DOI: 10.22620/agrisci.2025.45.003

Study on the behaviour of Holstein cows during milking

Svetoslav Karamfilov* (ORCID NUMBER: 0000-0002-1135-4731)**, Yordan Kanev**

Agricultural University – Plovdiv, Bulgaria
***Corresponding author: steven.k@au-plovdiv.bg**

Abstract

The aim of this study was to analyse the milking temperament of 382 cows of the Holstein cattle breed reared in two farms on the territory of Southern Bulgaria. The study was performed in two consecutive years: 2023 and 2024. It included cows in their first to fifth lactation whose behaviour was assessed between 40 and 160 days after the beginning of lactation. The cows were milked either in a herringbone milking parlour or with a central milk pipeline and their temperament was rated in a scale from 1 to 5 according to the scoring system. The temperament of the Holstein cows in the current study have an average score of 2.55 ± 0.10. The highest parameter variation was observed in cows at the first lactation – 3.34 ± 0.13. The observed trend indicated that with each consecutive lactation, the cows milking temperament became calmer in either of used milking technologies. A score of 1 and 2 have been assigned to 22.89% of the cows at the first lactation. The milking technology did not have a significant effect on the parameter examined. The father ($p < 0.05$) and the lactation number ($p < 0.001$), on the other hand, had a significant effect on the temperament of the Holstein cows.

Keywords: Holstein, temperament, milking parlour, central pipeline

INTRODUCTION

The importance of cows milking temperament assessment increases in view of the efficiency of their rearing, welfare and humane treatment (Mincu et al., 2021; Marçal-Pedroza et al, 2023). Currently, the parameter assessment is performed by different methods and techniques with the tendency towards standardization and introduction as a compulsory element in the breeding programs (Jaśkowski et al., 2023). A number of studies have proved the advantage of the selection of calmer animals for the dairy cattle breeding as they have higher productivity and are serviced easily (Radu et al., 2023; Antanaitis et al., 2021). The temperament is influenced by many factors, however, one of the major ones is the breed (Olson et al., 2019; Costilla et al., 2020). The mapping of Holstein genome revealed loci (QTL) connected with the animal behaviour (Hiendleder et al., 2003). The temperament is the individual attitude of the animal towards production environment and has a direct genetic connection with the productivity, reproduction and commercial use (Friedrich et al., 2015). One approach to assessing behavior in dairy cattle breeding is observing their response during milking. However, their temperament in the milking parlor may differ from their typical behavior exhibited outside of it (Wethal & Heringstad, 2019). The heritability of this parameter plays a crucial role in selecting calmer animals, making them well-suited for efficient robotic milking (Chen et al., 2020; Nino Rodriguez et al., 2023).

MATERIALS AND METHODS

The milking temperament of 382 cows of the Holstein cattle breed reared in two farms on the territory of Southern Bulgaria was analysed. The study was performed in 2023 and 2024. It included first to fifth lactation cows. The

behaviour was assessed between 40 and 160 days after the beginning of their lactation. The cows whose temperament was compared were milked either in a herringbone milking parlour (314 cows) or with a central milk pipeline (68 cows). The temperament was reported once during milking by means of a score from 1 to 5 in compliance with the generally accepted parameter evaluation methods in dairy cattle farming established by the Global Standard for Livestock data (ICAR), and by the approved Holstein breeding practices in the country. The temperament assessment was performed on the basis of a visual observation of the reactions and the behaviour of the animals upon milking and manipulations. This includes their reaction during udder washing (teat disinfection), drying, attaching the claw, milking, removing the claws and sealing (teat disinfection with a sealing product). The scores used to evaluate cow behaviour have specific characteristics. Score 1 – Very calm: do not show any nervousness, extremely calm and docile upon preparation and during milking. Score 2 – Calm: remain calm and docile at the milking spot, do not exhibit nervousness upon preparation and milking, but may frequently move and shift their weight, show slight nervousness. Score 3 – Moderately calm: generally calm but move frequently, they may sometimes lift their limbs during preparation and milking but do not kick, they often flick their tail or look restless. Score 4 – Nervous: they seem very restless upon preparation and milking, they sometimes kick the milking equipment, most of the time there is a more intensive leg activity, they flinch when a hand is reached out to them. Score 5 – Very nervous: very restless upon preparation and milking, they lift their legs, kick the equipment and the milker, there is stepping, flicking and moving at the milking spot, they react or withdraw when approached.

The data were processed via analysis of variance and the linear model has the following statistical expression: $Yijкl = \mu + Ai + Dj + Fk + eijk (l)$ where: Yijk- observation vector; μ- total average constant; Ai, Dj, Fk- fixed effects of the number of lactation (i=5), manner of milking (j=2), the father (k = 18); e- residuals. The data were statistically processed via SPSS (IBM, ver. 21).

RESULTS AND DISCUSSION

The temperament score of the Holstein cows subject in the study was 2.55 ± 0.10 on average. (Fig. 1)

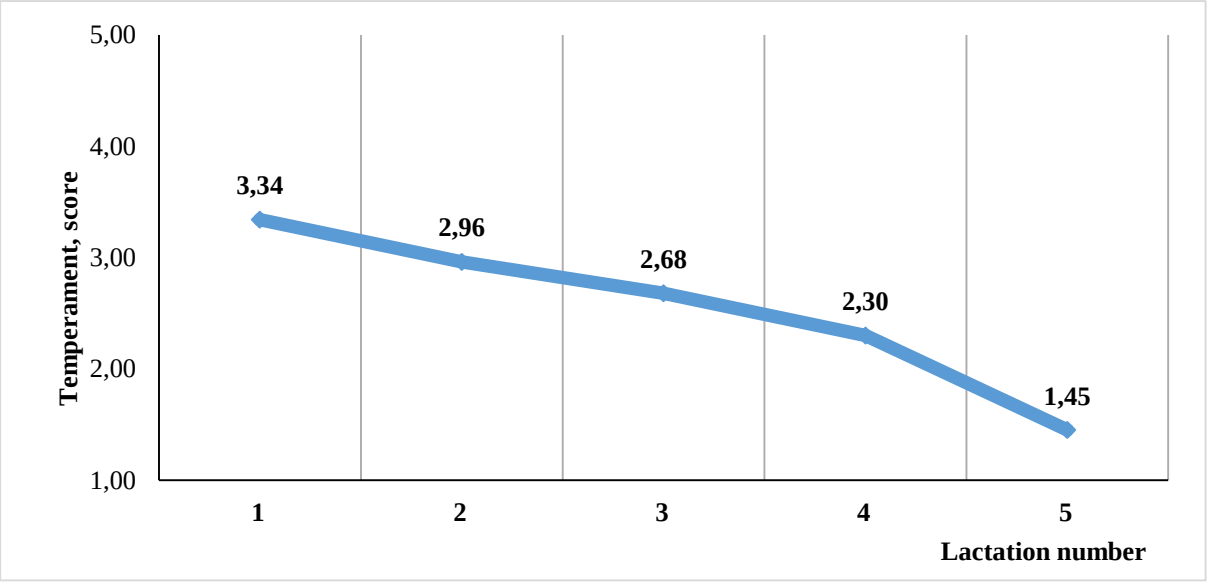

Figure. 1. Temperament of Holstein cows during different lactations

In terms of the lactation number, a wider variation of the parameter was observed with reference to the cows at their first and second lactation, and the lowest variation - with reference to the cows at their fifth lactation. The first-calf heifers were most nervous upon milking, while the fifth-lactation cows were the calmest, with the score difference between the two groups being 1.89. Sawa et al. (2017) reported similar results. According to the authors, the first-lactation Holstein cows had higher temperament scores, and the parameter correlated ($p \leq 0.01$) with functional traits such as milking speed, survival rate until the second lactation as well as with the cull cows level. The temperament score of the first-calf heifers from the same study was 0.38 higher when compared with the cows at their second lactation. It has been observed that the application of machine milking in first-calf heifers prior calving has a beneficial effect on the temperament and considerably reduces the stress at the beginning of the lactation (Ujita et al., 2021; Kutzer et al., 2015). Current study reported a negligible score difference between the second and the third lactation and it can be concluded that these two age groups have similar behaviour during milking. The tendency observed in the current study implied that with the increase of the lactation number (age), the temperament score decreased, and thus the older cows were calmer upon milking. They did not step or kick when the milking device was attached or during the milking process itself. According to Szentléleki et al. (2015), the milking temperament of older cows upon pre-milking udder preparation is connected to the milking speed: the milk release process in nervous cows is slower ($F = 9.102$, $df = 1$, $p = 0.003$). The fourth-lactation cows in the current study had a 0.66 lower score when compared with the second- lactation cows and a 1.04 lower score when compared with the first-lactation cows. The older cows at their fifth lactation had a calmer temperament with a score 1.51 lower when compared with the second-lactation cows and 1.23 calmer temperament than that of the third-lactation cows. The difference in the parameter with reference to the fourth- and fifth- lactation cows was 0.85. Broucek et al. (2021) claimed that the first-calf heifers behavior in the milking parlour is affected by the manner of their rearing during milk-fed period. The calmer cows ($p \leq 0.05$), had a higher milking speed of 2.36 kg/min in comparison with the more restless ones which had a milkability of 2.28 kg/min (Radu et al., 2023). In the current study 33.98 % of the first-calf heifers were more temperament and scores 4 and 5 (Table 1). The calmer animals from the same age category which had scores 1 and 2 were 22.89%. Gergovska et al. (2012) reported that during milking, 15.9% of the evaluated Holstein cows and 12.2% of the Brown cattle breed have the scores 1 and 2.

The first-calf heifers which received a score of 3 and 4 accounted for 70.58 %, and those with scores 1 and 5 only 7.87%. The results with reference to the second-lactation cows were similar to those about the preceding lactation period and the evaluated cows which received scores 2 and 3 reached 82.50 %.

Table 1. Milking temperament of Holstein cows during different lactations.

Lactation number	**N**	**Score, temperament** (%)				
		1	***2***	***3***	***4***	***5***
1	153	0.67	22.22	43.13	27.45	6.53
2	109	-	38.50	44.00	13.80	3.70
3	68	1.50	48.50	35.30	13.20	1.50
4	33	9.10	42.40	42.40	6.10	-
5	19	26.30	52.60	21.10	-	-

A tendency towards a score decrease could be observed as early as during the second lactation when the cows became more inclined towards an unproblematic machine milking without exhibiting reactions which slow the process down. No second-lactation cows received a score of 1, while those scoring 5 were 43.34% fewer than the first-lactation group with the same score. In contrast to the declining proportion of animals evaluated with higher scores, second-lactation cows with a score of 2 were 42.29% more than those in their first lactation but 20.62% fewer compared to third-lactation cows. The proportion of animals receiving a score of 4 remained identical for both second- and third-lactation cows. The third lactation cows with a score of 5 were 77.03% fewer than those at their first lactation. The number of cows from the former group which were evaluated with a score of 1 were 55.33% more than the first-calf heifers, and the share of the cows with a score of 2 and 3 was 83.8%. No animals with scores of 4 and 5 were reported among the oldest cows. Most of the fifth lactation cows had scores of 1 and 2 - 79.9%. When compared with the first-calf heifers, the fifth lactation cows with scores 1 were 97.45% more. Most of the animals with a score of 1 were at their fourth or fifth lactation. The manner of milking did not have a significant influence on the temperament of the Holstein cows. There were not significant differences between milking in a milking parlour or by a central milk pipeline (Fig. 2). A wider variation of the parameter with reference to both manners of milking was observed in the first and second lactation cows.

In the current study, the first lactation Holstein cows milked with the central milk pipeline had a score which was 0.21 higher in comparison to those milked in a milking parlour. The second and third lactation cows did not display a significant difference in the milking temperament within the age group. The fourth lactation cows exhibited a negligible difference upon milking with a central milk pipeline and had a temperament score 0.67 higher than cows milked in a milking parlour. The milking technology influenced both physiological and behavioral reactions of the cows. With a central milk pipeline, the milker had a direct contact with the animals and his/her treatment affected cows' behaviour (Santos et al., 2020). The fifth lactation cows did not show difference in the temperament depending on used milking technologies.

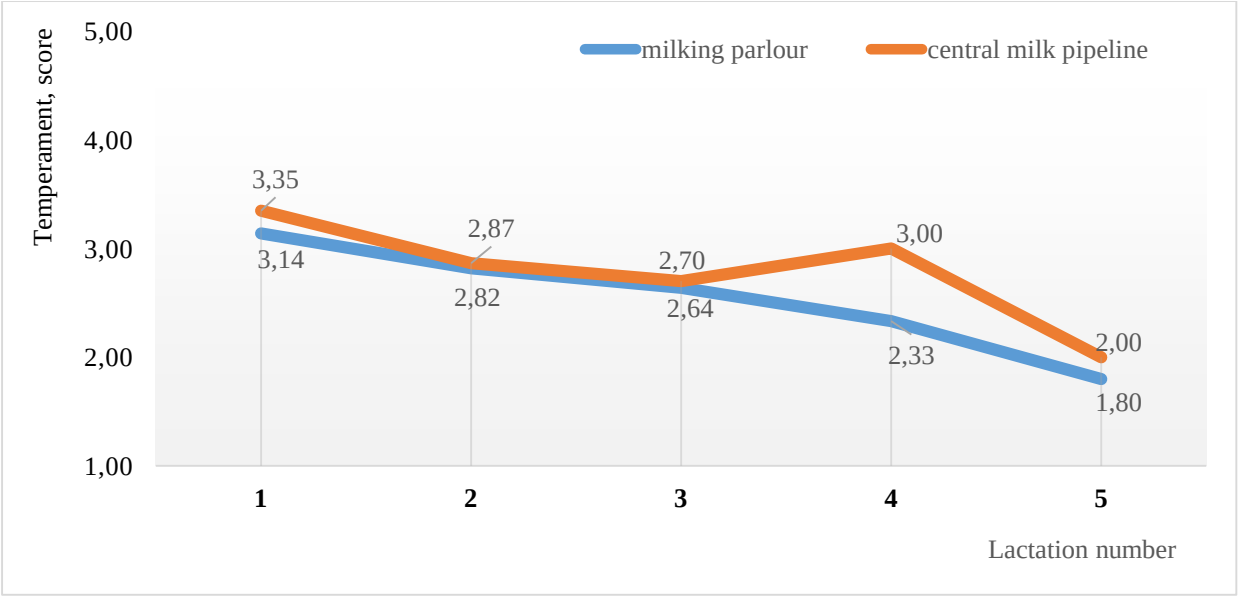

Figure 2. Temperament of Holstein cows upon application of different milking technology.

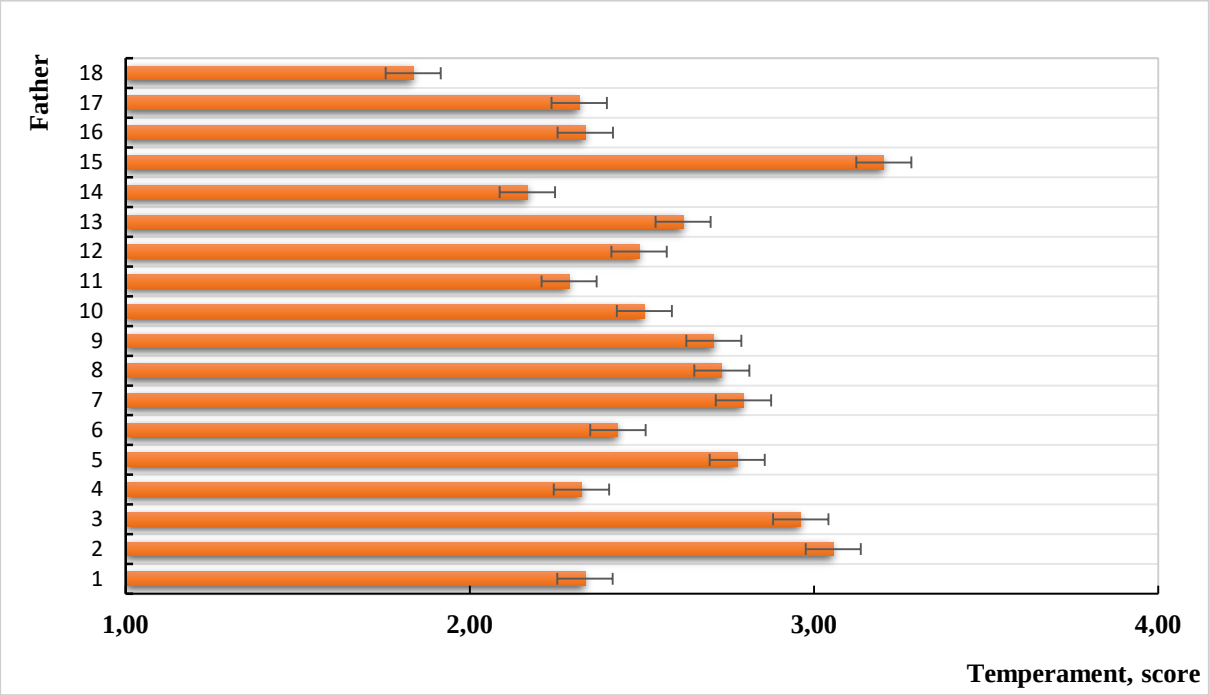

Figure 3. Influence of the father on the temperament of the Holstein daughters.

The cows milked in a milking parlour with a score of 1 were 2.22%, 34.71% received a score 2, and score 4 and 5 was assigned to 21.33% of the cows. A score of 1 and 2 were given to 39.70% of the cows milked with a central milk pipeline, and 23.52% of the cows received a score of 4 and 5. It was ascertained that between 8 and 12% of the cows in the milking parlour had a selective preference towards standing and milking from the right or the left side (Polupan et al., 2021).

The father also had a significant influence on the milking temperament of the daughters (Fig.3).

The daughters of 83.33% of the bulls studied were evaluated with an average milking temperament score between 2 and 3. Half of the bulls had daughters with an average score between 2 and 2.5. Two of the examined bulls had daughters with an average score above 3. The lowest parameter score of 1.83 ± 0.45 on average was reported with reference to the daughters of bull № 18, and the highest average score of 3.20 ± 0.35 with reference to the daughters of bull № 15. The highest parameter variation was observed in the daughters of bull №10, and the lowest - by those of bull № 2. The father ($p < 0.05$) and the lactation number (0.001) had a significant influence on the temperament of the Holstein cows (Table 2).

Table 2. Influence of different factors on the temperament of Holstein cows.

№	Factor	Temperament
1	Milking parlour	1.371
2	Father	1.664*
3	Number of lactation	7.343***

Legend: ***p<0.001; ** p<0.01; * p<0.05

In a similar study similar, Zhang Chi et al. (2018) found that the farm, the number and stage of lactation had a significant influence ($p < 0.05$) on the temperament. The complex selection by individual parameters concerning udder exterior, temperament upon milking with the use of automatic milking systems, and other parameters may well ensure a prolonged use of the cows (Dechow et al., 2020; Stephansen et

al., 2028). The use of specific temperament evaluation at bulls' selection may directly affect and enhance the qualities of the daughters. This will lay the foundations and create the prerequisite to search for connection between the temperament and other functional, productive or reproductive features which are directly connected to the rearing efficiency of a particular breed in a certain production environment.

CONCLUSIONS

The temperament of the cows subject to the study was evaluated with an average score of 2.55 ±0.10. The highest variation of the parameter was reported with reference to the first-calf heifers which had scores of 3.34 ±0.13. There was a tendency for a decrease in the temperament score with the increase of the lactation number. With scores 1 and 2 were evaluated 22.89% of the first lactation Holstein cows. The milking technology did not have a significant influence on the temperament of the cows. The father ($p< 0.05$) and the number of lactation ($p < 0.001$) had a significant influence on the temperament of the Holstein cows.

REFERENCES

Antanaitis, R., Juozaitienė, V., Jonike, V., Čukauskas, V., Urbšienė, D., Urbšys, A., ... & Paulauskas, A. (2021). Relationship between temperament and stage of lactation, productivity and milk composition of dairy cows. *Animals*, 11(7), 1840. https://doi.org/10.3390/ani11071840

Broucek, J., Uhrincat, M., Kisac, P., & Hanus, A. (2021). The effect of rearing conditions during the milk-fed period on milk yield, growth, and maze behaviour of dairy cows during their first lactation. *Archives Animal Breeding*, 64(1), 69-82. https://doi.org/10.5194/aab-64-69-2021

Chen, S. Y., Oliveira, H. R., Schenkel, F. S., Pedrosa, V. B., Melka, M. G., & Brito, L. F. (2020). Using imputed whole-genome sequence variants to uncover candidate mutations and genes affecting milking speed and temperament in Holstein cattle. *Journal of dairy science*, *103*(11), 10383-10398. https://doi.org/10.3168/jds.2020-18897

Costilla, R., Kemper, K. E., Byrne, E. M., Porto-Neto, L. R., Carvalheiro, R., Purfield, D. C., & Hayes, B. J. (2020). Genetic control of temperament traits across species: association of autism spectrum disorder risk genes with cattle temperament. *Genetics Selection Evolution*, *52*, 1-14. https://doi.org/10.1186/s12711-020-00569-z

Dechow, C. D., Sondericker, K. S., Enab, A. A., & Hardie, L. C. (2020). Genetic, farm, and lactation effects on behavior and performance of US Holsteins in automated milking systems. *Journal of dairy science*, *103*(12), 11503-11514. https://doi.org/10.3168/jds.2020-18786

Friedrich, J., Brand, B., & Schwerin, M. (2015). Genetics of cattle temperament and its impact on livestock production and breeding–a review. *Archives Animal Breeding*, *58*(1), 13-21. https://doi.org/10.5194/aab-58-13-2015

Gergovska, Z., Miteva, T., Angelova, T., Yordanova, D., & Mitev, J. (2012). Relation of milking temperament and milk yield in Holstein and Brown Swiss cows. *Bulgarian Journal of Agricultural Science (Bulgaria)*, *18*(5).

Hiendleder, S., Thomsen, H., Reinsch, N., Bennewitz, J., Leyhe-Horn, B., Looft, C., & Erhardt, G. (2003). Mapping of QTL for body conformation and behavior in cattle. *Journal of Heredity*, *94*(6), 496-506. https://doi.org/10.1093/jhered/esg090

Jaśkowski, J. M., Jaśkowski, B. M., Herudzińska, M., Tul, O., & Ciorga, M.

(2023). Contemporary Knowledge on the Assessment of Temperament in Cattle and Its Impact on Production and Reproduction Including Some Immunological, Genetic and Metabolic Parameters. *Animals*, *13*(12), 1944. https://doi.org/10.3390/ani13121944

Kutzer, T., Steilen, M., Gygax, L., & Wechsler, B. (2015). Habituation of dairy heifers to milking routine—Effects on human avoidance distance, behavior, and cardiac activity during milking. *Journal of dairy science*, 98(8), 5241-5251. https://doi.org/10.3168/jds.2014-8773

Marçal-Pedroza, M. G., Canozzi, M. E. A., Campos, M. M., & Sant'Anna, A. C. (2023). Effects of dairy cow temperament on milk yield: a systematic review and meta-analysis. *Journal of Animal Science*, *101*, skad099. https://doi.org/10.1093/jas/skad099

Mincu, M., Gavojdian, D., Nicolae, I., Olteanu, A. C., & Vlagioiu, C. (2021). Effects of milking temperament of dairy cows on production and reproduction efficiency under tied stall housing. *Journal of Veterinary Behavior*, *44*, 12-17. https://doi.org/10.1016/j.jveb.2021.05.010

Nino Rodriguez, F. A., Lopes, M. A., Lima, A. L. R., Almeida J. G. D., Novo, A. L. M., Barbari, M., & NASCIMENTO, E. (2023). Correlations between milking characteristics and behavior of cows milked in robotic systems. *Semina: Ciências Agrárias (Londrina)***,** 44(5), 1683-1696. https://doi.org/10.5433/1679-0359.2023v44n5p1683

Olson, C. A., Carstens, G. E., Herring, A. D., Hale, D. S., Kayser, W. C., & Miller, R. K. (2019). Effects of temperament at feedlot arrival and breed type on growth efficiency, feeding behavior, and carcass value in finishing heifers. *Journal of Animal Science*, *97*(4), 1828-1839. https://doi.org/10.1093/jas/skz029

Polupan, I., Siriak, V., Stavetska, R., Babenko, O., & Mohammadabadi, M. R. (2021). Behaviour of cows in the milking parlour and its relationship with milk production and type of NA. *Iranian Journal of Applied Animal Science*, 11(4), 687–695. http:// doi.org/rep.btsau.edu.ua/handle/BNAU/7372

Radu, N. I., Ludovic, C. T., Silviu, S. I., Ciprian, M. V., Alexandru, M. E., & Ilie, D. E. (2023). Effects of temperament on milk related traits in Simmental dual-purpose cows. *JAPS: Journal of Animal & Plant Sciences*, *33*(4), 893-902. https://doi.org/10.36899/JAPS.2023.4.0682

Santos, H. P., de Oliveira Aiura, A. L., Gonçalves, G. A. M., Aiura, F. S., Ferreira, M., de Santana Alves, I. C., & Cunha, B. F. C. (2020). Behavioral and physiological responses of crossbred Holstein-Zebu cows and their interaction with the milker in two milking systems. *Journal of Animal Behaviour and Biometeorology*, 7(1), 1-5. http://dx.doi.org/10.31893/2318-1265jabb.v7n1p1-5

Sawa, A., Bogucki, M., Neja, W., & Krężel-Czopek, S. (2017). Effect of temperament on performance of primiparous dairy cows. *Annals of Animal Science*, *17*(3), 863-872. http://dx.doi.org/10.1515/aoas-2016-0085

Stephansen, R. S., Fogh, A., & Norberg, E. (2018). Genetic parameters for handling and milking temperament in Danish first-parity Holstein cows. *Journal of dairy science*, *101*(12), 11033-11039. https://doi.org/10.3168/jds.2018-14804

Szentléleki, A., Nagy, K., Széplaki, K., Kékesi, K., & Tőzsér, J. (2015). Behavioural responses of primiparous and multiparous dairy cows to the milking process over an entire lactation. *Annals of Animal Science*,

15(1), 185-195. https://doi.org/10.2478/aoas-2014-0064

Ujita, A., El Faro, L., Vicentini, R. R., Lima, M. L. P., de Oliveira Fernandes, L., Oliveira, A. P., & Negrão, J. A. (2021). Effect of positive tactile stimulation and prepartum milking routine training on behavior, cortisol and oxytocin in milking, milk composition, and milk yield in Gyr cows in early lactation. *Applied Animal Behaviour Science*, 234, 105205. https://doi.org/10.1016/j.applanim.2020.105205

Wethal, K. B., & Heringstad, B. (2019). Genetic analyses of novel temperament and milkability traits in Norwegian Red cattle based on data from automatic milking systems. *Journal of dairy science*, *102*(9), 8221-8233. https://doi.org/10.3168/jds.2019-16625

Wethal, K. B., Svendsen, M., & Heringstad, B. (2020). Are farmer assessed temperament, milking speed, and leakage genetically the same traits in automatic milking systems and traditional milking systems? *Journal of dairy science*, 103(4), 3325-3333. https://doi.org/10.3168/jds.2019-17503

Zhang Chi, Z. C., Luo YuXi, L. Y., Wang JiaYi, W. J., Chang Yao, C. Y., Li YuanTao, L. Y., Su YiTong, S. Y., & Wang YaChun, W. Y. (2018). Study on scoring method and influencing factors of temperament in dairy cows. *Acta Veterinaria et Zootechnica Sinica*, 49(3), 488-496.