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Original study

Effectiveness of »natural stockmanship« training in cattle

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Abstract

The objective of this study was to investigate whether natural stockmanship training can be effective in the elimination of avoidance reactions by generating submissive behaviour in dairy cattle. The training session was divided into two procedures: natural stockmanship training focused on getting a submissive response to human approach; natural halter training focused on acceptance of stroking with a halter and fitting it. Both procedures were conducted on unrestrained animals by skilled trainer. Two tests were developed to assess the effectiveness of the method: »udder touching« testing natural stockmanship training and »halter-fitting« testing both natural stockmanship training and natural halter training. Training procedures followed the idea of employing natural behaviour of cattle (avoiding discomfort of pressure) to negative reinforcement conditioning (chasing away when an animal moved away) and habituation to trainer and training/testing arena. Sixty-three (n=63) animals from two barns were studied: 32 heifers and 31 cows followed by control group of 7 heifers and 11 cows. The approach developed proved to be an effective method of handling cattle: 93.7 % of animals completed »udder test« in an average 400.4 s and 75.8 % completed »halter fitting test« in an average 559.7 s compared to control group results: 77.8 % and 33.3 %, respectively. Animals responded with submission and avoidance distance was shortened to zero. Previous experience of being milked had a significant positive effect on »udder touching« test performance and duration but not »halter-fitting« test. No environmental impact was found and animals from both farms responded similarly.

Keywords: human-animal interaction, cattle, training, avoidance behaviour, welfare

Abbreviations: NST: natural stockmanship training, NHT: natural halter training, see also Table 3

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Introduction

According to experiences gathered during life, animals perceive humans positively, negatively or indifferently (Hausberger *et al.* 2008). Traditionally, for being moved, cattle are given signals that provoke flight from the handler. The animals quickly learn that on human approach, withdrawing and displacement behaviour should be performed. Such learned reaction facilitates managing and movement of cattle, but generates fear and aversive reactions and thus decreases animal welfare. Fear reaction and flight behaviour in cattle has been the subject of numerous studies (for review see Forkman *et al.* 2007). Similarly to other farm animals, the intensity of cattle fear reactions is genetically (Burrow & Corbet 2000, Lanier *et al.* 2000) and/or environmentally (de Passillé *et al.* 1996, Rushen *et al.* 1998) dependent. Cattle also generalise their responses towards people based on their previous experiences (Munksgaard *et al.* 1997).

On the other hand, predictable behaviour and ease of handling is expected when milking and during routine veterinary and husbandry procedures. This ambiguity of human demands toward cattle (standing still when approached by milkers and moving away when displaced to paddocks) can provoke confusion and fear reactions and cause serious consequences in terms of safety for both caretakers and animals. Fear of people caused by aversive handling can increase the risk of injuries (Rushen *et al.* 1999a, 1999b). According to Polish authorities the incidence of accidents with farm animals amounts to 1926 for 2011 and is a critical problem in husbandry-related labour safety. Numerous studies also proved decreased productivity and fertility as a result of fear and rough treatment (Breuer *et al.* 2000, Hemsworth *et al.* 2000). It was reported that hitting increases flight distance (Breuer *et al.* 2000, Munksgaard *et al.* 1997) and shouting accelerates heart rate more than a metal clank (Waynert *et al.* 1999). Moreover shouting was the second most aversive stimulus after an electric prod, preceding tail twist and hitting (Pajor *et al.* 2000). Development of an effective method to reduce flight reaction and avoidance behaviour of cattle would enhance ease of handling and could be a valuable tool for reducing the stress responses and increasing the welfare of animals and the handlers' safety. Recently, »natural« methods of handling horses have gained widespread popularity (Birke 2007, Miller 1995, 1997, Sighieri *et al.* 2003). They are supposed to rely on human-animal communication that include the animal's submissive behaviour during training which is a combination of negative reinforcement training (driving away) and habituation adopted from horsemanship techniques (Goodwin *et al.* 2009). The results of these methods are frequently overinterpreted and scientifically criticized (Luescher *et al.* 1998, McGreevy & McLean 2007, Warren-Smith *et al.* 2007), however they were also shown to be effective (Fureix *et al.* 2009, Rivera *et al.* 2002).

The aim of the present study was to examine if NST would be effective in the elimination of avoidance reactions by generating submissive behaviour in dairy cattle as observed in horses during the round pen training (Krueger 2007). To test that, we assessed the effectiveness of the method using an »udder touching« test and a »halter-fitting« test and compared tests' results with these obtained by testing untrained (control group) animals. Additionally, the trainability of heifers (naïve to human contact) and cows (experienced with human touch) was compared. Possible environmental effect (»farm« effect) on the effectiveness of NST was also studied.

Material and methods

All procedures were accepted by 3rd Local Commission for Ethics in Animal Experimentation, Warsaw, Poland.

Animals

A total of 63 Polish Holstein-Friesian cows and heifers kept at two different farms, were studied followed by 18 animals from control group (Table 1). The animals differed as to their reproductive status nested within age (heifers and cows). As the age and reproductive status could not be separated, we decided to classify the animals into a »status« groups only.

Table 1
Distribution of animals according to their status and allocation to farm

	Farm A	Farm B	Control
Heifers	11	21	7
Cows	21	10	11

Cows were kept in free stall barns total mixed ration fed. Heifers were raised with little contact with humans. Most farm procedures (feeding, bedding, manure removal) were mechanically performed. In both farms the animals were milked in a herringbone milking parlour, however the locations differ as to handling routines (Table 2).

Table 2
Housing and handling methods at each farm

	Farm A	Farm B
Contact with strangers	no	yes
Sharing calving boxes with experienced animals	yes	no
First milking in stalls	yes	yes/no
Milking by women	no	yes
Usage of nose tongs when restless	no	yes
Usage of cattle electric prod	no	yes
Manually total mixed ration feeding	yes	no
In stalls during manure removal	yes	no
Hoof trimming by familiar handlers	yes	no

Testing facilities

At farm A the training/testing facility was the calving pen where animals were placed two weeks before expected calving. The trained animal was handled with the presence of another animal. When handling a heifer a cow was a companion animal and vice versa. Animals were familiarized to the pen (23 m^2) and to each other. In farm B training was carried out in a training pen (18 m^2) separated with two stall poles from the passageway to provide visual and physical contact with other animals. All animals had access to food and water.

Natural stockmanship training

The training involved the following stages: making the animal stand still, approaching and moving a hand toward the animal, touching the withers, side, and hind leg (Table 3). Five second intervals between successive stages of training were maintained. The handler (female, P.A.) was allowed to move to the next stage only if the previous one was accepted by the animal and if no tension, fear and avoidance behaviour (head shaking, skin shaking, back lowering, tail waving, snorting, stepping) or aggressive behaviour (posturing, head battling, marked kicking and kicking) was seen. Thus, at each stage of the training, submissive behaviour (head lowered, licking and chewing) within 5 s/5 successive trials was admitted as the criterion to complete the stage (explained in detail in description of every stage). Every stage of training was conducted only once and immediately after the previous one. Due to aggressive or panic behaviour one heifer was not submitted to NHT after completing NST. Aggressive and violent cattle, as they could not move to another stage in one research event were rejected. Each test was performed immediately after last training stage.

Stage 1 – Standing still

The animal was left for 15 min to habituate to stall poles (farm B only, due to keeping animals in tested arena – calving pens at farm A). After 15 min, the handler (female, P.A.) entered the pen and approached the animal at a 90 degree angle towards the spine of the cow, with eyes focused on the cow's eye (active body position). Then, she drove the cow away around the pen waiting for submissive behaviour of the animal. As soon as an animal stopped, the handler stopped as well in a passive body position (looking down, arms next to the body). If the cow moved forward, the handler repeated driving away until the cow stopped again. This stage was considered as completed when the cow was standing still for 15 s.

Stage 2 – Approaching the cow and moving hand toward an animal

Approaching an animal was carried out sideways from the side of its body and toward the shoulder. The handler approached slowly in half circles. Every time an animal balked, the handler repeated driving away. On slowing down and submission signs, the handler ceased driving away. As soon as the cow allowed the handler to stand in a side-on position at 1 m distance, she started swinging an arm to and from the cow's shoulder as described by Miller (1998) in a shaping technique called »advance and retreat«. Standing still with head lowered evoked passive handler position. Five successful trials ended this part of the training.

Stage 3 – Touch

This stage involved the continuation of the previous one by touching the animal with similar swinging movements of the handler's arm. As soon as the animal allowed touching the shoulder, the handler adopted a passive body position. Again, if the animal moved away driving away was repeated until the cow stopped. Successively, the shoulder, the side, and hind limb were touched. Five successful trials ended this part of the training.

The times to perform all stages were measured in seconds. In addition, the total time (NST T) to complete the training was measured (Table 3).

Table 3
Stages of training and testing procedures (conducted in a single attempt)

Variable	Definition
NST	natural stockmanship training
SS	time to stand still in seconds
TS	time to stand still when hand swinging in seconds
TW	time to touch the shoulder/withers in seconds
TF	time to touch the flank in seconds
TL	time to touch the hind limb in seconds
NST T	total time of natural stockmanship training in seconds
»Udder test« U	time to accept touching the udder in seconds
NHT	natural halter training
TN	time to touch the neck in seconds
TC	time to touch the cheek in seconds
HH	time to stand still when swinging hand with a halter in seconds
HS	time to rub the shoulder with halter in seconds
HN	time to rub the neck with halter in seconds
HC	time to rub the cheek with halter in seconds
HJ	time to rub the jaw with halter in seconds
HM	time to muzzle in seconds
NHT T	total time of natural halter training in seconds
»Halter fitting test« H	time to fit the halter in seconds

»Udder test«

Since milking is the main opportunity of human-cow interaction, touching the udder was used as the criterion of effectiveness of the NST. The time to touch all quarters was measured in seconds (U). Control group animals were submitted to udder test but not to the training. They were also habituated to testing arena and afterwards approached calmly (1 step/s) for 1 min. With the lack of successive approach traditional methods were employed to make an animal to stop and stand still (driving to bed stalls, pressing with a hand on the side of the body). If the animal stood still within 15 s, while being touched on the udder, the test was considered as completed in both, test and control groups.

Natural halter training

For some situations (shows, relocation, veterinary treatment, leading to crushes) the cattle need to be restrained with a halter. However, untrained animals are often difficult to halter, especially in an emergency. We examined the effectiveness of the NST and NHT for fitting a halter. The NHT consisted of stages of: rubbing the animal's neck and head with hand and then on rubbing shoulder, neck, cheek and jaw with the halter. The next stage consisted of training to be muzzled with the halter. In this stage, the loop of the muzzle strap was placed on the muzzle (Table 3). If no avoidance behaviour was shown and submissive patterns were performed, the halter was immediately removed and the handler adopted a passive body position. Five successful trials were the criterion for completing this stage of training.

Table 4
The distribution of performers and non-performers in NST and halter-fitting test according to the status and location

Udder test (Performers/Non-performers; %)				
	Farm A	Farm B	Farm A+B	Control
Heifers	10/1; 90.9^{E}	18/3; 85.7^{F}	28/4; 87.5^{AC}	3/4; 42.9^{CEFG}
Cows	21/0; 100	10/0; 100	31/0; 100^{A}	11/0; 100^{G}
Total	31/1; 96.9^{O}	28/3; 90.3^{P}	59/4; 93.7^{d}	14/4; 77.8^{dOP}
Halter fitting test (Performers/Non-performers; %)				
Heifers	9/1; 90.0^{L}	9/8; 52.9	18/9; 66.7^{JT}	2/5; 28.6^{HjL}
Cows	18/3; 85.7^{M}	8/2; 80	26/5; 83.9^{KT}	4/7; 36.4^{HKMN}
Total	27/4;87.1^{bNR}	17/10; 63.0^{bS}	44/14; 75.9^{I}	6/18; 33.3^{IRS}

Capital letters –$P<0.001$, lowercase letters $P<0.05$

Halter fitting test

Halter fitting test (H) was used as the criterion of effectiveness of both the NST and NHT.

The handler approached the cow and after placing the muzzle strap, the halter was completely fastened on the animal's head. Animals from the control group were tested immediately after udder test. The handler approached calmly, speaking gently and moving slowly (1 step/s) with the halter along the body, than tried to fit it on animal's head. With the lack of success in 2 min the handler changed the approach and tried to force the animal by grabbing its collar or holding its neck in the halter strap and fit the halter on. Successive fitting with the strap fastened ended the halter test in the control group.

The time to perform all stages in both NHT and testing were measured in seconds. In addition, the total time to complete the training (NHT T) was measured (Table 5).

Table 5
Descriptive statistics of behavioural variables during training and test situation

	Trained		Control	
Variable	Mean ± SD, s	Range, s	Mean ± SD, s	Range, s
NST				
SS	56.7 ± 62.9	1-358	-	-
TS	123.9 ± 107.0	6-536	-	-
TW	129.8 ± 116.6	12-499	-	-
TF	60.3 ± 51.6	13-292	-	-
TL	42.7 ± 55.5	2-401	-	-
NST T	400.4 ± 261.1	82-1 551	-	-
NST udder test U	61.9 ± 68.6	5-367	81.4 ± 32.1	34-124
NHT				
TN	94.4 ± 114.1	10-562	-	-
TC	93.8 ± 87.7	10-362	-	-
HH	36.9 ± 26.9	4-119	-	-
HS	52.8 ± 51.6	8-239	-	-
HN	44.5 ± 47.1	2-233	-	-
HC	68.9 ± 64.4	4-265	-	-
HJ	86.9 ± 112.3	1-617	-	-
HM	177.8 ± 227.9	19-1 189	-	-
NHT T	559.7 ± 381.5	163-1 942	-	-
NHT halter fitting test H	121.5 ± 81.3	15-381	196.8 ± 33.8	44-114

Statistical analysis

The data showed non-normality (Shapiro-Wilk's), so they were subjected to log N transformation. Chi-square analysis was performed to examine the associations between performers and non-performers from trained and control groups. Pearson correlations were used to estimate which elements of NST could be predictive of the animal's final acceptance of the udder touch and fitting of the halter. Next, we examined which elements of NHT were predictive of time to fit the halter. The times to complete both training sessions (NST T and NHT T) were tested for correlation to each other to assess if NST facilitated halter training. The effects of farm and animal status on behavioural variables in training and testing sessions were examined using two-way analysis of variance in SPSS PASW Statistics 18 (SPSS Inc., Chicago, IL, USA).

Results

Performance

The training of cattle using a »natural stockmanship« approach proved to be an effective method of handling comparing with traditional methods. Out of a total number of 63 animals, 93.7 % successfully completed the »udder test« and 75.8 % of them completed the »halter fitting test« followed by control animals: 77.8 and 33.3 %, respectively (Table 4). The average time to complete the training (NST) was 400.4 ± 261.1 s. NHT lasted 559.7 ± 381.5 on average (Table 5). During NST, TS and TW lasted the longest. The other stages were of a similar shorter duration. All NST variables were distributed over a wide range (Table 5). In general, TW during NST was accepted by tested animals less willingly than TF and TL.

NHT consumed more time than NST. The shortest stage was HH while HM lasted longer than any other stage of NHT and NST. Average time of H was twice as long as the U in both, control and trained groups.

The influence of performed training (NST and NHT) stages on »udder test« (U) and »halter-fitting« test (H)

The faster the animals accepted successive human contact during NST, the less they reacted to touch of the udder (Table 6). Significant correlations were also found between H and NHT stages. The animals that completed TC, HH, HJ, HM faster performed better in the »halter fitting« test. No relationship was found between NST variables and the time to fit the halter (H) except for TS and TF.

Significant correlation between HH, HS, HN and HC with U were also discovered. Both tests were highly significantly correlated with the total time of the procedures that they were testing ($P<0.000$).

The effect of status and location

Status effect

In NST more cows completed successive stages compared to heifers (Table 4). All 31 cows submitted to NST training succeeded in the U, compared to 28 heifers. Untrained, traditionally handled cows (100 %) also performed better ($P<0.001$) than control heifers (42.9 %) and allowed the handler to touch the udder, but they were mostly standing on the

Table 6
Pearson correlations between NST, NHT variables, udder test and halter fitting test

	Udder test U	Halter fitting test H
Variable	r_s, *P*	
NST	r_s, *P*-value	r_s, *P*-value
SS	0.27, **0.0401**	0.08, 0.6272
TS	0.30, **0.0206**	0.30, **0.0508**
TW	0.39, **0.0022**	0.12, 0.4254
TF	0.33, **0.0108**	0.30, **0.0455**
TL	0.41, **0.0011**	−0.04, 0.7963
NST T	0.47, **0.0002**	0.02, 0.9204
NHT		r_s, *P*-value
TN	0.25, 0.0557	0.11, 0.4716
TC	0.15, 0.2651	0.37, **0.0147**
HH	0.31, **0.0364**	0.39, **0.0095**
HS	0.32, **0.0288**	0.07, 0.6289
HN	0.44, **0.0020**	0.09, 0.5536
HC	0.53, **0.0001**	0.25, 0.0990
HJ	0.12, 0.4153	0.40, **0.0071**
HM	0.07, 0.6479	0.44, **0.0031**
NHT T	0.20, 0.1284	0.66, **0.0000**

bed area of stalls, not freely, like the trained animals. Significant difference (Chi-square=4.13, *P*=0.0419) in the number of trained heifers and cows that completed vs. failed in the U was found. Animals from trained and control group also differed significantly in passing rate. The training increased it in heifers (*P*<0.001) but not in cows.

Total time needed to complete NST was shorter in cows compared to heifers (5.49, *P*=0.000, Table 7). The cows performed significantly less avoidance responses when being rubbed by the handler compared to heifers in stages: TW (*P*=0.00014) and TF (*P*=0.0081). Cows also reacted significantly faster with submission to TS (*P*=0.0408) and TL (*P*=0.0180). No significant differences were found in SS between cows and heifers.

There were no differences in udder test (U) duration between trained and control animals in general (Table 5). The time needed to complete the test in heifers (trained vs. control) and cows (trained vs. control) showed no difference (Table 7), H test (NHT) was successfully completed by 18 heifers and 26 cows from trained group and only two heifers and four cows from control group. The differences between trained and control animals were discovered (*P*<0.001) Completed vs. failed animal numbers did not show any significant differences in Chi-square analysis between trained groups but was found different when compared trained

Table 7
The effect of status and location on behavioural variables in NST, udder test and halter fitting test

Variable	Heifers	Cows			Farm A	Farm B					Control Heifers	Control Cows		
	LSM ± SE		$F_{status,}$	*P*	LSM ± SE		$F_{farm,}$	*P*	$F_{status*farm,}$	*P*	LSM ± SE	LSM ± SE	$F_{farm,}$	*P*
NST	N=32	N=31			N=32	N=31					N=7	N=11		
SS	3.68 ± 0.19	3.34 ± 0.18	1.66	0.2033	3.43 ± 0.18	3.60 ± 0.19	0.41	0.5254	0.13	0.1340	-	-	-	
TS	4.66 ± 0.18	4.16 ± 0.17	4.39	**0.0408**	4.33 ± 0.17	4.51 ± 0.18	0.54	0.4676	0.45	0.4540	-	-	-	
TW	4.82 ± 0.18	3.99 ± 0.17	11.31	**0.0014**	4.59 ± 0.17	4.22 ± 0.18	2.23	0.1407	0.23	0.2278	-	-	-	
TF	4.12 ± 0.13	3.60 ± 0.13	7.55	**0.0081**	3.92 ± 0.13	3.80 ± 0.13	0.44	0.5116	0.72	0.7244	-	-	-	
TL	3.73 ± 0.16	3.18 ± 0.16	5.95	**0.0180**	3.36 ± 0.16	3.55 ± 0.16	0.71	0.4033	0.00	**0.0045**	-	-	-	
NST T	6.12 ± 0.12	5.49 ± 0.12	14.43	**0.0000**	5.86 ± 0.12	5.75 ± 0.12	0.41	0.5272	0.92	0.9172	-	-	-	
Udder test U	N=28	N=31			N=31	N=28					N=3	N=11		
	4.13 ± 0.17	3.40 ± 0.16	8.24	**0.0058**	3.43 ± 0.16	4.0 ± 0.17	6.83	**0.0115**	0.96	0.3315	4.04 ± 0.23	3.73 ± 0.25	3.99	0.0689
NHT	N=27	N=31			N=31	N=27					N=7	N=11		
TN	4.07 ± 0.21	3.87 ± 0.19	0.46	0.4998	4.05 ± 0.18	3.89 ± 0.21	0.29	0.5910	0.03	0.8617	-	-	-	
TC	4.08 ± 0.17	4.20 ± 0.18	0.19	0.6628	4.39 ± 0.17	3.89 ± 0.20	3.59	0.0653	5.02	**0.0307**	-	-	-	
HH	3.46 ± 0.20	3.25 ± 0.18	4.42	0.4448	3.43 ± 0.17	3.29 ± 0.21	0.31	0.6104	1.71	0.1984	-	-	-	
HS	3.68 ± 0.20	3.58 ± 0.18	0.60	0.7035	3.49 ± 0.17	3.77 ± 0.21	0.26	0.3129	0.07	0.9338	-	-	-	
HN	3.52 ± 0.24	3.43 ± 0.21	0.15	0.7735	3.30 ± 0.20	3.65 ± 0.24	1.05	0.2802	1.16	0.2878	-	-	-	
HC	3.88 ± 0.25	3.78 ± 0.22	0.08	0.7730	3.77 ± 0.21	3.90 ± 0.26	1.20	0.7062	2.12	0.1531	-	-	-	
HJ	3.45 ± 0.28	4.28 ± 0.25	0.08	**0.0338**	3.58 ± 0.24	4.15 ± 0.29	0.14	0.1445	1.80	0.1863	-	-	-	
HM	4.41 ± 0.19	4.96 ± 0.18	4.83	**0.0418**	4.62 ± 0.17	4.76 ± 0.20	2.22	0.5783	1.79	0.1890	-	-	-	
NHT T	6.21 ± 0.14	6.38 ± 0.12	0.86	0.3588	6.30 ± 0.12	6.30 ± 0.14	0.00	0.6104	2.67	0.1101	-	-	-	
Halter fitting test H	N=18	N=26			N=27	N=17					N=2	N=4		
	4.47 ± 0.18	4.66 ± 0.16	0.68	0.4134	4.64 ± 0.15	4.49 ± 0.18	0.43	0.5143	1.85	0.1810	5.28 ± 0.17	5.27 ± 0.15	0.00	0.9834

to control animals ($P<0.001$). More trained heifers completed the H compared with control heifers ($P<0.05$) and the difference between cows was even greater ($P<0.001$).

NHT T did not differ between heifers and cows (Table 7). NHT resulted in faster completion of HJ ($P=0.0338$) and HM ($P=0.0418$) in heifers. No other significant differences in NHT variables were found.

H test took longer in control vs. trained animals ($P<0.001$). No significant differences in H test duration between cows and heifers were proved in trained animals as well as in control cattle.

Farm effect

The NST was completed in 31 animals from farm A and 28 animals from farm B, respectively (Table 4). The number of animals submitted and did not submit to the U did not differ significantly. Twenty-seven animals from farm A and 17 from farm B completed the H test and the rate of performers to non-performers in trained animals differed significantly (Chi-square=4.73, $P=0.0296$). The training increased the passing rate in heifers from both barns comparing to control heifer group ($P<0.001$). It was also true for cows from both barns ($P<0.001$). The duration of U between trained and untrained cows and heifers showed no difference.

The comparison of NST stages did not show any significant differences between farms, except for U ($P=0.0115$). No differences in NST T between farms were found.

The differences between farms in NHT variables and H were not significant and thus responses of animals to handling in farm A and B appeared to be similar and better than in control group (for farm A: $P=0.033$; for farm B: $P=0.024$).

The influence of interaction of both factors: »farm« and »status« on training variables

Significant interaction ($P=0.0045$) of both factors (status and farm) was observed during NST in TL stage (NST) and TC stage (NHT) only (Table 7). Cows from barn A completed TL significantly faster ($P=0.0045$) comparing to cows from barn B and heifers from barn B took less time to complete it than heifers from barn A. TC stage followed the same tendency ($P=0.0307$).

Discussion

Performance and training effectiveness

The »natural stockmanship« approach proved to be an effective method of handling cattle compared to traditional methods. High performance in both tests: 93.7 % for »udder test« and 75.8 % for »halter fitting test« comparing to lower passing rates of control group (77.8 % and 33.3 %) showed the effectiveness of the tested approach (Table 4). The presented study confirmed the conclusions of Rushen *et al.* (1999b) that cattle handling can be improved though usage of species-specific behaviour and thus establishment of a good stockman-animal relationship is possible. Even though cattle can discriminate between different types of handling (de Passilé *et al.* 1996, Munksgaard *et al.* 1997, Pajor *et al.* 2003) and learn to avoid people who hit them (Breuer *et al.* 2000, Munksgaard *et al.* 1997, Pajor *et al.* 2000, Rushen *et al.* 1999b) while non aversive handling (petting, brushing, gentling) has been found to

reduce the fear of humans and make the cattle easier to handle (Boissy & Bouissou 1988, Boivin *et al.* 1992, Boivin *et al.* 1994, de Passillé *et al.* 1996, Munksgaard *et al.* 1997) it is still questionable if they can perceive humans as part of their social organisation similar to conspecifics. This question is also still not answered in equestrian science (Goodwin *et al.* 2009, Goodwin 1999, Krueger 2007, McGreevy & McLean 2007, McGreevy *et al.* 2009). It is well recognised that animals which are less afraid of people are easier to handle in a wide range of handling situations and their behaviour toward humans is strongly affected by human behaviour during handling (Hemsworth *et al.* 1996a, 1996b). In our study calm behaviour of the handler towards control animals did not prove its effectiveness during test situations as it was found effective during management activities without tactile contact, like driving cows to milking places (Breuer *et al.* 2000).There is also no doubt that cattle, as with other prey animals, are calmer when they can predict their environment and human behaviour toward animals. The successful communication between an animal and human was achieved in the present study by shaping desired behaviours in one event lasting a few minutes whereas in other studies handling performed by an unknown to animals person was not that successful (Waiblinger *et al.* 2004). The success of training can be a combination of conditioning (negative reinforcement and habituation) and using species-specific communication for interspecies communication. Also, the combination of the handler's body posture with stroking might have an additional effect on ease of handling as stroked cows responded with lower heart rates (Schmied *et al.* 2008b) even during stressful situations (Waiblinger *et al.* 2004). Cattle (Grandin 1993) as horses (McGreevy 2004, Miller 1999) and pigs (Hemsworth *et al.* 1986, Miura *et al.* 1996) can interpret both: aversive human body posture (while driving away) and calming posture (while approaching the animal) but, effects of gentle tactile stimulation per se in cattle without other forms of contact are still ambiguous(Boivin *et al.* 1998a, Jago *et al.* 1999) which may be partly explained by the manner of stroking, which can affect the behaviour (Schmied *et al.* 2008a). Also, the additional time for conditioning either gentling, brushing or hand feeding needs to be considered, as these handling methods are perceived, as with any novelty, as aversive (de Passillé *et al.* 1996, Grandin 1997). Moreover to make it rewarding for cattle a certain quality of human-animal relationship is needed first (Waiblinger *et al.* 2004). That makes all these methods time consuming and less effective. Omitting the habituation process to feeding and then to gentling, by using species specific communication to accept human touch might be the key to shorten training.

In our study a number of trained animals seemed to find being touched pleasurable as training progressed, even though the handler was concentrated on obtaining submissive behaviour. There were also a few individuals that only tolerated it, calmly showing acceptance by submission, as they learned (completing previous stages successfully) how to cope in new circumstances showing the habituation effect which is known to decrease flight response intensity over time (Boivin *et al.* 1998a, 1998b, Pajor *et al.* 2000). The pleasure response for touching of hanging ears, neck stretched and half closed eyes was not observed in control group. All animals were tense and tried to avoid human touch by moving away or moving to stalls. During testing procedures: udder touching and halter fitting they even fall down (two and five times, respectively) or spin fast to avoid haltering (six animals). All animals during handling showed responses like exposing flanks while walking away, lowering the head with neck extended, muzzle licking and occasionally chewing without rumination described as

calming and submissive gestures in other species like horses (Miller 1995, 1997, Parelli *et al.* 1993, Roberts 1996, Sighieri *et al.* 2003, Krueger 2007). Some of them (ex. head lowering) were also observed in other studies in cattle (Waiblinger *et al.* 2004). Ceased chasing when an animal showed desired behaviour and submission leaded to improvement while continuation with control group animals lead to more fear and sometimes panic reactions with attempts to run thought the fence of falling. The results of the presented research show that release of pressure during cattle handling is the crucial reinforcement which progresses into the following stages and prompts completion of the training session.

The present study proved that humans can be perceived with submissive and without flight response as observed, over training time, during »round pen technique« training in horses (Sighieri *et al.* 2003). Drugan *et al.* (1997) concluded that responses to stress are lower when the animal can learn to control the stressful stimuli. As stated (Raussi 2003) improvement of the human-animal relationship is possible when the animal plays an active role during interactions while passive presence of human and brushing restrained animals is ineffective. Drugan *et al.* (1997) and Hagen & Broom (2004) mentioned that even the ability to control a situation without fear and pain involved might be perceived as rewarding.

The ease of stroking of body parts in cattle

The ease of stroking of particular parts of body was expressed in elapsed time. In NST, TS and TW were found to last the longest as the animals in free stall housing systems are expected to walk away when approached and being waved at. The touching of front quarters (TW) during NST was less willingly accepted than hind quarters (TF, TL) even though 64 % of social grooming in cattle is directed to the neck part. Also, the fact that this activity is performed mostly by subordinates on dominants (Reinhardt & Reinhardt 1981, Sato *et al.* 1993) contributing to the stability of subordinate-dominant animal relations (Sambraus 1969, Sato *et al.* 1993) might explain why it would be confusing for cattle when performed by humans. On the other hand grooming front quarters of the body has been suggested as being performed on request while non requested grooming is oriented to the back and rump of the animals (Sato *et al.* 1991). The reluctance to be touched in this particular region might be because cattle in large commercial farms do not perceive humans as social partners and they only learned to accept touch related to milking during their experience in the milking unit. Approaching the front of an animal from a commercial dairy farm might be also interpreted as a challenge since fighting behaviour is mostly performed by head to head contact.

Results obtained in this work also showed that animals that were more relaxed in NST did not complete NHT earlier, which might indicate that the results of one type of training (touching) did not influence the results of other type of training (haltering). As restrained animals have higher heart rates and cortisol level which are clear indicators of stress, making an animal stand still without tethering (NST) can result in lower stress and fear and could be used for many situations such as first milking sessions and other handling situations.

In general NHT consumed more time than NST. The shortest stage was HH where trained animals accepted reaching to their withers with a halter with ease, while TS (NST) took as much as three times longer. Animals learn very quickly from previous experience and they can use it to cope with comparable tasks (Wechsler & Lea 2007). HM (stage of NHT) lasted

longer than any other stage of NHT and NST as any attempts to fit the halter on the animal's head might be related to aversive experience of nose tongs or other restraint. The HM took 31.8 % of total time of NHT which prolonged the total procedure. It is difficult to examine if stages longer than other (TS, TW in NST and HJ, HM in NHT) were crucial for completing it or not. Previous experience of improper handling might be the cause of the H test lasting, on average, twice as long as the U in both groups: trained and control.

The relationship between training (NST and NHT) variables and test (U and H)

Animals that accepted all NST stages faster as well as completed NST T faster, also faster completed »udder test« (U). Cattle that accepted human touch the area of withers (TW) and leg (TL) were the easiest to udder manipulation (U). TS stage could be used as an indicator of positive human-animal interaction and easy temperament when handling udder or fitting a halter as it was both correlated with U (P=0.0206) and H test (P=0.0508).

No correlation between U and NHT T or other stages like HJ and HM directly preceding haltering (H) could indicate a lack of generalisation by the animal or may show differences between these two tasks from an animal's point of view. If an animal is to be haltered, respective training needs to be performed.

The HM stage best predicted the ease of halter fitting (H) followed by HJ and TC, HH from the very beginning of the procedure. The sooner an animal completes stages involving head stroking the greater is the likelihood of fitting the halter.

Finally, it was noticed that fast completion of training was followed by fast completion of the tests.

Status effect

In general, both in trained and control animals significantly (P<0.001) more cows completed the U compared to heifers and for cows it took less time what makes experience of previous milking sessions useful for NST training and »udder touching test« performance. Training significantly increased the passing rate of U in heifers but not in cows what is in agreement with results obtained in other studies where heifers have also been found to be more difficult to handle than cows (Albright & Arave 1997, Bremner 1997). Cows could relate some training stages to experience of being touched in particular body regions they were habituated to what resulted in shorter TS, TW, TF and TL in this group. Lack of positive interactions and/or learned forward movement, when being approached by the caretakers, affected similar responses of cows and heifers expressed in SS stage duration.

Situation appeared different when novel experience of haler training (NHT) and test (H) were applied. Animals' reactions were more individual (Table 7). Cows tend to take longer to accept rubbing jaw (HJ) which might be as a result of head restraint with nose rings and tongs or prodding. Cattle learn fast to avoid handlers that use electric prods (de Passillé *et al.* 1996, Gonyou *et al.* 1986, Pajor *et al.* 2000) and authors of this paper suspect that touching animals with a tool might be related by cattle to previous adverse experiences. Significantly better performance of heifers in HJ and HM might be due to the lack of negative experiences and proved (Ksiksi & Laca 2002, Wechsler & Lea 2007) greater learning ability according to the age. In our study 75.9 % of heifers and cows that finished the training allowed the handler

to fit the halter what was accompanied by submission gestures. Single training session makes the natural stockmanship training effective in novel, handling situation despite the age, even thought, passing rate of cows was higher (Table 4) and duration of test (H) was longer for these group (Table 7) The percentage of successive haltering (83.9 %) was similar to the result reported by Lewis & Hurnik (1998) in which 85 % of the cows studied showed little resistance to a halter, but not to results obtained by cows from control group in present study (36.4 %). Moreover the rate presented by mentioned authors was lower for animals stroked on the withers and lateral chest (50 %) which means that the order of experimental stages is essential. There is a lack of data concerning haltering dairy heifers due to calve, nevertheless in our study less control heifers were found to halter successively compared to trained animals (Table 4).

Natural stockmanship can be used both to build a good stockmanship and to introduce novel handling practises (like milking in heifers) to inexperienced animals. Experiencing good stockmanship especially during the last weeks of pregnancy can reduce the stress of the novel milking experiences in primiparous cows, since the abrupt transition periods like weaning (Boivin *et al.* 1992b), last months of pregnancy (Das & Das 2004) could be good moments for grooming. Bertenshaw & Rowlinson (2001) noted that habituation at this time can reduce kicking behaviour in the parlour and increase milk flow rate in these animals.

The evaluated training can be used in common management practises to improve handling safety and make it less stressful for animals, as fear of humans is one of the most important factors of welfare abuse.

Effect of the environment

Even though farms differed in handling procedures there was no significant differences between farm A and B in response to either training event which means that the natural stockmanship was effective despite environmental effect and previous handling experiences. Trained animals from both farms and control cattle differed in passing rates in both tests but duration differed only for H test (Table 7). Differences between farms in trained animals were recognised in H test passing rate which was significantly higher in farm A. There was no farm effect in the passing rate of the U (Table 4) although U result was significantly better in farm A (Table7). A possible explanation could be the use of the milking parlour crush to stop kicking during milking in farm A and use of a leg yoke in farm B. For heifers important factors may be: humans perceived as food givers, no usage of cattle prods and being in the stall during routine practises. Gained results might also suggest that the environments are largely predictable or similarly perceived by cattle, although there are practices that could be improved.

The results concerning farm factor suggest that in the close presence of humans, animals respond according to their age connected with their experiences (status). Housing young animals with multiparous cows (Table 2) where they can observe the behaviour of experienced animals being milked does not provide habituation to the touch of man and tactile handling. That was supported by the study of Das & Das (2004) where handled and unhandled animals were kept in the same pen during the experiment reacted differently. The influence of both factors: »farm« and »status« on the training variables and tests.

Significant factor interaction was shown in the TL and TC stages. In both stages heifers from barn B and cows from barn A showed less avoidance responses. No significant interactions between factors: barn and status were proved in the U and H tests.

In conclusion, natural stockmanship approach can be an effective way of handling and training cattle. Animal directed pressure and release of it is well recognised by cattle as a signal of communication as cattle, like horses, face no difficulties with interpretation of human aversive and passive posture. Proper, positive and tactile contact cannot be replaced by just the possibility of interacting with humans or observing other animals' positive experiences with a handler. The training performed during this study reduced flight responses of heifers and cows to human approach, to the close presence of people and touch. Avoidance behaviour was replaced with submission and acceptance. Nevertheless the possibility of establishing a social bond with cattle as they form with conspecifics needs further research.

Loose housing systems, based on giving the animal the opportunity to decide what it wants to do, have been found to be best for production and animal welfare reasons. Robot milking systems are designed to follow this idea as well. Giving the animal an illusion that it is the one who controls the situation during handling was found effective in this research and might be the key to improvement of human influenced factors of cattle welfare.

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