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MODERN
TRENDS
IN LIVESTOCK
PRODUCTION

PROCEEDINGS

11th - 13th October 2017 - Belgrade, Serbia

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INSTITUTE FOR ANIMAL HUSBANDRY
BELGRADE - SERBIA

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Proceedings of the 11th International Symposium
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DAIRY COWS HEALTH PARAMETERS IN DIFFERENT SEASON - AN WELFARE APPROACH

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Original scientific paper

Abstract: The aim of the research was to determine whether the frequency of certain injuries and diseases of cows as important parameters for ensuring their welfare varies considerably depending on the growing season (summer/winter). The research was conducted by Welfare Quality Assessment Protocol for Dairy Cows (2009) on total of 16 dairy farms (N=4.833 cows), wherein the provision of good health was descriptively categorized as unacceptable, acceptable, enhanced and excellent, according to calculated score (0-100 points).The air temperature of given location was recorded during each farm visit, so the average temperature of conducted assessment for specific season, served as additional indicator of dairy cows' thermal comfort. The results of the study showed that the effect of the season on the incidence of injuries and illness was not significant ($p > 0.05$), but certain disorders were more frequent in one of the seasons. In the summer season, mastitis (2.63%), diarrhea (2.31%), discharge from the eye and nose (6.24% and 1.69%) were more frequent, and in the winter season lameness (27.78%) , tachypnoea (0.13%), and vaginal discharge (1.73%). Relying on welfare standards, it can be concluded that the parameters tested do not represent an alarming risk for the welfare of raised animals with the exception of mastitis rates and ocular discharge in the summer period. However, the overall health of dairy cows in both seasons is considered acceptable (in average 40 from 100 points) indicating that only minimal requirements for ensuring well-being are met and that there is a need to improve the health situation. Given that related studies have shown a low level of protection of the comfort of the examined animals as well as its significant influence on the provision of thermal comfort and health of cows, the recommendations are directed primarily at ensuring appropriate conditions of keeping with adequate and continuous health control of the herd.

Key words: dairy cows, season, health, welfare, parameters, thermal comfort

Introduction

Cattle are known as species of domestic animals that are easily acclimatized and adapted to living conditions worldwide, of course with the provision of adequate nutrition, water supply, as well as simple but appropriate protection against excessive airflow, solar radiation and precipitation. However, many studies have shown that housing cows in unfavorable weather conditions negatively affects their health and therefore the welfare and productivity (*Shearer and Beede, 1990; West, 2003; Hristov et al., 2008, EFSA, 2009*).

Generally, it is considered that adult cows can much better cope with cold stress when sufficiently fed than with heat stress. This is especially true of cows in lactation due to their "stronger" metabolic profile (*Kadzere et al., 2002*). Weather conditions (temperature and air humidity) affect the survival and spread of microorganisms and thus the appearance of various infectious diseases of cattle depending on their specific and non-specific resistance as well as the climate in which they are reared (*Webster, 1981). Belić et al. (2010)* note that in the summer months, milk cows have an increase in rectal temperature with pronounced diurnal variations, tachypnoea, and decreased rumen contraction. In addition, changes in haematological parameters (reduction in the number of erythrocytes, leukocytes, hemoglobin and hematocrit) have been observed, indicating activated cooling mechanisms such as evaporation.

Early research on the health of dairy cows from the perspective of welfare provision in Serbia has shown that it can be rated as acceptable to enhanced, i.e., grades 3 to 4 on scale 1-4 (*Ostojić Andrić et al., 2016*). This estimation was somewhat better than those achieved on EU farms *(Welfare Quality Network, 2012)* probably derived as a result of also better estimated feed provision and lower milk yield e.g. lower selection pressure of cows in Serbia.

Speaking of health - weather relation in the assessment of the quality of dairy cows' welfare, we most often encounter the term provision of thermal comfort, which is commonly linked to temperature-humidity index-THI, as well as detection of thermoregulatory behavior *(Hristov et al., 2008)*. Since this may be complicated and still unreliable procedure *(Welfare Quality Consortium, 2009)*, we based this research on seasonal effect which generally represent aggregation of most important factors such are temperature, humidity, solar radiation, precipitation and air movement. The aim of the research was to determine whether the incidence of certain injuries and diseases of cows as important parameters for ensuring their welfare varies considerably from season to season.

Materials and Methods

The farms

The study was conducted on 16 selected Serbian commercial dairy farms (N=4833; Mean ± SEM: 301±71.6 lactating cows). The tie-stall farms-TSH (n=9) and loose housing systems-LHS (n=7) were selected according to management practices, farm size, veterinary records and availability of different information necessarily for assessment. Presence of the races were 80% and 20% for Domestic Simmental and Holstein Friesian cattle, respectively. All the tie-stall farms were closed, with solid flooring. The cows were kept on stalls with length between 140 cm and 240 cm, and width between 100 cm and 120 cm. Straw bedding was used in all of tie-stall farms (3 kg/head/day or less). The cows had access to outdoor loafing area in 4 tie-stall farms and pasture only on one farm (24 hours a day for 60 days a year). The farms with LHS were both closed and half opened, having cubicles (4 farms) or straw yards (3 farms) for the cows' rest. Straw bedding was used in the majority of the loose housing barns. The milking (automatic) was done in milking parlours, twice per day. In the warm season, the cows were pasturing on one farm for 12 hours a day for 210 days a year.

Information about weather condition in winter and summer season

In order to examine the impact of the season on selected parameters of quality of welfare, basic information on weather conditions during the winter and summer season in the year of research were also analyzed (2012). The summer season of 2012 was classified as extremely warm in the average seasonal temperature and many tropical days, while the winter season was on average cold with high precipitation *(RHMZ, 2012a; RHMZ, 2012b).*

Each farm was visited twice a year, in order to compare values of welfare parameters in two main, opposite seasons: winter and summer (cold and hot weather). During each farm visit, the air temperature of given location was noted *(RHMZ, 2012c).* This information, in further analysis calculated as average temperature of conducted assessment for specific season, served as additional indicator of dairy cows thermal comfort.

Welfare assessment and statistical analysis

In this study welfare assessment of the cows was done according to the Welfare Quality® Assessment Protocol for Cattle *(Welfare Quality Consortium, 2009)* in which detailed information about the methodology of assessment can be found. Protocol includes 4 four major welfare principles, 12 criteria and 29

measures that are used to obtained overall welfare assessment. This study however, was focused on principle providing of good health (PGH) assessed by evaluation of two corresponding criterions: absence of injuries (CAI) and absence of diseases (CAD). In order to obtain information about state of mentioned principles in two seasons, three trained assessors (experienced in cows' welfare assessment) evaluated the sampled cows on each farm.

Processing of data collected on the farms was carried out using the Welfare Quality® scoring system software program for the calculation of the scores for the welfare criteria and principles and for classifying the farms in a certain welfare category (not classified, acceptable, enhanced and excellent).

All statistical analyses were performed using Statistica for Windows version 8.0 (StatSoft, Inc. 2007, data analysis software system). Descriptive statistical indicators were determined (mean, standard error of the mean, standard deviation, minimal and maximal values) for the assessed measures, criteria and for the scores of the of selected welfare principles (good feeding and housing). The statistical significance of the seasonal effect on welfare (measures, criteria and principles of welfare) in the studied farms was determined by the t-test or the Mann-Whitney test, depending on the normal or abnormal distribution of the data, established with the Kolmogorov-Smirnov test. P values less than 0.05 were considered as significant.

Results and discussion

Within principle providing of good health (PGH), the assessment of the appropriate indicators listed in Table 1 the absence of injuries (CAI) and the absence of disease (CAD) were considered as criteria for assessing the quality of the welfare of dairy cows. It was found that the season did not exhibit a significant influence on any of the observed criteria as well as on the overall health state of the cows - PGH ($p>0.05$). However, within the CAI, a slightly higher incidence of laminitis in the winter season (38.6% versus 32.3%) was determined, which is consistent with the results of *Rowlands et al. (1983)* and can be explained by poor conditions of comfort in the winter season (*Ostojić Andrić et al., 2017*). Score of CAD was almost the same for both seasons, but diseases such as mastitis, lameness, diarrhea, nasal and eye irritation were more common in summer and accelerated breathing and vaginal discharge in the winter season.

Based on the recommendations of *Forkman and Keeling (2009)* on the frequency of these diseases from the aspect of well-being, it can be concluded that the health of dairy cows in both seasons is satisfactory and does not represent a factor of risk for welfare. The exception is the appearance of discharge from the eye in the summer season that exceeds the so-called alarm threshold of 6.0% and

can be due to eye irritation due to increased ventilation of objects during warm summer months *(Radostits et al., 1999).*

The frequency of mastitis in the summer months has also been increased in relation to the winter period and slightly exceeds the 2.25% warning threshold stated by *Forkman and Keeling (2009*). Increased frequency of mastitis in summer months was also found in studies by other authors (*Hogan et al, 1989; Shearer and Beede, 1990)*, as a result of higher resistance to microorganisms under given conditions and adaptive changes in the physiological status of cows that increase the disposition to inflammation (*Webster, 1981)* .

Table 1. Effect of season on provision of good health

Season	Winter					Summer					*F*
Number of farms, N	n=16					n=16					
Average temperature range (C˚)	-4.2 to 7.2					19.3 to 27.4					
Principle, criteria and indicators	$\bar{x}$	*SD*	S^2	*Min*	*Max*	$\bar{x}$	*SD*	S^2	*Min*	*Max*	
Principle: Good health (PGH)	40.93	8.63	74.45	23.90	56.60	41.41	7.83	61.38	26.30	55.20	ns
1. Criterion: Absence of injuries (CAI)	50.16	15.58	242.87	21.00	81.10	52.98	14.44	208.39	21.90	81.10	ns
Not lame cows, %	61.42	18.53	343.47	20.60	90.00	67.70	16.58	274.98	34.00	88.60	ns
Lame cows, %	27.78	14.62	213.85	6.98	61.80	25.23	13.12	172.15	9.20	51.00	ns
Severely lame, %	9.93	6.84	46.78	0.50	20.30	11.97	20.40	416.12	0.00	86.55	ns
Cows with at least one part of skin without hair, no lesion, %	17.14	14.42	208.02	0.00	56.70	18.47	18.71	350.04	2.40	73.68	ns
Cows with at least one skin lesion, %	6.37	7.13	50.86	0.00	30.00	6.62	6.99	48.81	0.00	29.82	ns
Cows without skin lesion, %	92.66	8.88	78.82	70.00	100.00	87.69	22.61	511.43	6.90	100.00	ns

Season	Winter					Summer					*F*
Number of farms, N	n=16					n=16					
Average temperature range (C˚)	-4.2 to 7.2					19.3 to 27.4					
Principle, criteria and indicators	$\bar{x}$	*SD*	S^2	*Min*	*Max*	$\bar{x}$	*SD*	S^2	*Min*	*Max*	
2. Criterion: Absence of diseases (CAD)	59.51	22.12	489.43	33.30	100.00	59.56	21.94	481.27	30.20	100.00	ns
Cows with nasal discharge, %	0.19	0.60	0.36	0.00	2.31	1.69	4.21	17.75	0.00	15.18	ns
Cows with hampered respiration, %	0.13	0.34	0.12	0.00	1.00	0.00	0.00	0.00	0.00	0.00	ns
Cows with ocular discharge, %	1.72	3.69	13.59	0.00	14.20	6.24	8.87	78.61	0.00	29.17	ns
Cows with diarrhea, %	1.70	2.53	6.38	0.00	7.78	2.31	2.40	5.76	0.00	8.16	ns
Cows with vulvar discharge, %	1.73	1.83	3.34	0.00	5.55	1.16	1.10	1.21	0.00	3.20	ns
Frequency of coughing per cow per 15 min	0.06	0.25	0.06	0.00	1.00	0.13	0.34	0.12	0.00	1.00	ns
Frequency of mastitis, %	1.96	0.98	0.96	0.70	4.74	2.63	0.96	0.93	1.35	5.26	ns

ns = $p>0.05$; * = $p<0.05$; ** = $p<0.01$

In considering the seasonal impact on the health parameters of cows, it is important to emphasize the importance of adequate nutrition and housing conditions to the possibility of providing thermal comfort, and consequently to the general health of cows, which is assessed as acceptable here, indicating the need for its improvement. According to linked study *(Ostojić Andrić et al., 2017),* examined cows during both seasons were provided only by minimal comfort conditions in housing, which consequently indicates the lack of resources to ensure their thermal comfort, especially in extreme weather conditions. The main risk

factors originate from inadequate housing conditions, reflected in a condition of dirtiness of cows, which, in particular during the winter period, when they are exposed to low temperatures and high humidity, favours the formation of not only the skin but also systemic diseases.

Conclusion

The results of the study showed that the effect of the season on the incidence of injuries and illness was not significant, but certain disorders were more prevalent in one of the seasons. It was found that mastitis, diarrhea, nasal and nose discharges were more frequent in the summer season, and lameness, tachypnoea and vaginal discharge in the winter season. Enhanced ventilation of objects during the summer months is often cited as the cause of the occurrence of ocular discharge whose frequency exceeds the alarm threshold from the welfare point of view. The more frequent occurrence of mastitis during the summer months results from higher resistance of microorganisms in given conditions and adaptive changes in the physiological status of cows that increase the disposition to inflammation. On the other hand, a greater share of lame cows in the winter can be associated with poorer hygiene and comfort conditions during this time of the year.

In conclusion, it is important to emphasize that the established, acceptable assessment of the health of dairy cows (in average 40 from 100 points) in both seasons indicates that only minimal requirements for ensuring well-being are met and that there is a need to improve the health situation. Given that related studies have shown a low level of ensuring of the comfort of the examined animals as well as its significant influence on the provision of thermal comfort and health of cows, the recommendations are directed primarily at ensuring appropriate housing and rearing conditions with adequate and continuous health control of the herd.

Parametri zdravstvenog stanja mlečnih krava u različitim sezonama – sagledavano iz ugla dobrobiti

Dušica Ostojić Andrić, Slavča Hristov, Milan M. Petrović, Vlada Pantelić, Dragan Nikšić, Violeta Caro Petrović, Aleksandar Stanojković

Rezime

Cilj istraživanja je bio da se utvrdi da li se učestalost pojave određenih povreda i bolesti krava kao važnih parametara obezbeđenja njihove dobrobiti,

značajno razlikuje u zavisnosti od sezone gajenja (leto/zima). Istraživanje je sprovedeno prema *Protokolu o proceni kvaliteta dobrobiti mlečnih krava (2009)* na ukupno 16 farmi za proizvodnju mlijeka (N = 4.833 krava), pri čemu je obezbeđivanje dobrog zdravlja deskriptivno kategorizirano kao neprihvatljivo, prihvatljivo, poboljšano i odlično, prema izračunatim ocenama (0-100 poena). Temperatura vazduha određene lokacije beležena je tokom svake posete farmi, tako da je prosečna temperatura za određenu sezonu služila kao dodatni indikator termičkog komfora mlečnih krava. Rezultati istraživanja pokazali su da uticaj sezone na učestalost pojave povreda i bolesti nije bio signifikantan (p>0,05), ali su određeni poremećaji bili zastupljeniji u jednoj od sezona. U letnjoj sezoni učestalije su se javljali mastitis (2,63%), dijareja (2,31%), iscedak iz oka i nosa (6,24% and 1,69%), a u zimskoj sezoni šepavost (27,78%), tahipnea (0,13%) i vaginalni iscedak (1,73%). Oslanjajući se na standarde dobrobiti, može se zaključiti da ispitivani parametri ne predstavljaju alarmantan rizik po dobrobit gajenih životinja sa izuzetkom mastitis rate and ocular discharge u letnjem periodu., Ipak, celokupno zdravlje mlečnih krava u obe sezone ocenjeno je kao acceptable (in average 40 from 100 points) što ukazuje da su zadovoljeni samo minimalni zahtevi u obezbeđenju dobrobiti i da postoji potreba za poboljšanjem zdravstvene situacije. Sa obzirom da su srodne studije pokazale nizak nivo obezbeđenja komfora ispitivanih grla kao i njegov značajan uticaj na obezbeđenje termalnog komfora i zdravlja krava, preporuke su usmerene pre svega na obezbeđenje odgovarajućih uslova držanja uz adekvatan i kontinuiran zdravstveni nadzor stada.

Ključne reči: mlečne krave, sezona, zdravlje, dobrobit, parametri, termalni komfor

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