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ESTIMATION OF TEMPERAMENT OF DAIRY COWS BY RESPONSE TO A NOVEL OBJECT

P. Juhás, Klára. Vavrišínová, J. Dóbi, P. Strapák

Summary

The presented study aims to develop on farm test temperament in dairy cattle based on individual differences in behavior during approaching the novel object. The novel object was a red cycling light. Behavior traits (duration of walking and standing at stops) were recorded from the video records as well as numeric modifier (distance of stop). Individual differences in the behavior were evaluated by differences in duration of approaching the novel object. Due to differences in walking speed in the cows the corrected duration of approaching (CDA) was calculated from real duration of approaching the novel object, number of stops and 1st stop distance. A group of 53 tested cows was split into 4 distinctive clusters. Members of cluster 1 had calm type of temperament, cluster had 28 members, median CDA was 28 s (min 11 s, max 53 s). Members of cluster 2 had curious type of temperament, cluster had 14 members, median CDA was 87 s (min 58 s, max 121 s). Members of cluster 3 had vigilant type of temperament, cluster had 9 members, median CDA was 155 s (min 132 s, max 250 s). Members of cluster 4 had fearful type of temperament, and cluster had only 2 members, median CDA was 460 s (min 439 s, max 482 s). Results showed the possibility of on farm temperament type measure by simple test. Testing discovered inappropriate type of temperament in 2 of tested dairy cows with higher risks of problem with habituation to novel objects or during manipulation.

Key words: dairy cattle, novel object, on farm, temperament, test

Introduction

Temperament is usually defined as consistent behavioral differences in individuals over time and across contexts. These differences are inherited, appearing early after birth, and continuing throughout life (Réale et al., 2000; Petherick, 2005; Powell and Gartner, 2011).

Temperament as one of the functional traits in dairy cattle has ever greater importance worldwide. Importance of temperament in dairy cattle is based on its connection to milk production and quality. Animals with calm temperament have better milk yield and milking speed (Breuer et al., 2000; Sewalem et al., 2011). Cziszter et al. (2016) suggested connection of temperament and fat yield, protein yield, protein content as well as calving interval in Simmental cows. Sewalem et al. (2011) reported correlation between bull estimated breeding value for milking temperament and wide range of reproduction traits in Canadian Holsteins. Individual differences in behavior related to temperament can also affect animal welfare (Müller and Schrader, 2005; MacKay et al., 2014; Finkemeier et al., 2018).

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Trait temperament can be measured by variety of methods: the novel object test (NOT), human approach test, open field test, test of behavior in restriction, handling test etc. (Forkman et al., 2007). Set of various measures are used in different tests, aggressiveness against handler, number of escapes, behavior response to human approach, touching cow from head to tail, activity and exploration in unknown arena etc. (Forkman et al., 2007; Finkemeier et al., 2018). Results of fear-based test can be difficult to understand because of many factors leading to the same activity. Test should be designed in accordance with biologically related situations. Novel arena/open field test in social species is affected by social motivation and should not be used for species which ancestors have evolved for open areas. Handling and restraining tests involve human presence therefore the level of fear toward humans and confidence to handler can affect the results. Reactions to novel objects can be influenced by conflicting emotions such as reactivity and investigatory (Le Neindre, 1989; Forkman et al., 2007; Gibbons et al., 2009). NOT should be performed in familiar environment, because reaction to new object can be influenced by reaction to novel environment (Schrader, 2002). The situation or fear-provoking stimulus should be as simple as possible. Problem with behavior of non-curious, indifferent or fearful animals can be solved in NOT by using forced approach. The most common behaviors recorded in NOT are the latency to the contact, distance from the novel object, frequency or duration of contact, exploration (licking, smelling), body posture and vocalization (Forkman et al., 2007; Gibbons et al., 2009; Hirata et al., 2016). Test designed for using on commercial farms should be restricted to behaviors which can be observed easily and described simply (Gibbons et al., 2009).

The stability of temperament in different tests and heritability of temperament related trait is appropriate for use this trait in selection by progeny testing (Lawstuen et al., 1988; Gauly et al. 2002; Miglior et al., 2017; Finkemeier et al., 2018; Guarini et al., 2018). Because no objects can be novel on repeated exposure the repeatability and intra-stability of NOT with same object is questionable. NOT should be repeated only with new and different objects (Gibbons et al., 2009; Hirata et al., 2016).

The aim of the present study was to design and check simple method of an on farm estimation of temperament by the novel object approaching test. It was expected that the group of tested dairy cows would be divided into subgroups with different types of temperament based on the test results.

Materials and methods

Animals and housing

The study was conducted at commercial dairy cattle farm in Kozarovce, Slovakia. Fifty-three Simmental dairy cattle in average 377.49 days in milk (DIM), SD = 82.83 DIM and average age 1930.51 days, SD = 687.58 days with mean milk yield 6754.1 kg, SD = 1490.6 kg (last standardized 305 days lactation) were involved in test. Eighteen cows were at first lactation, 35 were multiparous (7 at 2nd, 9 at 3rd, 9 at 4th, 4 at 5th and 2 at 6th lactation, 4 cows had unknown parity). Cows were housed in freestall housing system, milked twice a day at 04.00 and 16.00 h, and fed a corn silage based total mixed ration twice a day, after milking for *ad libitum* consumption.

Behavior test

The novel object was presented individually to each cow in the 11 m long and 1.83 wide passageway exiting milking parlor (Fig. 1). The passageway was familiar environment to the cows, they have been passing it twice a day during lactation period. The novel object in test was one red cycling light in flashing mode positioned approximately at cow eyes height at the end of the passageway behind the barrier. The dairy cow does not need to walk alongside the light, they just approach and turn and leave the corridor before the light. Cow noticed it immediately after entering passageway. The assistant stood out of cow`s sight and gently force cow to walk when cow stand longer than 20 s or failed to pass and attempt turn back to parlor. All procedures related to animals were performed in accordance with guidelines of the Slovak University of Agriculture Ethics Committee.

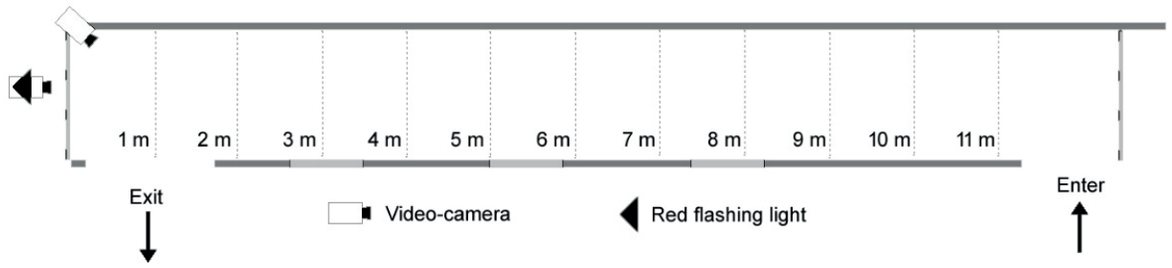

Figure 1 Testing facility for the novel object test

Data collection and behavior analysis

The cow`s behavior during test was recorded by two video-cameras. Camera 1 was placed at end of the passageway behind the barrier. Camera 2 was mounted at ceiling (Fig. 2). The flashing light was mounted at video-camera 1 tripod stand. The behavior was analyzed from video-records by the Noldus Observer XT 11.5 software. A coding scheme of two behaviors and one numeric modifier was used (Table 1).

Figure 2 Snapshot from both video-cameras recording behavior during approaching the novel object. Dairy cow ear tag # 096113846 is in the picture.

Table 1 Coding scheme used for behavior analysis with Noldus Observer XT

Code	Description
walking	movement from passageway enter toward the novel object
standing	stop, with all four legs on ground, head up (head is raised above the shoulders) or head down (head is below the shoulder height), Gibbons et al. (2009)
numeric modifier	distance of 1st stop

Statistical analysis

Because of recorded differences in walking speed in observed cows, the real duration of approaching (DA) the novel object was replaced by corrected duration of approaching (CDA). CDA was calculated from DA, number of stops and 1st stop distance by next formula:

$$CDA = DA * \left(1 + \frac{NS}{10} + \frac{DS1}{10}\right)$$

CDA - corrected duration of approaching in seconds.
DA - real duration of approaching in seconds.
NS - number of stops
DS1 - distance of the first stop in meters

No cow data correlated with behavioural traits and were omitted from the following analyses. Evaluation of differences among individual cows and dividing to groups with similar CDA was performed by k-means cluster analysis. Relation among measured traits used in behavior analysis was analyzed by correlation analysis (Pearson correlation coefficient, r). No All statistical analyses were performed with IBM SPSS version 26.

Results and Discussion

No cow was excluded because of extreme stress related behavior (MacKay et al., 2014). Thirty-six cows approached the novel object voluntary, 11 without any stop. Seventeen cows had to be forced by staff for approaching the novel object and passing corridor to stall. All cows were approaching the novel object by walking without change the pace, no one used trot, gallop or jump.

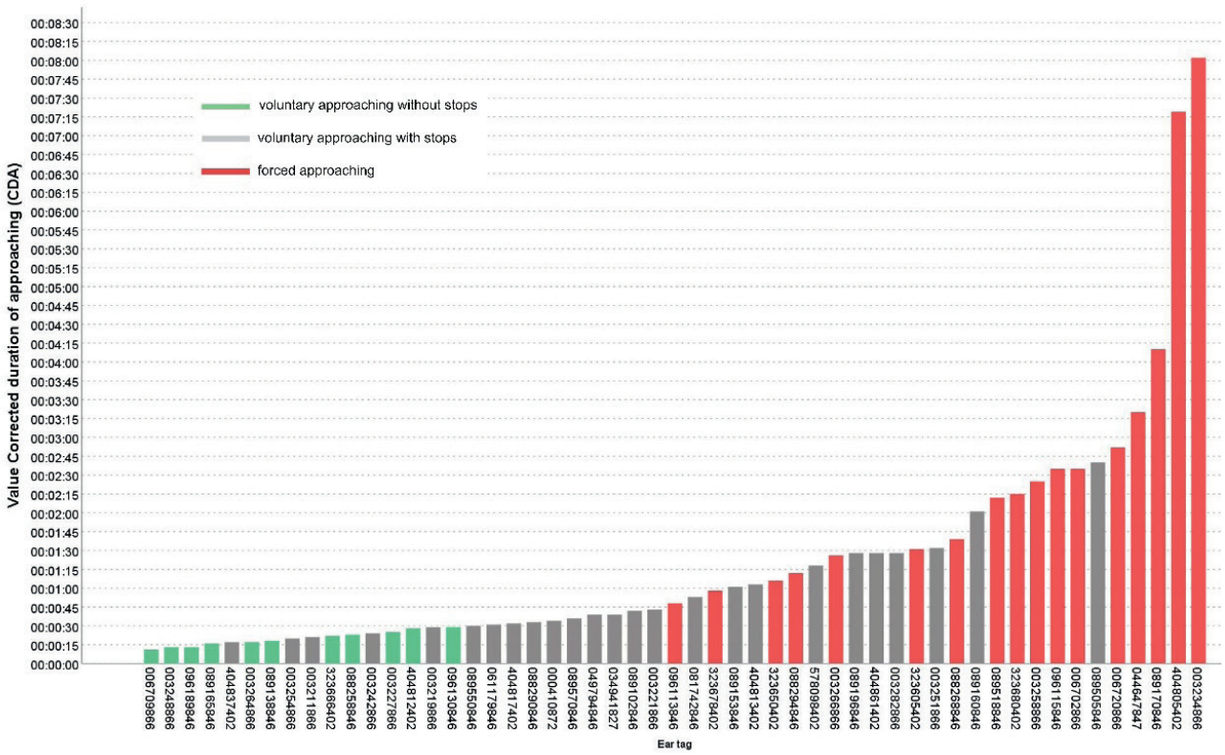

Figure 3 Distribution of corrected duration of approaching the novel object in tested dairy cows (n = 53)

Mean number of stops in voluntary passing cows was 2.04, SD = 1.1, in cows that had to be forced mean = 4.53, SD = 2.79. Mean distance of 1st stop in voluntary passing cows was 5.64 m, SD = 2.88 m, in cows that had to be forced mean distance was 9.06 m, SD = 1.71 m. Average CDA was 48 s and ranged from 11 s to 482 s. Distribution of CDA and way of approaching the novel object are displayed in Figure 3.

Flashing light has good visibility and did not initiate flight nor intensive aversive reaction in cows during testing like some sudden or more intensive stimulus, although Gibbons et al. (2009) does not recommend use of flashing light as novel object in NOT.

DA as well as CDA significantly correlates with the number of stops ($r = 0.635$, $P < 0.001$ resp. $r = 0.719$, $P < 0.001$) and distance of 1st stop ($r = 0.556$, $P < 0.001$ resp. $r = 0.593$, $P < 0.001$). Duration of test is very important from practice use on farm. Gibbons et al. (2009) forced cow to pass testing passageway if cow failed passing in 20 s. Because of correlation DA and 1st stop distance duration during pilot testing, test can be significantly shortened by forcing cow to leave testing passageway after 1st stop occurrence. Age, parity, DIM and milk yield did not correlate with any behavior data (r ranged from -0.21 to 0.252, $P > 0.05$). Group of tested cows was split to 4 distinctive clusters. Members of cluster 1 had calm type of temperament, cluster had 28 members, median CDA was 28 s (min 11 s, max 53 s). Twenty-seven cows voluntary approaching the novel object and all 11 cows approaching without stop was in cluster 1. Members of cluster 2 had curious type of temperament, cluster had 14 members, voluntary

approaching was recorded in 8 of them, median CDA was 87 s (min 58 s, max 121 s). Members of cluster 3 had vigilant type of temperament, cluster had 9 members, one cow approached voluntary, median CDA was 155 s (min 132 s, max 250 s). Members of cluster 4 had fearful type of temperament, and cluster had only 2 members, median CDA was 460 s (min 439 s, max 482 s). Only few authors used more simple differentiation of temperament type. Cassandro et al. (1999) described only two types – easy to handle and difficult to handle during milking. Dividing to 3 or more categories is more common. MacKay et al. (2014) described 3 types of temperament – neophobia or fear, vocalization and boldness. Cows in our test did not vocalize but contacted the floor with nose during stops. Graunke et al. (2013) found 4 types of temperament - neophobic/fearful – alert, interested – stressed, subdued/uninterested – calm and neoophilic/outgoing – alert. Gauly et al. (2001) divided individuals to 5 types – calm, slightly nervous, nervous, excited and very excited.

Testing showed good temperament in 79.2% of cows and discovered inappropriate type of temperament in 2 (3.8%) of tested dairy cows with higher risks of problem with habituation to novel objects or during manipulation. Cassandro et al. (1999) identified 4.9% individuals with problematic type of temperament. Other authors presented good temperament in smaller part of tested individuals, from 19.67% to 52.38% (Kilgour, 1975; Graunke et al., 2013).

Conclusions

Results of testing suggested evident differences in reaction to the novel object among individual cows. Tested cows displayed an appropriate spectrum of behavioral responses to flashing light, applicable and safe to use for testing the temperament in a commercial farm condition. Accordingly, presented test is simple and suitable for on farm assessment.

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PROCJENA TEMPERAMENTA MLIJEČNIH KRAVA ODGOVOROM NA NOVI OBJEKT

Sažetak

Cilj ovog rada je razviti farmski test za procjenu temperamenta farmi u mliječnih goveda na temelju individualnih razlika u ponašanju tijekom pristupanja novom objektu. Novi objekt bilo je crveno biciklističko svjetlo. Iz video zapisa snimljene su osobine ponašanja (trajanje hodanja i stajanja na stajalištima) kao i numerički modifikator (udaljenost zaustavljanja). Individualne razlike u ponašanju procijenjene su razlikama u trajanju približavanja novom objektu. Zbog razlika u brzini hodanja kod krava, korigirano trajanje približavanja (CDA) izračunato je iz stvarnog trajanja približavanja novom objektu, broja zaustavljanja i udaljenosti prvog zaustavljanja. Skupina od 53 testirane krave podijeljena je u 4 različite grupe. Članovi klastera 1 bili su mirnog tipa temperamenta, klaster je imao 28 članova, medijan CDA bio je 28 s (min 11 s, max 53 s). Članovi klastera 2 imali su čudan tip temperamenta, klaster je imao 14 članova, medijan CDA bio je 87 s (min 58 s, max 121 s). Članovi klastera 3 imali su budni tip temperamenta, klaster je imao 9 članova, medijan CDA bio je 155 s (min 132 s, max 250 s). Članovi klastera 4 imali su strašljiv tip temperamenta, a klaster je imao samo 2 člana, medijan CDA bio je 460 s (min 439 s, max 482 s). Rezultati su pokazali mogućnost mjerenja tipa temperamenta na farmi jednostavnim testom. Testiranje je otkrilo neodgovarajući tip temperamenta kod 2 testirane mliječne krave s većim rizikom problema u navikavanju na nove objekte ili tijekom manipulacije.

Ključne riječi: mliječna goveda, novi objekt, temperament, test

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