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SCREENING OF SELECTED INDICATORS OF DAIRY CATTLE WELFARE IN MACEDONIA

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ABSTRACT

The welfare state of cattle in dairy farms in Macedonia has never been assessed previously. The objective of this study was to perform screening analysis of dairy cows welfare and to test the practical implementation of the Welfare Quality® Assessment protocol for cattle in dairy farms in Macedonia. In ten small scale and large scale tie stall farms 23 measures were recorded related to 9 welfare criteria of 4 welfare principles (WP) described in the Welfare Quality® Assessment protocol for dairy cows. The mean percentage of very lean cows was 40.5±9.1%. All assessed farms were not providing access to pasture and an outdoor loafing area. Regarding cleanliness, the presence of dirty udder, upper leg/flank and lower leg was 65.2±9.0%, 85.5±8.0% and 86.5±5.8%, respectively. The overall prevalence of lameness was 5.6±5.0%, and for mild and severe alterations it was 30.8±5.8% and 54.1±4.6%, respectively. The ocular and vulvar discharge, diarrhea, dystocia, percentage of downer cows and mortality rate exceeded the warning and alarm threshold. The avoidance – distance test classified 70.4±6.8% as animals that can be touched or approached closer than 50cm, with overall score of 42.9±3.5. This screening reveals that the most welfare concerns are found in the WP Good Feeding and Good Housing. The on-farm welfare assessment using the full protocol on a representative sample of farms in the country is highly recommended for emphasizing the key points for improving the animal welfare in Macedonian dairy farms.

Key words: welfare assessment, cattle, dairy farms, animal based measures

INTRODUCTION

The maintenance of good animal welfare is an essential part of dairy production systems. Farmer's strong commitment to animal welfare in dairy cattle and appropriate dairy herd management is driven by fulfilling the physiological and behavioral needs of the animal, compliance with the relevant international (1, 2) and national animal welfare regulations (3, 4), and respecting the consumer expectations for animal welfare standards in the food industry (5).

The implementation of welfare standards must be accompanied by proper assessment which

should be based on valid and reliable indicators of animal welfare. The recently adopted EU Strategy for the Protection and Welfare of Animals 2012–2015 highlights that the possibility of using scientifically validated outcome-based indicators complementing prescriptive requirements in EU legislation should be considered when necessary (6). Factors affecting animal welfare include the physical environment, resources available to the animal and management practices on the farm. Depending on its characteristics (breed, sex, age, etc.) the animal will respond to these inputs and the animal's responses are assessed using animal-based measures. Animal-based measures are evaluative, quantitatively and qualitatively, and may be obtained in a reliable way. To have an objective indication of an animal's welfare and to perform a good welfare assessment, a set of measures are needed to be measured. Animal-based measures can be collected on-farm either by observation or inspection of the animal on individual and herd level. Animal-based measures usually have been used to identify animals whose welfare is poor, as an early warning for animals with deteriorating welfare, as well as, for immediate recognizing of improvements in welfare

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in order to maximize benefits (7). The European Welfare Quality® Project was set out to develop scientifically sound tools to assess animal welfare on-farm. The acquired data provides feedback to animal unit managers about the welfare status of their animals and is translated into accessible and understandable information on the welfare status of food producing animals, including dairy cattle (8). This paper uses selected indicators for assessment of animal welfare designed by this project.

Currently, a total number of 238 000 of cattle are kept in the dairy sector in Macedonia (9) out of which about 50% are milking cows with a total milk production of 350 million liters and an annual average of milk yield of 2,928 L per cow (10). The dairy farms are categorized in three categories: 1) traditional farmers with up to 3 cows; 2) family farms with 5 – 20 milking cows; and 3) specialized farms with more than 20 milking cows. The most dominating farms are in the first two categories

study in order to identify the possible challenges and obstacles in implementing a more comprehensive analysis of dairy cattle welfare in Macedonia.

MATERIAL AND METHODS

The study was conducted on eleven dairy farms in Macedonia, four large-scale tie stall farms with at least 30 milking cows and seven small – scale tie stall farms with less than 15 milking cows. The number of tested animals and categories for each farm is presented in Table 1. At the Farm F only the avoidance distance test was performed and no other measures were taken into account, while at the Farm K the avoidance distance test was not possible to perform due to the conditions and physical obstacles. Hence, the total number of included farms in the assessment for each measure in this study is ten (4-large and 6-small scale farms).

Table 1. Allocation of farms according to category and number of animals assessed

Farm type	Farm	No. of milking cows	No. of dry cows	No. of heifers	Total no. of animals	No. of animals tested
Large scale tie-stall	A	43	0	17	60	37
	G	39	0	5	44	32
	H	120	0	0	120	55
	I	30	0	7	37	28
Small scale tie-stall	B	8	3	0	11	11
	C	5	0	2	10	7
	D	11	1	6	18	18
	E	3	1	1	5	5
	F	5	0	2	7	7
	J	2	0	0	2	2
	K	6	0	1	7	7
Total number:	11	272	5	41	321	209

(up to 20 cows) with 97% of all farms in the country, while only 1% of the dairy farms keep more than 50 milking cows (10). The most prevalent housing system is the tie stall system without grazing periods.

Assessing the welfare state of dairy cows in Macedonia, the neighboring countries and in the Balkan Peninsula has received only little attention so far. Studies concerning the welfare assessment in dairy farms in this region were conducted in Serbia (11), Croatia (12) and Romania (13-16). Until now, on-farm welfare assessment in dairy farms in Macedonia has not been performed. Therefore, the objective of this study was to assess selected indicators of dairy cattle welfare from the Welfare Quality® Assessment protocol (8) and to identify the main welfare concerns and challenges in Macedonian farms. This study also served as a pilot

The welfare assessment and sampling procedure were performed according to the Welfare Quality® Assessment protocol for cattle (8).

For the on-farm assessment, nine out of twelve welfare criteria as proposed by Welfare Quality® were selected, consisting of 23 measures. Welfare principles (WP), criteria and measures applied in this study are summarized in Table 2. The majority of the measures were performed in individual animals and few measures were referring to housing resources and management.

The gathered data was translated into criterion scores expressed on a 0 to 100 value scale, where 0 corresponds to the worst and 100 corresponds to the best level of welfare. The calculation of criterion scores was performed using an on-line Welfare Quality® scoring system (<http://www1.clermont.inra.fr/wq>).

Table 2. Welfare principles, criteria and measures applied in the screening study

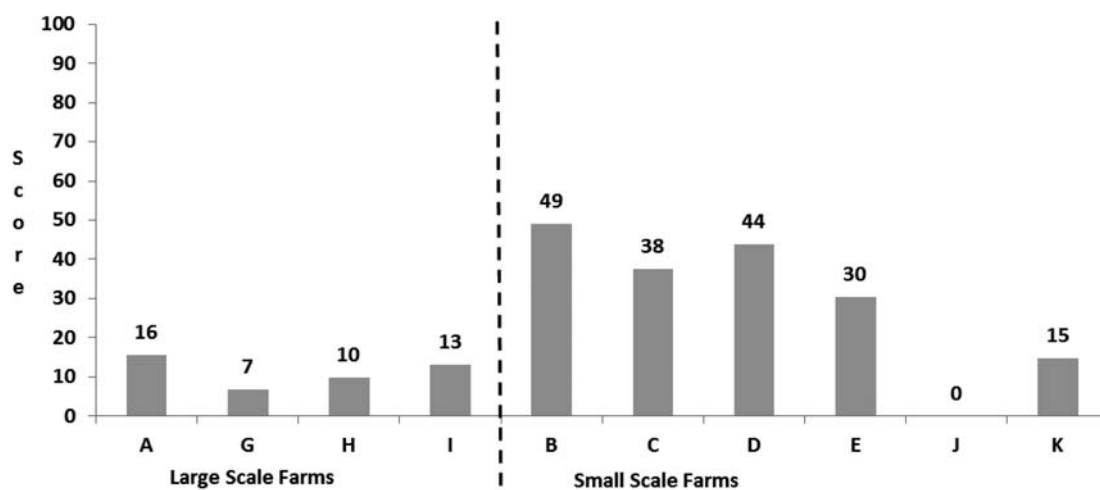
Welfare principle	Welfare Criteria	Measures	
1. Good feeding	1.1 Absence of prolonged hunger	1.1.1 Body Condition Score 1.2.1 Water provision	
	1.2 Absence of prolonged thirst	1.2.2 Cleanliness of water points 1.2.3 Water flow	
2. Good housing	2.1 Comfort around resting	2.1.1 Cleanliness of udders 2.1.2 Cleanliness of flank/upper legs 2.1.3 Cleanliness of lower legs	
	2.2 Ease of movement	2.2.1 Presence of tethering 2.2.2 Access to outdoor loafing area or pasture	
3. Good health	3.1 Absence of injuries	3.1.1 Lameness 3.1.2 Integument alterations	
	3.2 Absence of disease	3.2.1 Nasal discharge 3.2.2 Ocular discharge 3.2.3 Hampered respiration 3.2.3 Diarrhea 3.2.4 Vulvar discharge 3.2.5 Mortality 3.2.6 Dystocia 3.2.7 Downer cows	
		3.3 Absence of pain induced by management procedures	3.3.1 Disbudding/Dehorning 3.3.2 Tail docking
4. Appropriate behavior		4.1 Expression of other behaviors	4.1.1 Access to pasture
		4.2 Good human - animal relationship	4.2.1 Avoidance distance

All data processing and statistical analyses were performed using MS Excel® 2010, MS Office Professional Plus 2010 (©2010 Microsoft Cooperation) and StatSoft, Inc. (2007), STATISTICA (data analysis software system), version 8.0. The statistical analysis was based on descriptive statistical indicators (mean, standard error of the mean and quartiles) for the measures and criteria used in the study. Tests for statistically significant differences between large-scale and small-scale farms were performed by the Mann-Whitney

U Test, except for data from the avoidance distance test, which were analyzed by the Chi-Square test for independence. The significance level was set at $p < 0.05$.

RESULTS

The mean percentage of very lean cows per farm was $40.5 \pm 9.1\%$ ($Q_1=14.29$; $Q_3=54.72$) with no differences between large and small scale farms ($p=0.14$).

**Figure 1.** Scores for the criterion Absence of prolonged hunger

Consequently, the criterion scores for Absence of prolonged hunger ranged between 0 (Farm J) and 49 (Farm B), (Fig. 1). The water supply in the farms was one bowl per two animals and the majority of bowls were assessed as clean except in two farms (E and G). Two farms (G and J) did not provide continuous water supply - some animals did not have free access to water and the water flow was lower than 10 l/min. Therefore, the scores for the criterion Absence of prolonged thirst were 3 in two farms, 32 in four farms and 60 in the remaining four farms. Overall, considering the scores for both criteria, Absence of prolonged hunger and thirst, there was no significant difference with regard to the size of the farm ($p=0.35$).

In all farms, cows were kept in a tie-stall system and were not provided access to pasture or outdoor loafing area throughout the year. This resulted in the lowest possible score (score of 15) for the criterion Ease of movement. In addition, as part of the WP Good Housing, the prevalence of dirty udder, upper leg/flank and lower leg were assessed, with a mean prevalence of $65.2\pm 9.0\%$ ($Q_1=50.00$; $Q_3=84.62$), $85.5\pm 8.0\%$ ($Q_1=85.71$; $Q_3=100.00$), $86.5\pm 5.8\%$ ($Q_1=77.78$; $Q_3=100.00$), respectively. According to the Welfare Quality Assessment protocol (8) all farms, with the exception of Farm E for cleanliness of the udder, were classified as farms with “serious problem” considering the three measures of cleanliness. Although the percentage of cows with dirty udder, upper and lower leg was

numerically lower in the small scale farms, there were no differences between large scale and small scale farms (udder, $p=0.14$; upper and lower leg $p=0.29$) (Fig. 2).

Three welfare criteria were assessed concerning the WP Good Health. The criterion Absence of pain induced by management procedures was measured in terms of the percentage of animals submitted to the procedures of disbudding/dehorning and tail docking. At two farms, the small scale farm D - 50% of the animals and the large scale farm H - all animals at the farm were submitted to the disbudding procedure at the age of 4 and 2 weeks, using caustic paste and without any analgesia or anesthesia. Milking cows with docked tail were not found in any of the assessed farms. Regarding the welfare criterion Absence of injuries, lameness prevalence was $5.6\pm 5.0\%$, and $30.8\pm 5.8\%$ were cows with mild (hairless patch) alterations and $54.1\pm 4.6\%$ of the cows showed severe alterations (lesions and swellings), without any differences considering the size of the farms. The overall mean score for the criterion Absence of injuries was 57.0 ± 7.4 . The measurements taken concerning the criterion Absence of disease showed that the prevalence of ocular discharge at farms B and J (9% and 50% of tested animals); diarrhea at farms B, D and I (9%, 28% and 7% of tested animals); vulvar discharge at farm E (20%); the incidence of dystocia at farms A, C and H (17%, 7% and 5% of all animals in the last twelve months); the incidence of downer cows

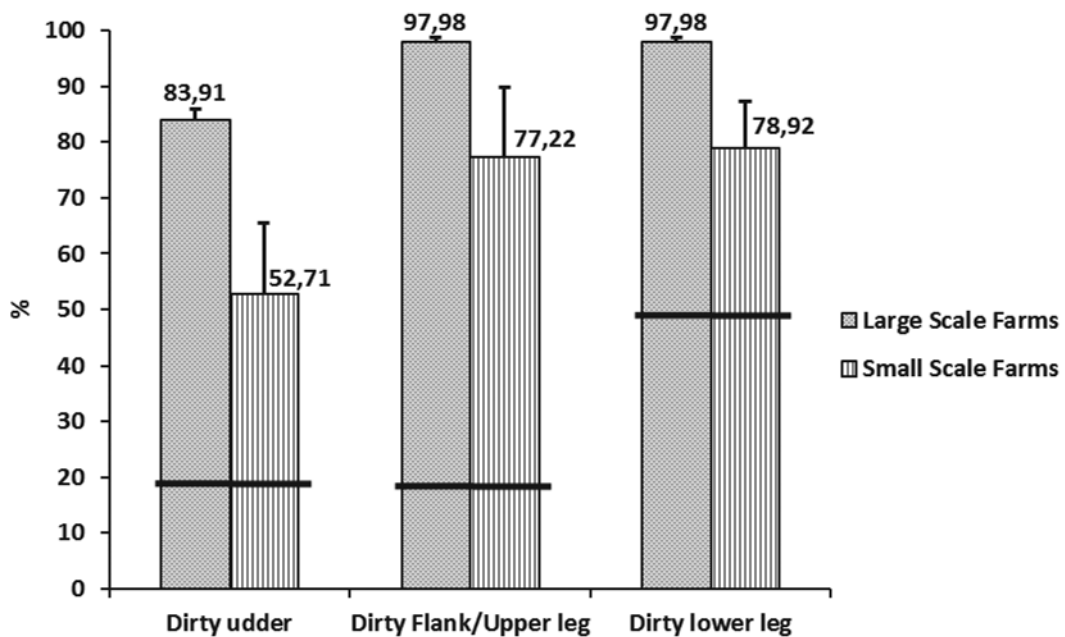


Figure 2. Percentage of animals (mean \pm SE) with dirty lower leg, upper leg and udder in large and small scale farms. Black lines are showing the threshold for the level of cleanliness being considered a “serious problem”

Table 3. Prevalence in percentage and comparison between small and large scale farms for measures from the welfare criteria Absence of disease

Measure	Small Scale Farms			Large Scale Farms			P
	Mean±SE	Q ₁	Q ₃	Mean±SE	Q ₁	Q ₃	
Nasal Discharge	2.4±1.6	0.0	5.6	4.5±2.7	0.0	9.0	0.61
Ocular Discharge	9.9±8.2 ^a	0.0	9.1	1.4±0.9	0.0	2.7	1.00
Hampered respiration	0.0	0.0	0.0	2.6±0.9	1.6	3.6	0.07
Diarrhea	6.1±4.6 ^w	0.0	9.1	3.7±1.12 ^w	2.3	5.1	0.47
Vulvar discharge	3.3±3.3 ^w	0.0	0.0	2.6±0.9 ^w	1.6	3.6	0.26
Dystocia	1.2±1.2	0.0	0.0	6.0±3.8 ^a	1.0	11.0	0.17
Downer cows	4.0±2.6 ^w	0.0	10.0	1.9±1.9	0.0	3.9	0.76
Mortality rate	9.5±8.2 ^a	0.0	7.0	3.8±1.8 ^w	1.0	6.5	0.61

Measures above the (^a) Alarm Threshold and (^w) Warning Threshold, defined in the Welfare Quality® Assessment Protocol for cattle

– farms A, C and I (8%,10% and 14% in the last twelve months) and mortality rate in farms B, H, I and J (7%, 5%, 8% and 50%, respectively) were above the defined alarm or warning thresholds in the protocol (8), (Tab. 3).

The welfare criterion Good Human – Animal Relationship, as part of the WP Appropriate Behaviour, was measured using the Avoidance distance towards an unknown observer and the animals were categorized in four categories: 1) animals that can be touched, 2) animals that can be approached closer than 50cm, 3) between 50 – 100 cm and 4) animals that cannot be approached closer to 100cm. From 200 cows which were assessed in all farms, 70.4±6.4% were classified as animals that can be touched or approached closer than 50cm. The mean overall score for this criterion was 42.9±3.5 (Q₁=36.00; Q₃=53.00). Similar findings were found

in small and large scale farms (p=0.18), where 72.5±11.2% and 67.2±5.7% were cows classified in the first two categories of this measure (Fig. 3).

During the welfare assessment process in the assessed farms, the following findings were observed regarding the implementation of the Assessment protocol for Cattle: a) all selected indicators could be measured according to the suggested methodology in the protocol (8), except the Avoidance distance test, where due to the physical obstacles in front of the cows, in one farm failed to be performed; b) there were no reliable records kept by the farmers for presence of diseases, mortality level, milk production and other information requested by the Assessment protocol; and c) no continuous analysis of the somatic cell counts in milk on individual level in all assessed farms.

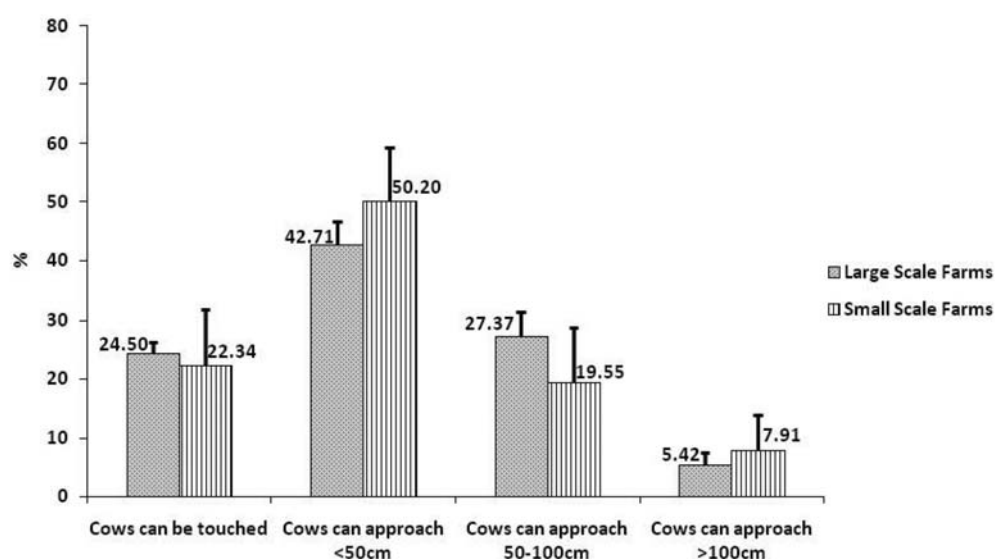


Figure 3. Mean ± SE percentage of cows categorized in four categories in the Avoidance distance test, considering the size of the farms

DISCUSSION

The present screening of cattle welfare in dairy farms in Macedonia has indicated the major welfare concerns in dairy production in the country. Since this is the first screening performed in Macedonia, the results from this study are compared with a number of publications from Serbia, Croatia and Romania. In these studies the number of farms involved in the assessment varies from 2 in Croatia (12) up to 52 in Romania (14). The results of this study are not representing the overall dairy cattle welfare in Macedonia, due to the small sample size (10 farms for each measure), and are preliminary findings. Hence, the discussion focuses on the findings for tie stall housing systems considering the cultural and traditional similarities in dairy production.

Using most of the measures suggested by the Welfare Quality® Assessment protocol for cattle (8), the main overview for dairy cattle welfare was established for the assessed dairy farms. Considering the WP Good Feeding, the percentage of very lean cows per farm was high resulting in low scores for the criterion Absence of prolonged hunger. Although, there were no significant differences considering the size of the farms, still in most of the small scale farms the presence of very lean animals was numerically lower in comparison with the large scale farms. The comparison with results from studies in other countries for tie stall systems shows that the percentage of very lean cows in our study is higher than the findings in Serbia (11) and Romania (13, 16), almost equal to the results in Croatia (12) and lower than North - Eastern Transilvania (14). Although, this pilot study covered only 10 farms in Macedonia, the findings for the absence of prolonged hunger are alarming and it is expected to be one of the most serious disturbances of cattle welfare. Regarding provision of water, all farms are complying with the minimal standards suggested by the Assessment protocol (8); however, the assessed farms are far from fulfilling the recommendations for this criterion by the Assessment protocol and Anderson et al. (1984), which is at least one water bowl for each animal and water flow of 15 l/min (8, 17). For the WP Good Feeding, according to the classification thresholds in the Assessment Protocol (8), seven farms were classified as “acceptable” and three farms as “not classified”.

The hygiene level, in terms of cleanliness of the animals was classified as a serious problem in all farms. Lower percentages of soiled animals, using the same assessment methods, were found in the studies performed in UK (18), Romania (13, 16), Switzerland (19), while almost equal percentage

of dirty body regions with our results was found in Serbia (11) and Croatia (12). The main reason for the findings in the present study were inappropriate lying areas, in terms of improper length of the cubicles, insufficient amount of bedding material and too infrequent and irregular cleaning of the stalls. The high percentage of dirty body regions on the animal is highly related to the traditional and cultural way of dairy farming in this region, characterized with hard surfaces and poor bedding resulting in low hygiene. Additionally, keeping the animals tethered during the whole year is quite common in dairy farms in Macedonia. Therefore, all assessed farms have no access to outdoor run and pasture during the whole year which has high impact on the welfare criteria “Ease of movement” and “Expression of other behaviour”, resulting in the lowest scores for these criteria.

Most of the low scores in the WP Good Health are likely to be related to poor housing and hygiene conditions. This is supported by the high percentage of animals with integument alterations, where the percentage of animals with at least one swelling or lesion is dominating over the mild skin alterations. The main factors for these findings are poor bedding conditions and inappropriate lying areas (20, 21), confirmed by the location of integument alterations on the body, which were predominantly on the hock and carpal regions. Mild alterations were less prevalent and severe alterations more prevalent in comparison with the findings in tied cattle in Romania (13) and Switzerland (19), but similar to the findings in tie-stalls in Ontario (21) and Serbia (11), especially for the mild alterations. Additionally, some studies suggest that continuously tethered animals tend to have more skin injuries compared with systems with access to loafing areas, pasture and loose housed cattle (13, 19). Although the proposed method for assessing the lameness in tied cows is different from the one for loose animals (8), at least severely lame may be reliably detected (22). The prevalence of lameness had wide range in the assessed farms, but not exceeding 16.2% per farm. Lameness in cattle is highly related to the bed surface, bedding material, cleanliness, hock skin alterations, regular exercise and feeding management (21, 23, 24, 25) – factors observed in poor condition in the assessed farms.

The measures of criterion “Absence of disease”, ocular discharge, diarrhea, vulvar discharge, dystocia, percentage of downer cows and mortality rate exceeded the warning and alarm threshold set up by the protocol. The study conducted in Serbia revealed similar findings as regards the percentage of animals with ocular discharge, diarrhea, dystocia and mortality rate (11), while the

respective prevalences found in Romania (13, 16) were lower for all parameters than ours. Although there were no significant differences in the above mentioned measures, ocular discharge, mortality rate, diarrhea, downer cows and vulvar discharge were higher in small scale, while dystocia, nasal discharge and hampered respiration were higher in large scale farms. This pilot study found that testing for milk somatic cell count in milk samples per individual animal did not exist in all visited farms. This confirms the categorization of this measure as “parameters which should be included but lack reliability in most countries” (26). Testing for milk somatic cell count is only done for the bunk tank milk – which is not useful for welfare assessment. This should be taken in consideration for complete implementation of the Welfare Quality® Assessment Protocol for cattle (8).

Tail docking is not practiced in Macedonian dairy farms, thus avoiding unnecessary pain of the animal. However, all the disbudding / dehorning procedures are performed without any use of anesthesia and analgesia which contributes to the presence of pain during the management procedures and lowers the welfare score in the farms with dehorned animals.

Human – animal relationship represents the mutual perception of stockman and animals and is essential for good animal welfare (27). Many studies confirmed that negative handling experiences of animals result in higher levels of fear of humans which may have negative effects on production, reproduction, welfare and the risk of injuries for both, animal and man (28, 29, 30). Positive handling might improve the welfare (31), resulting in good animal health, performance and stockman’s confidence in the animals. In this study, most of the assessed cows allowed to be touched or approached in a distance of less than 50cm by the assessor. These findings indicate that the animals are not exposed to severe handling experiences by the farmers. Considering the size of the farms in the study, there were no differences between small and large scale farms, while similar findings for the avoidance distance test was found in other studies with tie (13) and loose (18) stalls. The assessed farms were without access to pasture, but according to Matiello et al. (32) farms with access to pasture are expected to have a larger avoidance distance. Additionally, in one farm (Farm K) the Avoidance Distance Test could not be performed due to the placement of the tethered animals in the shed (the cows were facing very closely to the wall). Such cases represent a real obstacle in full implementation of the Assessment Protocol (8). The other criteria and measures of the WP Appropriate Behaviour were not included in this study, therefore, for further detailed analysis of this

principle complete assessment measures defined in the protocol (8) must be performed.

Considering the present dairy production in Macedonia, where most of the farms have less than 20 animals (9, 10) with predominantly tie stalls, the acquisition of farms was focused on tie stalls, while the categorization of large and small scale farms was set up only by the number of animals (more than 30 and less than 15 milking cows). Since this study was performed only as initial screening and for the first time the Welfare Assessment Protocol (8) was performed in Macedonian dairy farms, the number of farms was very low for complete representation of the present welfare state of milking cows. Therefore, the absence of any differences between large and small scale farms could be due to the low number of farms included in the study. Since there is considerable variability within small scale farms this could have biased the representation of the current welfare status on state level. In future analyses, proper sampling, in terms of valid geographic distribution and representative number of small and large scale dairy farms, is highly recommended for any detailed analysis on the dairy cattle welfare.

CONCLUSION

This study confirms that the Welfare Quality® Assessment Protocol for cattle could be put in practice and implemented in Macedonian dairy farms with precautions while measuring some of protocol’s defined measures. Therefore, implementation of the whole protocol and on-farm welfare assessment on a representative sample of farms with different housing systems in Macedonia is highly necessary. Subsequently, a baseline study for animal welfare of dairy cattle could be created which will point out the key areas for improvement in the welfare of dairy cattle in Macedonian farms.

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