WELFARE ASSESSMENT ON DAIRY CATTLE FARMS IN EASTERN CROATIA

Eberhart, N. L.; Krawczel, P. D.; Mijić, Pero; Gantner, Vesna; Gregić, Maja; Bobić, Tina

Source / Izvornik: **Biotechnology in Animal Husbandry, 2019, 35, 13 - 24**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.2298/BAH1901013E

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:151:926554

Biotechnology in Animal Husbandry 35 (1), 13-24 , 2019 ISSN 1450-9156
Publisher: Institute for Animal Husbandry, Belgrade-Zemun UDC 636.083'62'497.13
https://doi.org/10.2298/BAH1901013E

WELFARE ASSESSMENT ON DAIRY CATTLE FARMS IN EASTERN CROATIA

Nicole L. Eberhart[1], Peter D. Krawczel[1], Pero Mijić[2], Vesna Gantner[2], Maja Gregić[2], Tina Bobić[2]

[1]Department of Animal Science, University of Tennessee, Knoxville, Tennessee, USA
[2]Faculty of Agrobiotechnical Sciences Osijek, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia
Corresponding author: Peter D. Krawczel, krawczel@utk.edu
Original scientific paper

Abstract: The objective of this study was to evaluate the welfare status of high-producing Holstein dairy cows on commercial Croatian farms. Lying behavior data was collected from 278 dairy cows across four farms with varying milking parlors and housing systems in eastern Croatia for at least 3 days. Data loggers recording at 1-min intervals recorded behaviors: lying time (min/d), lying bout duration (min/bout), lying bouts (n/d) and laterality of lying. Acceleration data was summarized into lying behaviors for each individual cow. Health scores (udder cleanliness, locomotion, and hock injuries) were also assessed. The univariate procedure was used to generate mean lying behaviors and health scores by farm with a 95% CI. Mean lying time per farm ranged from 11.7 ± 2.7 to 10.4 ± 2.7 h/d. Prevalence of lame cows ranged from 28% to 50%. Heavily soiled udders ranged from 2% to 12%. Prevalence of left hocks with minor to major swelling ranged from 50% to 100%; prevalence of right hocks with minor to major swelling ranged from 45% to 100%. In conclusion, all farms assessed have opportunities to improve overall welfare through increasing udder cleanliness and reducing hock injuries.

Key words: dairy cows, assessment, welfare, hygiene, lameness

Introduction

The European Safety Food Authority (EFSA) published a series of scientific opinions on the state of welfare in dairy cows and assessments of risk associated with cow management and practices (EFSA, 2009). The opinions offer a science-based set of suggestions to further define how to protect the “Five Freedoms” of animal welfare including access to adequate stall space in order for cows to be able to rise and lie without any restrictions and regular monitoring of dairy herds for lameness. Apart from legislative and scientific incentive to improve and maintain adequate welfare standards on dairy farms, worldwide public perception of the industry provides additional motivation. In a recent study, 68% of surveyed

consumers in the United Kingdom reported wanting to know how their food was produced and 55 % had avoided purchasing some food products over welfare concerns (*Ellis et al., 2009*). In order to ensure that consumers have access to products from animals raised and maintained in adequate welfare conditions, effective systems of assessment need to be in place.

Animal-based assessments (such as evaluating udder hygiene, lameness, and hock injuries) are important in determining overall cow comfort and well-being on dairy farms and the impact of cow welfare on production. Poor udder hygiene negatively affects milk production by increased Somatic Cell Score (SCS) (*Schreiner and Ruegg, 2003; Seegers et al., 2003*). Cows with hock injuries are more likely to become lame (*Klaas et al., 2003*) which causes alteration in normal lying behaviors (*Ito et al., 2010*). Therefore, it is likely that cows with higher hock injuries and locomotion scores will have abnormal lying behaviors. Assessment of cow well-being on farms can benefit the cow as well as the producer. Lameness and hock injuries decrease on farms previously assessed when a second evaluation was requested by the farmer (*Chapinal et al., 2014*). This suggests that information collected on farms can be a useful tool for producers and managers to make changes to facilities and practices in order to improve overall cow welfare.

The objective of this study was to assess the welfare status of high-producing Holstein dairy cows on commercial Croatian farms by collecting lying behavior, udder hygiene, lameness, and hock health data.

Materials and methods

The University of Tennessee Institutional Animal Care and Use Committee approved this project (approval number 2118-0812). Four commercial dairy farms across eastern Croatia were used for this study. Lying behavior data was collected from 81 cows on farm 1, 93 cows from farm 2, 42 cows from farm 3, and 62 cows from farm 4. Health scores were collected from 381 cows on farm 1, 213 cows from farm 2, 82 cows from farm 3, and 116 cows from farm 4 (representative of 30% of the cows housed with the farm defined “high” production pens). Cows in all stages of lactation were included in the study. Farms 1, 2 and 3 used free stall housing with mattresses while cows on farm 4 were loosely housed. All farms used straw as bedding, but quantity of straw used varied greatly. Parlor types varied across farms: farm 1 had 40 cow rotary parlor, farm 2 had a 24 double sided herringbone parlor, farm 3 used 6 automatic milking systems (4 were used to milk the “high” production cows), and farm 4 had a 20 double sided parallel parlor. Farms 1 and 4 milked twice daily, farm 2 milked three times daily except for late lactation cows, which were milked twice daily, and farm 3 cows had free choice for number of daily milkings. Farms 1, 2 and 3 had stocking densities below 100% stocking density while farm 4 was over 100%. All farms used DeLaval milking equipment (Tumba, Sweden) and fed total mixed ration two times per day.

Lying behaviors were collected with Hobo Pendant G data loggers (Onset Computer Corp., Bourne, MA) as previously validated (*Ledgerwood et al., 2010*) for a minimum of 3 days and summarized with a SAS code (AWP, 2013). Udder hygiene was assessed using a 4-pt scale with 0 indicating that fresh manure splashes covered <50 % of the udder and a score of 3 representing the entire udder covered in manure (*Schreiner and Ruegg, 2003*). Locomotion was evaluated using the NAMHS scoring system (NAHMS) with a score of 1 representing a sound cow, a score of 2 representing a moderately lame cow, and a score of 3 representing a severely lame cow. Hocks were scored on a 0-3 scale where 0 indicated no visible injury and a score of 3 indicated major swelling (*Fulwider et al., 2007*). Both right and left hocks were scored separately.

A proc univariate model was used (SAS 9.3, Cary, NC) to generate mean lying behaviors by farm with a 95% CI. Results are presented in means ± standard deviation. Frequencies of health scores were analyzed using chi square tables by farm and health score.

Results and Discussion

Mean total lying time on each farm was close to 11 h/d (Figure 1). Mean right side lying time on each farm was close to 5 h/d. Mean left side lying time on each farm was close to 6 h/d except on farm 3, which had a mean left side lying time of 4.9 h/d (Figure 1).

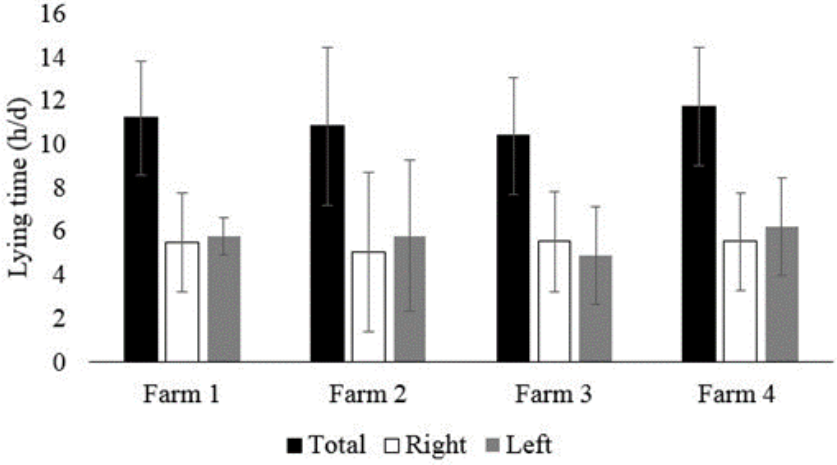

Figure 1. Mean daily lying time (h/d ± SD) by farm and cow side

Mean total lying bout duration ranged from 89.6 ± 67.2 (farm 2, Figure 2) to 58.5 ± 33.2 min/bout (farm 1, Figure 2). Mean total lying bouts ranged from 13.9 ± 6.4 (farm 1, Figure 3) to 9.1 ± 3.5 n/d (farm 2, Figure 3).

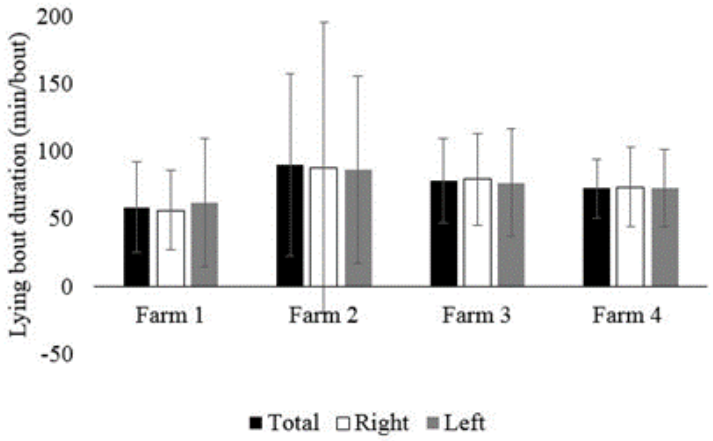

Figure 2. Mean lying bout duration (min/bout ± SD) by farm and by cow side

Farm 2 had the highest prevalence of cows with clean udders (89.7% clean) and farm 4 had the lowest prevalence (64.7 % clean; Figure 4) Farm 4 had more cows with heavily soiled udders (12.1%) compared to cows on farm 2 (1.88% heavily soiled; Figure 5).

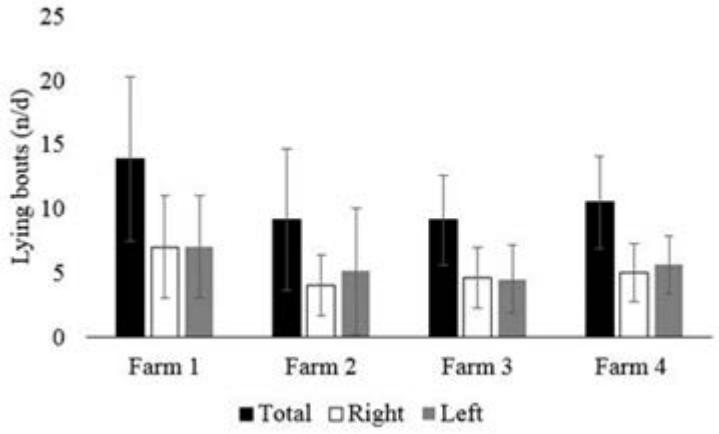

Figure 3. Mean daily lying bouts (n/d ± SD) by farm and cow side

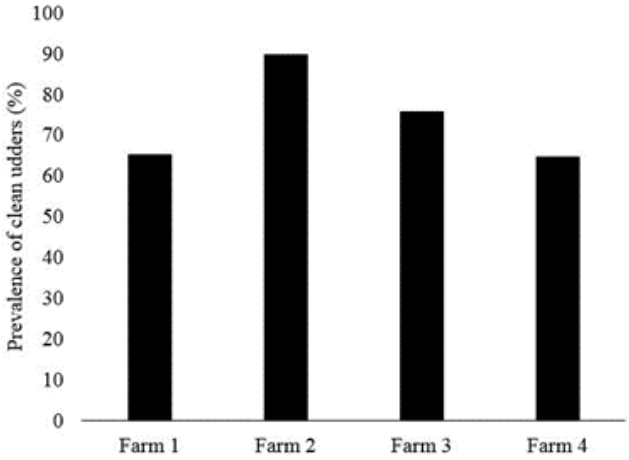

Figure 4. Prevalence of clean udders by farm

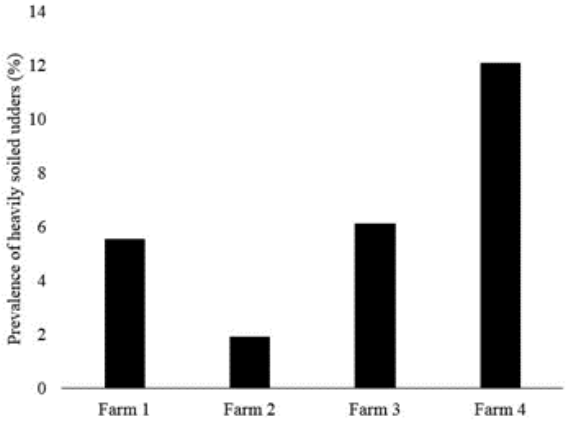

Figure 5. Prevalence of heavily soiled udders by farm

Lameness was most prevalent on farm 3 (50 % lame) and the least prevalent on farm 1 (28.4 % lame; Figure 6). Severely lame cows were most common on farm 3 (17.1 % severely lame) and the least common on farm 1 (5% severely lame; Figure 7).

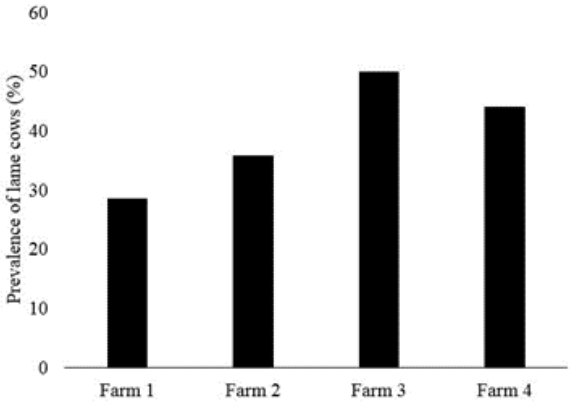

Figure 6. Prevalence of lame cows by farm

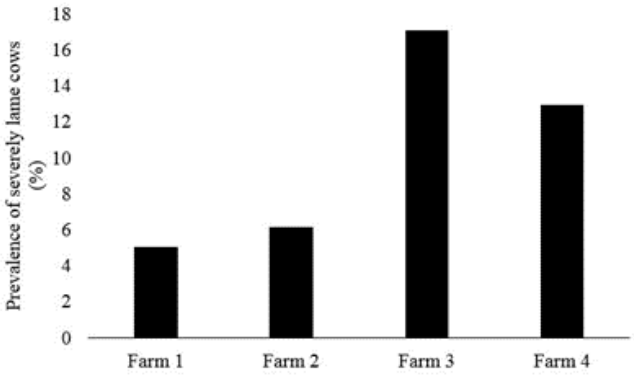

Figure 7. Prevalence of severely lame cows by farm

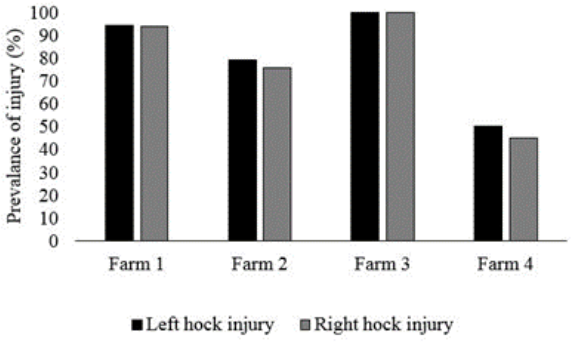

Figure 8. Prevalence of hock injuries by farm and side of injury

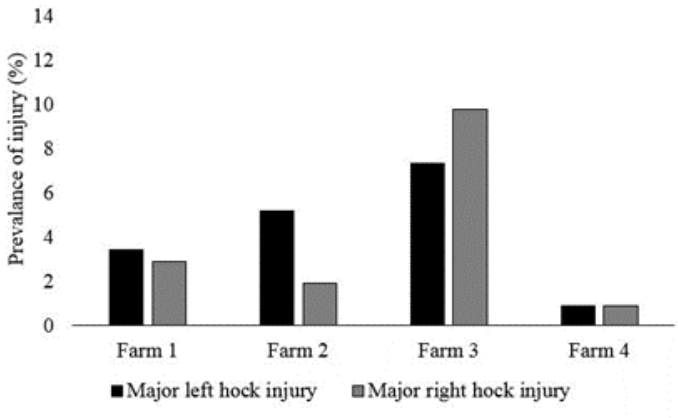

Figure 9. Prevalence of major hock injuries by farm and side of injury

Every cow scored on farm 3 had at least a minor left and right hock injury. Farm 4 had the lowest prevalence of left and right hock injuries (50% and 44.8 % injured, respectively; Figure 8). Farm 3 had the highest prevalence of cows with major hock swelling on both left and right hocks (9.8 % and 7.3 %, respectively). Farm 4 had the lowest prevalence of cows with major hock swelling on left and right hocks (Figure 9) with one cow having major swelling on both left and right hocks.

Cow welfare, by this approach, was assessed for the first time on Croatian dairy farms with free-stall or loosely housed systems. An assessment of the welfare state on Croatian dairy farms with tie-stall systems was previously conducted using visual assessments for cow behaviors as well as hygiene scoring (*Vučemilo et al.,*

2012). These authors found that cows in tie-stalls with rubber mattresses and partial access to pasture were more likely to be dirty than cows housed in tie stalls with straw bedding and without pasture access. A similar study was conducted in Macedonia on farms with tie-stall systems that found high prevalence of poor udder hygiene, hock injuries and moderate lameness (*Radeski et al., 2015*).

An observed daily lying time for commercial farms using free-stalls has been found to range from 9.5 to 12.9 h/d (*Ito et al., 2009*) and 10.5 to 11.9 h/d on free-stalls with mattresses among sound and lame cows (*Ito et al., 2010*). Lying behavior variation found on free-stalls farms can be a result of differing management practices and varying stall quality, in particular bedding quality and quantity (*Tucker et al., 2003; Fregonesi et al., 2007*). The farm with loosely housed cows (farm 4) averaged 11.7 ± 2.7 h/d of daily lying time. Average lying times found previously on bedded pack housing (which allows cows to freely move about) have ranged from 11.8 ± 0.5 h/d to 14.1 ± 0.3 h/d and indicate that cows will spend more time lying down in areas with larger open spaces (*Fregonesi and Leaver, 2001*). This is consistent with the behavioral response observed in the present study.

Cow averages for lying durations across farms are similar to average ranges of 65 to 112 min/bout previously reported across commercial dairy farms in Western Canada (*Ito et al., 2009*). Farm averages for lying bout are similar to the 7 to 10 bouts/d found on free-stalls (*Ito et al., 2009*) and 6.8-11.5 bouts/d on free-stalls and open yard facilities (Tolkamp et al., 2010). Comparing lying durations and lying bouts from the present study to previous work indicates while farm variation exists, there is little to suggest abnormal cow lying behaviors.

The prevalence of lameness assessed across all farms in this study (34.9 % of cows with locomotion scores of 2 or 3) was similar to the 36.8% (SE ± 1.3%) previously found on farms surveyed in England and Wales with both free-stall and deep stray yard housing types (*Barker et al., 2010*).

The prevalence of cows with dirty udders (27.3%) on farms in this study were lower than assessments conducted in Algeria on part time tie stall housing systems where 62.6% of cows had dirty udders and assessments in Macedonia on tie stall housing systems that found a prevalence of dirty udders to be 65.2% (*Benatallah et al., 2015, Radeski et al., 2015*). Part of this difference in udder hygiene differences could be due to the differences in housing types (tie stall vs. free-stall and loose housing). Dirty udders are a symptom of inadequate waste management, which results in an increased incidence of clinical mastitis (*Bartlett et al., 1992; Reneau et al., 2003*). Due to the relatively high prevalence of cows with dirty udders in the current study, cows from each assessed farm could be at a higher risk for developing clinical mastitis and diminished overall welfare.

Previous studies have found hock injury prevalence of 42% in British Columbia, 56% in California, and 81% in north-eastern United States (*von Keyserlingk et al., 2012*) on free-stall farms. The current study found that the farm with loosely

housed cows (50 % left side, 45% right side) had less prevalence of hock injuries than the free-stall farms (90% left side, 89% right side). The differences between prevalence of hock injuries on the farm with loosely housed cows and cows housed in free-stalls might be explained by the free-stall design on farms 1, 2 and 3. Previous studies have indicated that poorly bedded mattresses increases risk of hock injuries (*Fulwider et al., 2007*). Stalls that do not allow for proper range of rising and lying motion have been also been shown to increase risk of leg injuries, which lead to an increased likelihood of lameness (*Klaas et al., 2003*).

Conclusions

In conclusion, the prevalence of hock injuries, lameness, and severe lameness indicate that high-producing, lactating dairy cows in Croatia were not housed in environment that fit their needs. This demonstrates the potential for welfare issues related to physical structures within housing systems and the management of those systems. These data also indicate a systematic assessment program focused on identifying the causes of these injuries could lead to improvements in the welfare and productivity of dairy cows in Croatia. Furthermore, routine assessments are needed to evaluate the success of changes made to alleviate hock injuries and lameness.

Procena stanja dobrobiti na farmama za proizvodnju mleka u istočnoj Hrvatskoj

Nicole L. Eberhart, Peter D. Krawczel, Pero Mijić, Vesna Gantner, Maja Gregić, Tina Bobić

Rezime

Cilj rada bio je proceniti dobrobit visoko proizvodnih krava za proizvodnju mleka rase holštajn na komercijalnim farmama sa područja istočne Hrvatske. Podaci o ponašanju kod krava koji se odnose na ležanje u trajanju od najmanje 3 dana (d) prikupljeni su za 278 krava. Istraživanje je sprovedeno na četiri farme na području istočne Hrvatske s različitim izmuzištima i sistemima držanja. Uređaji za kontinuirano merenje (Data logger) u intervalima od 1 minuta (min) su snimali podatke o ponašanju krava koji se odnose na ležanje (vreme ležanja (min /d), interval ležanja (min/ležanju), interval ležanja (n/d) i preferirana strana tela za ležanje. Navedena svojstva kumulativno su prikazana za svaku pojedinu kravu. Za izračunavanje ukupnih prosečnih podataka o ponašanju za ležanje i zdravstvenih ocena po farmi sa 95% sigurnosti korišćena je PROC UNIVARIATE (SAS/STAT). Prosečno vreme ležanja po farmi kretalo se od 11,7 ± 2,7 do 10,4 ± 2,7 h/d.

Prevalenca šepajućih krava kretala se od 28% do 50%. Izrazito prljava vimena kretala su se od 2% do 12%. Prevalenca od manjih do većih otoka na skočnim zglobovima levih nogu bila je u rasponu od 50% do 100%, dok je kod desnih nogu ta vrednost iznosila od 45% do 100%. Može se zaključiti da sve ispitivane farme imaju prostora za poboljšanje ukupne dobrobiti, povećanjem čistoće vimena i smanjenjem povreda na zglobovima.

Ključne reči: mlečne krave, procena, dobrobit, higijena, šepavost

Acknowledgment

The authors would like to acknowledge G. Vučković for providing support for data collection in Croatia and A. Saxton for statistical advice. This endeavor was funded by a Fulbright Scholar grant awarded to Dr. Peter Krawczel and partially funded by USDA Hatch Funds.

References

AWP (2013): U. Ubc animal welfare program: Sop - hobo data loggers. University of British Columbia, Vancouver, Canada, pp. 1-23.

BACH A., VALLS N., SOLANS A., TORRENT T. (2008): Associations between nondietary factors and dairy herd performance. Journal of Dairy Science, 91, 3259-3267.

BARKER Z. E., LEACH K. A., WHAY H. R., BELL N. J., MAIN D. C. J. (2010): Assessment of lameness prevalence and associated risk factors in dairy herds in England and Wales. Journal of Dairy Science, 932-941.

BARTLETT P. C., MILLER G. Y., LANCE S. E., HEIDER L. E. (1992): Managerial determinants of intramammary coliform and environmental streptococci infections in Ohio dairy herds. Journal of Dairy Science, 75, 1241-1252.

BENATALLAH A., GHOZLANE F., MARIE M. (2015): Dairy cow welfare assessment on Algerian farms. African Journal of Agricultural Research, 10, 895-901.

CHAPINAL N., WEARY D. M., COLLINGS L., VON KEYSERLINGK M. A. G. (2014): Lameness and hock injuries improve on farms participating in an assessment program. The Veterinary Journal, 202, 646-648.

EFSA (2009): Scientific opinion of the Panel on Animal Health and Welfare on a request from European Commission on the overall effects of farming systems on dairy cow welfare and disease. Annex to the EFSA J. 1143, 1-38.

ELLIS K. A., BILLINGTON K., McNEIL B., McKEEGAN D. E. F. (2009): Public opinion on UK milk marketing and dairy cow welfare. Animal Welfare, 18, 267-282.
FREGONESI J. A., LEAVER J. D. (2001): Behaviour, performance and health indicators of welfare for dairy cows housed in strawyard or cubicle systems. Livestock Production Science, 68, 205-216.
FREGONESI J. A., VEIRA D. M., VON KEYSERLINGK M. A. G, WEARY D. M. (2007): Effects of bedding quality on lying behavior of dairy cows. Journal of Dairy Science, 90, 5468-5472.
FULWIDER W. K., GRANDIN T., GARRICK D. J., ENGLE T. E., LAMM W. D., DALSTED N. L., ROLLIN B. E. (2007): Influence of free-stall base on tarsal joint lesions and hygiene in dairy cows. Journal of Dairy Science, 90, 3559-3566.
ITO K., VON KEYSERLINGK M. A. G., LEBLANC S. J., WEARY D. M. (2010): Lying behavior as an indicator of lameness in dairy cows. Journal of Dairy Science, 93, 3553-3560.
ITO K., WEARY D. M., VON KEYSERLINGK M. A. G. (2009): Lying behavior: Assessing within- and between-herd variation in free-stall-housed dairy cows. Journal of Dairy Science, 92, 4412-4420.
KLAAS I. C., ROUSING T., FOSSING C., HINDHEDE J., SORENSEN J. T. (2003): Is lameness a welfare problem in dairy farms with automatic milking systems? Animal Welfare 12, 599-603.
LEDGERWOOD D. N., WINCKLER C., TUCKER C. B. (2010): Evaluation of data loggers, sampling intervals, and editing techniques for measuring the lying behavior of dairy cattle. Journal of Dairy Science, 93, 5129-5139.
NAHMS. NAHMS lameness detection video. https://www.youtube.com/watch?v=3bOpSrowaJA (March 3, 2016).
RADESKI M., JANEVSKI A., ILIESKI V. (2015): Screening of selected indicators of dairy cattle welfare in Macedonia. Macedonian Veterinary Review, 38, 43-51.
RENEAU J. K., SEYKORA A. J., HEINS B. J., BEY R. F., ENDRES M. I., FARNSWORTH R. J. (2003): Relationship of cow hygiene scores and SCC. Journal of Dairy Science, 86, 359-360.
SCHREINER D. A., RUEGG P. L. (2003): Relationship between udder and leg hygiene scores and subclinical mastitis. Journal of Dairy Science, 86, 3460-3465.
SEEGERS H., FOURICHON C., BEAUDEAU F. (2003): Production effects related to mastitis and mastitis economics in dairy cattle herds. Veterinary Research, 34, 475-491.
TOLKAMP B. J., HASKELL M. J., LANGFORD F. M., ROBERTS D. J., MORGAN C. A. (2010): Are cows more likely to lie down the longer they stand? Applied Animal Behaviour Science, 124, 1-10.

TUCKER C. B., WEARY D. M., FRASER D. (2003): Effects of three types of free-stall surfaces on preferences and stall usage by dairy cows. Journal of Dairy Science, 86, 521-529.
Von KEYSERLINGK M. A. G., BARRIENTOS A., ITO K., GALO E., WEARY D. M. (2012): Benchmarking cow comfort on north American freestall dairies: Lameness, leg injuries, lying time, facility design, and management for high-producing Holstein dairy cows. Journal of Dairy Science, 95, 7399-7408.
VUČEMILO M., MATKOVIĆ K., ŠTOKOVIĆ I., KOVAČEVIĆ S., BENIĆ M. (2012): Welfare assessment of dairy cows housed in a tie-stall system. Mljekarstvo 62, 62-67.

Received 16 October 2018; accepted for publication 10 January 2019