



MANIFESTATION OF PAIN IN DAIRY COWS WITH REFERENCE TO ENTERIC METHANE EMISSION

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Introduction: In intensive production, dairy cows are often exposed to situations in which pain occurs, such as claw diseases and mastitis, calving and various veterinary and zootechnical interventions. Impaired health status and the presence of pain in dairy cows can directly or indirectly influence the increase in enteric methane formation (Džermeikaitė et al., 2024).

One of the essential components of good animal welfare is the recognition and control of pain (Mainau et al., 2022; Tschoner et al., 2024). Pain assessment in animals can be done either by measurement of general body functions, physiological responses, or behavior (Weary et al., 2006). Since cows are natural prey animals, they can endure long periods of time and hide their pain to avoid attracting the attention of predators (Hudson et al., 2008). The strong pain-masking behavior in cows is related to a higher pain threshold compared to other animal species (Tschoner et al., 2024). When signs of pain become noticeable, the animal is often in a condition that is difficult to remedy.

Objectives:

1. to assess the presence of pain in cows
2. to measure the emission of enteric methane in cows, and
3. to determine relationship between the amount of enteric methane, the age, the health status of the cows and the behavioral signs of pain i.e. pain scores.

Methodology:

The study was conducted on 120 Holstein-Friesian cows kept in a tie-stall barn.

Data on the age of the cows and health status i.e. recent illness were taken from farm records.

The Cow Pain Scale (Gleerup et al., 2015; 2017) was used to assess whether the cow was in pain.

The guidance from the report by Leach and Whay (2009) was used to determine lameness in tied cows.

The final score was determined by evaluating the follows:

1. attention to surroundings,
2. head position,
3. ear position,
4. facial expression,
5. back position,
6. lameness, and
7. response to human approach.

These behaviors were recorded while the cow was standing, first from a distance and then on approach. They were scored on a scale from 0 to 2. The final score can be between 0 and 12. If the pain score is higher than 3 (5), it is assumed that the cow was experiencing pain.

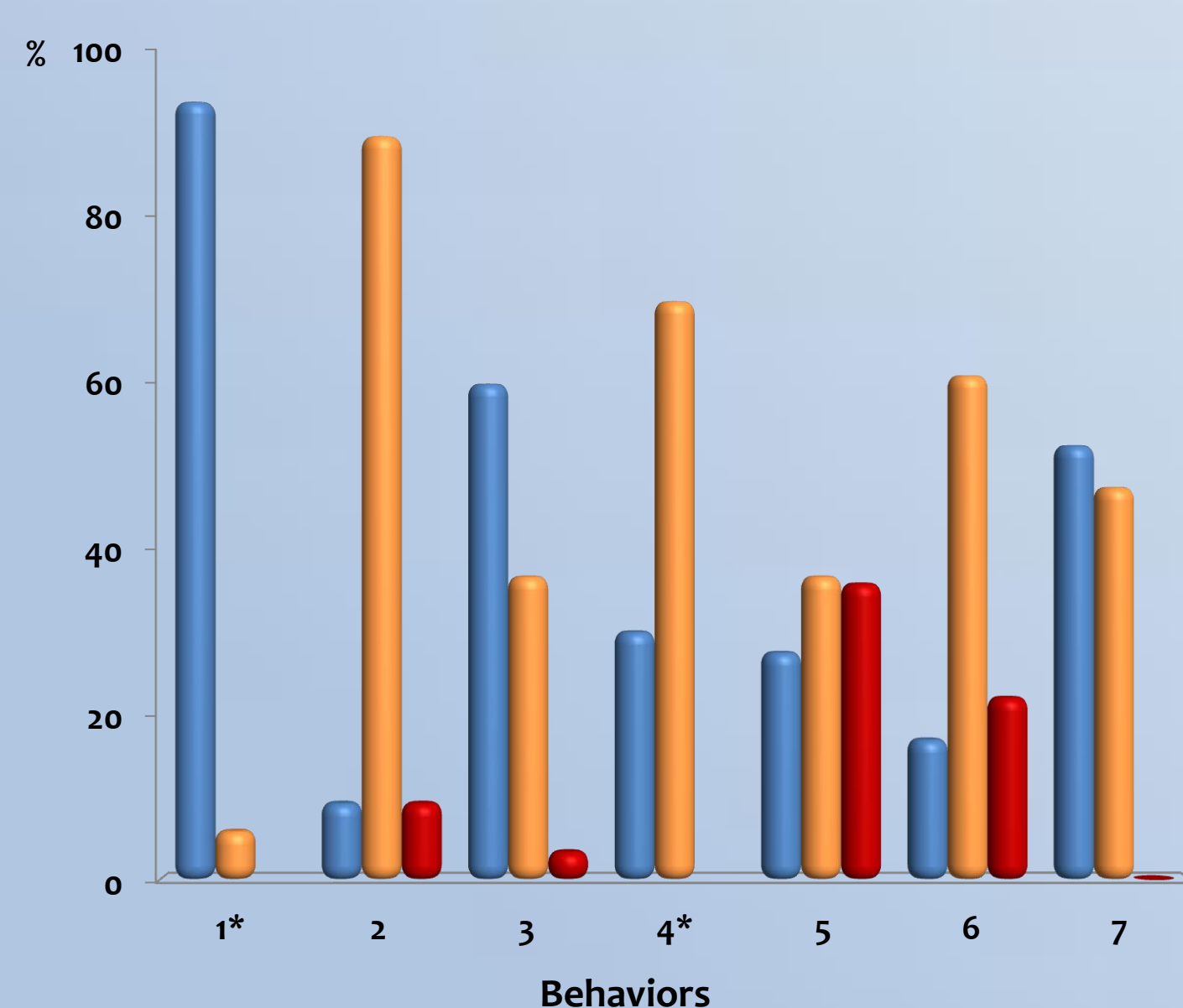
Excel and STATISTICA 10 (StatSoft, Inc.) were used for the data analysis. The correlation between the values of the analyzed parameters was examined.

Of the total number of cows, 36 had their enteric methane emissions measured using the "Laser Methane mini" methane gas detector (Tokyo Gas Engineering Solutions, Japan). The publications of Niero et al. (2020), Pinto et al. (2020), Grešáková et al. (2021), and Sorg (2022) were used for the preparation of the measurement protocol and the processing of the sample data.

The methane measurement was carried out on the same day after the cows' behavior had been assessed using the cow pain scale, and it was the two hours after the morning meal distribution.



Results and Discussion: Gleerup et al. (2015) used a score of more than 3 as an indicator of cows in pain; however, according to Gleerup et al. (2017), a score of more than 5 indicates pain. In this study, the pain score was higher than 3 in 75.83% of the cows and higher than 5 in 31.67% of the cows observed. The Cow Pain Scale was originally developed for cows kept in loose housing and we have applied the method to tethered cows.



1- attention to surroundings; 2 - head position; 3 - ear position; 4 - facial expression; 5 - back position; 6 - lameness; 7 - response to human approach.
* behavior can only be rated 0 or 1; all other behaviors are scored 0, 1, or 2.

Graph. 1. Ratings for the cows' behavior in connection with pain

Table 1. Ratings of pain scores

| Score | % |
|-------|-------|
| 0 | 0.83 |
| 1 | 3.33 |
| 2 | 5.83 |
| 3 | 14.17 |
| 4 | 16.67 |
| 5 | 27.50 |
| 6 | 13.33 |
| 7 | 11.67 |
| 8 | 5.83 |
| 9 | 0.83 |

Among the behavioral changes, lower head posture was observed most frequently (in 90% of the cows) and less frequently (in 5.83%) a lack of attention to the surroundings. Cattle in pain often appear dull and depressed, hold their heads low, and show little interest in their surroundings (Hudson et al., 2008). In our study, it was most frequently observed that the cows paid attention to their surroundings (94.17%), and this correlated positively and significant ($p < 0.05$) with the pain score. Positive significant correlations were also found between other parameters, as is shown in table 2.

The amount of methane measured was significantly positively correlated with the posture of the cow, i.e. the appearance of the back line ($p < 0.05$). In 83.05% of the cows the back was arched and in 47.46% of the cows both an arched back and other signs of lameness were observed (repeated weight shifting between feet, standing on the edge of a step, resting one foot more than another, turning feet from the line parallel to the midline of the body). In our study, the most common diagnosis in cows was related to claw disease (in 62.90% of cows). Our results confirm that lameness-related discomfort in dairy cows can alter methane emissions (Mostert et al., 2018).

Head position very low (score 2)

Tense expression: tension of the muscles above eyes (score 1)

Low ears (score 2)

Tense expression: tension of the muscles (score 1)

Tense expression: strained nostrils (score 1)

Arched back, lame cow (score 2)

Tense expression: increased tonus of the lips (score 1)

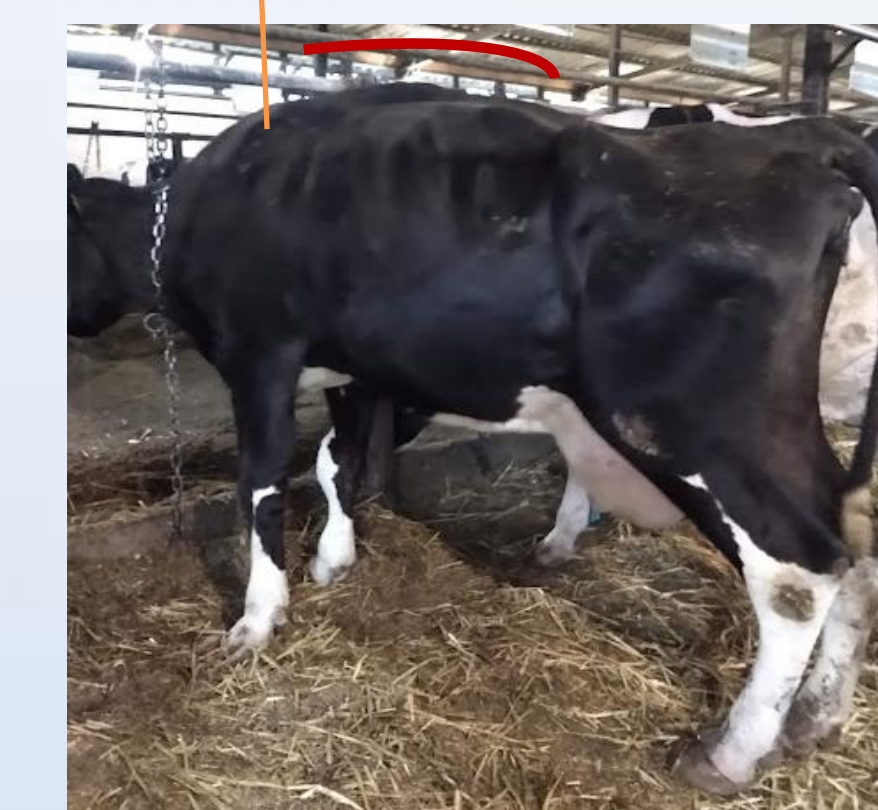


Table 2. Spearman correlation coefficients, correlation strength and significance's value for all parameters except enteric methane quantity

| Parameters | Spearman R | p- value |
|--------------------------------------|------------|----------|
| Age & Facial expression | 0.35 | 0.000 |
| Age & Back line | 0.32 | 0.000 |
| Age & Lameness | 0.24 | 0.009 |
| Age & Pain score | 0.29 | 0.002 |
| Attention & Ear position | 0.24 | 0.007 |
| Attention & Pain score | 0.22 | 0.015 |
| Head position & Response to approach | 0.19 | 0.034 |
| Head position & Pain score | 0.41 | 0.000 |
| Ear position & Pain score | 0.31 | 0.001 |
| Facial expression & Back line | 0.29 | 0.001 |
| Facial expression & Lameness | 0.25 | 0.007 |
| Facial expression & Pain score | 0.54 | 0.000 |
| Response to approach & Pain score | 0.45 | 0.000 |
| Back line & Lameness | 0.61 | 0.000 |
| Back line & Pain score | 0.62 | 0.000 |
| CH ₄ & Back line | 0.45 | 0.006 |

Conclusion: The results suggest that certain changes in cow behavior may have multiple clinical significance. Knowledge of the behavior that indicates pain can contribute to the timely treatment of the animal or to the elimination of the causative factors and thus to a better welfare of the animal. Further research is needed both for pain assessment in tied cows and to investigate the relationship between methane emission and certain health conditions.

Acknowledgement: This work was supported by the Science Fund of the Republic of Serbia, project "Mitigation of methane production from dairy cattle farm by nutritive modulation of cow's metabolism – MitiMetCattle" No 7750295.

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