance of 0 m (First test: 3, 2 and 1 Positive, Negative and Control respectively, P = 0.319; Second test: 4, 0 and 1, Positive, Negative and Control respectively, P = 0.028). This was consistent with findings at four weeks of age when the positive group were more likely to approach a handler (K.E. Schütz, Unpublished data).

The Positive group were more difficult to move into the crush during the second testing (Table 1), followed by Negative then Control groups,

FIGURE 1: Average heart rate (beats/min) ± standard error of the mean for one year-old heifers that had received Positive (●, n = 9), Negative (o, n = 9) and minimal (▲ Control, n = 10) handling during Baseline and the second two minute restraint test.



suggesting a reduced fear of humans, corresponding to the reduced flight speed of these animals. Heart rate increased in response to restraint for all groups (19.4 ± 4.7, 20.6 ± 3.7 and 20.6 ± 3.1 beats/min ± standard error of the mean, Positive, Negative and Control respectively, Figure 1). However, by the end of the restraint, heart rate had returned to baseline levels for Positive and Negative groups, but stayed elevated for Controls. Controls struggled more during both restraint tests and were faster to exit compared to Positive and Negative groups (Table 1). Exit speed is a repeatable measure of temperament that can be interpreted as a measure of fear (Petherick *et al.*, 2009). In addition, an objective measurement of struggling behaviour during restraint can indicate the degree of aversion to the situation (Schwartzkopf-Genswein *et al.*, 1998).

In summary, dairy cows that received minimal on-farm handling during rearing showed the greatest avoidance behaviour towards a human and reactivity during restraint, compared to animals that received positive or negative handling. At one year of age, no differences were found between groups that had received either positive or negative handling, in contrast to differences found at five weeks of age. This may indicate that at one year of age, the amount of handling during rearing has a greater effect on subsequent responses than the nature of that handling. Handling during early rearing continues to influence behavioural and physiological responses at one year of age in dairy cattle. More research is needed to fully understand the long-term effects of early handling.

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REFERENCES

Hemsworth, P.H. 2003: Human-animal interactions in livestock production. *Applied Animal Behaviour Science* **81**: 185-198.

Petherick, J.C.; Doogan, V.J.; Holroyd, R.G.; Olsson, P.; Venus, B.K. 2009: Quality of handling and holding yard environment, and beef cattle temperament: 1. Relationships with flight speed and fear of humans. *Applied Animal Behaviour Science* **120**: 18-27.

Schwartzkopf-Genswein, K.S.; Stookey, J.M.; Crowe, T.G.; Genswein, B.M. 1998: Comparison of image analysis, exertion force, and behavior measurements for use in the assessment of beef cattle responses to hot-iron and freeze branding. *J Anim Sci* **76**: 972-979.

Waiblinger, S.; Boivin, X.; Pedersen, V.; Tosi, M.-V.; Janczak, A.M.; Visser, E.K.; Jones, R.B. 2006: Assessing the human-animal relationship in farmed species: A critical review. *Applied Animal Behaviour Science* **101**: 185-242.