Welfare of dairy cows in Kosovo and intervention thresholds for selected welfare indicators as suggested by farmers and veterinarians**

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Abstract

Despite increased concerns about dairy cattle welfare, there is a paucity of knowledge regarding their welfare and the attitudes of farmers and veterinarians in the Western Balkan region. This is the first on-farm study to address dairy cattle welfare and the attitudes of farmers and veterinarians towards animal welfare in Kosovo. Thirty tie-stall dairy farms across seven Kosovo regions were assessed twice with an interval of 10 to 12 months. During the first visit, the Welfare Quality® assessment protocol was applied, whilst the second visit focused on clinical animal-based indicators and interviews with the farmers regarding intervention thresholds for a number of welfare indicators. Additionally, such thresholds were obtained from 15 veterinarians via an online questionnaire. The main areas of concern that were highlighted relate to comfort around resting (soiling of animals, restriction of lying down movements) and injuries, including lameness. Farmers and veterinarians agreed on the intervention thresholds for the majority of the indicators (eg animals with dirty udders, animals with lesions/swellings) but differences were found for important health and welfare issues (eg farmers suggesting a higher threshold for lameness compared to veterinarians). Compared to the on-farm prevalences, both farmers and veterinarians suggested lower intervention levels for welfare issues indicating an awareness of problems. In conclusion, investments into close co-operation between farmers, veterinarians and other advisors regarding awareness-building and inducing changes in daily management routines are considered necessary to improve dairy cow welfare.

Keywords: animal-based measures, animal welfare, dairy cows, Kosovo, on-farm assessment, tie-stalls

Introduction

In Kosovo, more than 98% of dairy cows (total cow population: 261,689) are estimated to be kept in small- and medium-sized farms with tie-stalls (Kosovo Agency of Statistics [KAS] 2014). The concept of loose-housing systems was recently introduced however most farmers are currently unable to afford new buildings. Together with a high prevalence of zero-grazing and poor feed quality, tie-stall housing may result in an unsatisfactory level of welfare for animals, the emergence of chronic health problems and low production (Bajrami *et al* 2017). However, many Eastern European countries are only belatedly considering the concept of animal welfare. For non-EU Balkan countries in particular, research and advisory activities to assess and improve animal welfare as well as societal awareness of animal welfare can still be considered to be at very early stages of development. In EU-candidate country, Serbia, attempts to harmonise legislation with EU standards have taken place (Phythian *et al* 2017), while in Macedonia part of the welfare legislation is already aligned with EU requirements (Keeling *et al* 2012). Animal welfare legislation in Kosovo (which is considered a potential candidate for EU membership) contains various general provisions (eg appropriate handling), but regulations do not specifically address dairy cows and implementation is limited due to restricted capacities of the competent authorities. In addition, cattle farmers in Kosovo have little or no knowledge about animal welfare and existing standards in their region. However, the first attempts at integrating knowledge regarding animal welfare were made in 2012 with the topic being incorporated into the curricula at the Faculty of Agriculture and Veterinary Medicine of the University of Pristina.

For the on-farm assessment of dairy cattle welfare, the Welfare Quality® protocol (Welfare® Quality 2009) is a well-recognised method for addressing the different dimensions of welfare. It relies primarily on animal-based measures and, to a lesser extent, on resources or management features (Botreau *et al* 2009). It has been developed as an assessment system that may also be used to convert

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Geographical distribution of selected farms in Kosovo.

welfare measures into summary information at the farm level. In Balkan countries, dairy cattle welfare has been assessed on-farm in a number of studies, including in Romania (Popescu *et al* 2014), Croatia (Vučemilo *et al* 2012), Serbia (Ostojić-Andrić *et al* 2011) and Macedonia (Radeski *et al* 2015). In most of those studies, the assessment was based on the Welfare Quality® protocol (2009) for dairy cattle, and the main findings indicated problems related to housing and feeding system such as poor body condition, soiling of the animals and lameness.

In Western countries, the attitudes of different stakeholders such as consumers (Frewer *et al* 2005; Spooner *et al* 2014; De Backer & Hudders 2015), students and faculty members (Heleski *et al* 2004; Heleski & Zanella 2006; Ostovic *et al* 2017) and veterinarians (Sabuncuoglu & Coban 2008) have been investigated. In recent years the importance of measuring farmers' attitudes towards animal welfare has also been emphasised in different countries (Kauppinen *et al* 2010; Hansson & Lagerkvist 2014; Sumner *et al* 2018). However, the only study on farmers' attitudes towards animal welfare in Balkan countries has been conducted in Serbia (Phythian *et al* 2017). The majority of farmers were aware of animal welfare, but there was no clear association between their satisfaction with animals' living conditions and their welfare state as measured by animal-based indicators.

Intervention thresholds may serve as guidance for farmers and within farm assurance schemes (Whay *et al* 2003). Most studies on intervention points have focused on selected measures such as clinical mastitis and foot health (Bruijnis *et al* 2013; Espetvedt *et\ al* 2013), but considering a broader range of indicators helps to ensure that the overall welfare of cows continues to improve.

The aims of the present study were to: (i) assess the welfare state of dairy cows in Kosovo; (ii) evaluate the opinion of farmers and veterinarians regarding intervention thresholds for different welfare problems on dairy farms; and (iii) investigate the extent to which thresholds suggested by farmers correlate with the on-farm situation.

Materials and methods

Study design

This study was conducted on 30 private dairy farms, situated across the seven geographical regions of Kosovo (see Figure 1) between November 2013 and December 2014. The recruitment of farms was supported by the Ministry of Agriculture of the Republic of Kosovo and through address lists from previous projects of the Faculty of Agriculture and Veterinary Medicine Pristina.

The initial list contained 40 farms which were first approached via telephone and, of these, 35 agreed to be visited to be informed of the project in detail and confirm participation. Of the farms visited, 33 fulfilled the following selection criteria: minimum number of 15 cows; coverage of regions; farm design such as sufficient space for behaviour observations; and willingness to participate in the entirety of the study. Thirty farms were finally enrolled in the study and three remained on a reserve list in the event of a farm dropping out.

At the time of the study (2013–2014), no Ethics Committee was available at the University of Natural Resources and Life Sciences, Vienna and the work did not require experimental licensing because it did not involve any invasive procedures. Furthermore, farms complied with national legislation on dairy cow welfare. Consent was subsequently obtained from the owners for the participation of their animals in this study.

Data collection

During the study period, two visits took place in all 30 dairy farms. Data collection was carried out by one researcher (EZ), who participated in a four-day training course on the Welfare Quality® protocol for dairy cattle in Vienna, Austria in July 2013 which comprised classroom training as well as on-farm training on three different farms. Another training session was carried out in October 2013 on three Macedonian dairy farms. At least satisfactory agreement with the silver standard (CW) was achieved for all measures (PABAK: 0.58–1.00), but weak to moderate agreement was found (PABAK: 0.17–0.50) for different types of integument alterations.

First visit: Full assessment using the Welfare Quality® protocol for dairy cattle

During the first farm visit, the full Welfare Quality® protocol for dairy cattle was applied (Dec 2013–Feb 2014; Visit I). The Welfare Quality® protocol comprises 32 indicators with a focus on 'animal-based measures' (behavioural indicators, physical appearance and health indicators) and, to a lesser extent, on 'resource- and management-based

measures' such as provision of access to pasture. In brief, assessments (one farm per day) started with behavioural observations (avoidance distance, qualitative behaviour assessment and assessment of social and resting behaviour). For qualitative behaviour assessment, the cows were observed from several observation points for a total of 20 min. Thereafter, observations of agonistic and resting behaviour took place for a total of 120 min. For this purpose, segments in the barn comprising 6 to 8 stalls were specified, which were then repeatedly observed. The assessment of health indicators and other measures of physical appearance were then carried out for each animal present in the barn. Information on resource- and management-based measures was obtained via an interview with the farmer. A detailed description of the assessment procedure and definitions of the indicators can be found in Welfare Quality® (2009).

Second visit: Partial assessment of the Welfare Quality® protocol focusing on health and physical appearance of the animals

Since the first visit had identified animals' clinical state (eg body condition, health aspects, hygiene, injuries etc) as the main concern, the second focused on those indicators with the aim of making a comparison with the first assessment and using the information gathered to formulate a process regarding health and welfare. Visit II took place about 10–12 months after Visit I (December 2014; Visit II).

Somatic cell count data were not available since routine assessment of individual and bulk tank somatic cell counts is yet to be fully established throughout all the regions of Kosovo. As a consequence, those Welfare Quality® protocol measures on udder health status were excluded.

Questionnaire for farmers and veterinarians: Identification of intervention thresholds

A questionnaire was designed to assess the opinion of farmers and veterinarians regarding intervention levels for a selection of welfare indicators. It contained 14 items which referred to animal-based indicators from the Welfare Quality® protocol (eg health aspects, hygiene measures). The farmers and veterinarians were asked to indicate the herd level prevalence or incidence at which they would react in terms of interventions to improve the welfare situation at herd level. The final version of the questionnaire was translated into Albanian and made available both as a hard copy and online. Completion of the questionnaire by the farmers took place on the day of visit, after finishing the second on-farm assessment (Dec 2014), but before the farmers had seen the results of their assessment. After the assessment the assessor was present to provide further technical explanations if necessary. The online version of the questionnaire was designed for the Veterinary Chamber and Veterinary Agency in Kosovo in order for it to be available to official and practising veterinarians and it was distributed to 86 members in the Veterinary Chamber and 40 members of the Veterinary Agency. In total, 15 veterinarians completed the questionnaire.

Data analysis

Data were processed using Microsoft Excel® 2010 and transferred to SPSS® version 21 for further analysis (SPSS Inc®, Chicago, IL, USA). Prevalence differences between Visits I and II for those animal-based indicators which were assessed at both visits as well as differences of thresholds suggested by farmers and veterinarians were tested using the Wilcoxon test. Additionally, associations between prevalence of selected animal-based indicators from Visit II (eg very lean animals, animals with dirty hindquarter etc) and median intervention thresholds suggested by farmers were tested using Spearman rank correlations. Prevalence of the indicator 'Hampered respiration' was zero in the vast majority of cases and was excluded from further analysis.

Results

Farm characteristics

All participating farms were family-run with a mean (± SD) agricultural area of 37.5 (± 31.0) ha (range: 10–150 ha). On all 30 dairy farms, cows were kept in tie-stalls. In 80% of farms straw was provided for bedding and in 10% sawdust, whilst 10% of farms used rubber mats in the stalls. Three farms offered access to pasture for 170 (± 46) days per year, while on 12 farms the cows had access to a loafing area on 196 (± 54) days per year. Herds tended to consist of a variety of breeds but Holstein and Simmental predominated followed by Brown Swiss and Montbéliarde. The mean herd size was 27 (± 11) cows, varying in different regions, eg the smallest herds with a minimum of 15 cows were located in the central region of Kosovo while the largest herds with up to 55 cows in the southwestern part of the country. Based on the average production on the day of the first visit, the mean estimated yield per cow per year was 4,130 (± 840) kg.

On-farm welfare situation according to Welfare Quality® principles

In terms of 'Good feeding', the median prevalence of very lean cows in Visits I and II was 6.7 and 8.5%, respectively, ranging from 0 to 25% (Table 1). On all farms, cows were provided with water in drinking bowls, with one drinking bowl serving two cows. The majority of the farms obtained water from their own resources or from regional water companies. Regarding functionality of the water bowls, the median water flow was 10.1 L min^{-1} with a minimum of 5.2 L min^{-1} and a maximum of 15.9 L min^{-1}.

With respect to the 'Good housing' principle, the prevalence of dirty udders, hindquarters and lower hindlegs varied highly amongst farms and between visits. At the first visit, the median prevalence of dirty animals was 93.3, 100 and 96.0% for udders, hindquarters and lower hindlegs, respectively. Slightly but significantly lower prevalences were found for Visit II regarding dirty hindquarters (95.1%; $P = 0.005$) and lower hindlegs (88.8%; $P = 0.001$).

During Visit I, the median duration of lying down movements was 5.7 s. The median prevalence of animals

Table 1   Animal- and resource-based measures for the principles of Good feeding (GF) and Good housing (GH) for Visits I (Dec 2013–Feb 2014) and II (Dec 2014) (Wilcoxon test; n = 30 farms).

Measures	Visit I			Visit II			
	Median	Mean (± SD)	Min–max	Median	Mean (± SD)	Min–max	*P*-value
GF: Absence of prolonged hunger and thirst							
Very lean animals (%)*	6.7	8.2 (± 6.4)	0–25	8.5	9.6 (± 6.5)	0–21.4	0.381
Water flow (L min⁻¹)	10.1	10.2 (± 2.7)	5.1–15.9	–	–	–	–
GH: Comfort around resting							
Animals with dirty udder (%)*	93.3	91.6 (± 8.5)	75–100	92.4	86.6 (± 14.6)	52.3–100	0.080
Animals with dirty hindquarters (%)*	100	95.7 (± 6.1)	79.2–100	95.1	87 (± 19.3)	23.8–100	0.005
Animals with dirty lower leg (%)*	96.0	94.1 (± 8.5)	62.5–100	88.8	82.5 (± 18.7)	32.5–100	0.001
Duration of lying down movements (s)	5.7	5.7 (± 1.0)	4.1–7.7	–	–	–	–
Animals colliding with housing equipment when lying down (%)*	18.3	22.1 (± 19.3)	0–75	–	–	–	–
Animals lying partly outside the lying area (%)*	1.9	7.8 (± 13.9)	0–66	–	–	–	–
GH: Ease of movement				–	–	–	
Access to loafing area (days per year)	0	78 (± 103)	0–300	–	–	–	–

* Prevalence calculated as % of animals affected on day of visit.

colliding with housing equipment and animals lying partly outside the lying area was 18.3 and 1.9%, respectively.

For 'Good health' (Table 2), the median prevalence of lame cows at Visit I was 29.6%, with significantly less lame animals found during Visit II (28.3%; *P* = 0.001). The prevalence of mild and severe skin alterations was almost unchanged between both visits (72.7 vs 73.0% and 21.1 vs 20.9% of the animals, respectively). Other health disorders such as nasal discharge, ocular discharge, hampered respiration and diarrhoea were rarely found during Visits I and II (median prevalences: 0%). Cows with vulvar discharge were present in both visits (6.3, 5.6%) with no significant change between these. The median incidence of dystocia and downer cows was estimated by the farmers to be 7 and 0%, respectively. The median mortality rate was reported to be 0%; however, data on reasons for mortality and culling rate were not available.

The indicators for 'Appropriate behaviour' were only recorded for Visit I (Table 3). The median frequency of agonistic behaviours was 0.6 per animal per hour. On average, 40% of animals could be touched during the avoidance test, while 53.5% showed an avoidance distance of < 50 cm. Avoidance distances of > 50–100 cm and > 100 cm were only found in an average of 5.5 and 0% of animals, respectively. Qualitative Behaviour Assessment scores (criterion 'Positive emotional state') ranged from –5.00 to –0.8 with a median of –2.9 (possible range: –8.0 to +8.0).

Management procedures

In 56% of the participating farms, disbudding of calves was reported, predominantly using caustic paste and only one farm stated the use of anaesthetics. Tail docking was not performed in the investigated farms (Table 4).

Suggested intervention levels

The median suggested intervention level (Table 5) ranged from 0 to 20%, with a maximum of up to 50% for farmers (as regards 'Very lean animals', 'Lameness', 'Lying partly outside', 'Avoidance distance > 50 cm') and 90% for veterinarians ('Avoidance distance > 50 cm'). Farmers and veterinarians agreed regarding most indicators. A significant difference was only found for lameness with veterinarians (median 0%) proposing lower thresholds than farmers (10%; *P* = 0.048). Furthermore, thresholds of veterinarians tended to be higher in three cases ('Very lean animals'; *P* = 0.055; 'Dystocia'; *P* = 0.076; and 'Mortality'; *P* = 0.059). Farmers and veterinarians agreed that any occurrence related to 'Respiratory problems', 'Downer cow syndrome' and 'Mortality' required intervention.

Association between on-farm situation and farmers' opinion on thresholds

The correlation between farmers' thresholds (Table 5) and outcomes of the on-farm welfare assessment from Visit II (Tables 1 and 2) are presented in Table 6. No correlation between thresholds set by farmers and animal welfare indicators was found.

Table 2   Animal-based measures for the principle of Good health for Visits I (Dec 2013–Feb 2014) and II (Dec 2014) (Wilcoxon test; n = 30 farms).

Measures	Visit I			Visit II			
	Median	Mean (± SD)	Min–max	Median	Mean (± SD)	Min–max	*P*-value
Absence of injury							
Lame animals* (%)[1]	29.6	37.8 (± 21.6)	0–85	28.3	25.8 (± 13.3)	0–53	0.001
Animals with mild integument alteration (%)[1]	72.7	68.7 (± 21.2)	19–95	73.0	69.4 (± 15.8)	24–90	0.766
Animals with severe integument alteration (%)[1]	21.1	29.8 (± 21.5)	4–81	20.9	25.2 (± 18.2)	0–77	0.221
Absence of disease							
Number of coughs per animals in 15 min (n)	0.3	0.4 (± 0.2)	0.1–1.0	–	–	–	–
Animals with nasal discharge (%)[1]	0	2.0 (± 3.2)	0–13	0	1.3 (± 2.4)	0–7	0.451
Animals with ocular discharge (%)[1]	0	0 (± 0)	0–0	0	0.1 (± 0.4)	0–2	0.317
Animals with diarrhoea (%)[1]	0	1.2 (± 3.4)	0–13	0	0.3 (± 1.0)	0–4	0.116
Animals with vulvar discharge (%)[1]	6.3	7.6 (± 8)	0–40	5.6	6.9 (± 6.2)	0–21	0.733
Mortality during one year (%)[2]	0	2.5 (± 5.8)	0–31	–	–	–	–
Animals with dystocia during one year (%)[2]	7	8.1 (± 6.4)	0–25	–	–	–	–
Downer cows during one year (%)[2]	0	3.6 (± 5.0)	0–19	–	–	–	–

* Based on a 2-level 'Standing score' using resting a foot, stepping, standing on the edge of a step or reluctance to bear weight when moved sideways as indicators of lameness. When a cow showed at least one of these indicators she was considered lame. This scoring method is less sensitive than gait scoring with less severe cases being less likely to be identified (Leach *et al* 2009).
[1] Prevalence values calculated as percentage of animals affected on the day of visit;
[2] Incidence values calculated as cases per 100 animals during the 12-month period preceding the farm visit based on treatment records and/or farmer estimates.

Table 3   Animal- and resource-based measures for Appropriate behaviour at Visit I (Dec 2013–Feb 2014) (n = 30 farms).

Measures	Median	Mean (± SD)	Min–max
Expression of social behaviour			
Number of head butts, displacements and chasing ups per animal and hour	0.6	0.8 (± 0.3)	0.5–2.5
Expression of other behaviours			
Access to pasture (days per year)	0	13 (± 0)	50–210
Access to pasture (hours per day)	0	0.2 (± 0)	1–4
*Good human-animal relationship**			
Animals touched (%)	40	39.9 (± 18)	12.7–62
Animals approached < 50 cm (%)	53.5	53.8 (± 31.5)	13.1–78.5
Animals approached > 50–100 cm (%)	5.4	4.5 (± 0)	5.5–16.6
Animals approached > 100 cm (%)	0	0.7 (± 0)	2.2–8.3
Positive emotional state			
Qualitative behaviour assessment (score)	–2.9	–3.1 (± [–1.3])	0.8–(–5.0)

* Prevalence values calculated as % of animals showing an avoidance distance corresponding to the different categories on day of visit.

Table 4 Management-based measures (disbudding/dehorning practices) for the criterion 'Absence of pain induced by management procedures' (principle of Good health) (n = 30 farms).

Measures	Percentage of farms	Number of farms
Disbudding of calves	56.0	17/30
• Use of hot-iron disbudding	6.7	2/30
• Disbudding using caustic paste	50.0	15/30
• Use of analgesics	30.0	10/30
• Use of anaesthetics	3.3	1/30
Dehorning of heifers/adult cattle	0	0/30

Table 5 Thresholds regarding prevalence/incidence (%) of selected welfare measures for which farmers and veterinarians, respectively, stated intervention to be needed (Wilcoxon test; farmers: n = 30, veterinarians: n = 15).

Welfare measures	Farmers		Veterinarians		*P*-value
	Median	Min–max	Median	Min–max	
Very lean animals[1]	10	0–50	20	0–40	0.055
Animals lying (partly) outside[1]	10	10–50	10	0–30	0.513
Animals with dirty udder[1]	10	0–30	10	0–20	0.564
Animals with dirty hindleg[1]	20	0–30	10	0–30	0.785
Animals with dirty lower hindleg[1]	20	0–40	20	0–40	0.242
Lame animals[1]	10	0–50	0	0–20	0.048
Animals with lesions/swellings[1]	10	0–20	10	0–40	0.763
Animals with digestive disorders/diarrhoea[1]	0	0–30	10	0–50	0.837
Mastitis[2]	10	0–20	0	0–20	0.763
Respiratory problems[2]	0	0–10	0	0–10	0.317
Dystocia[2]	0	0–20	10	0–30	0.076
Downer cow[2]	0	0–30	0	0–20	0.655
Mortality[2]	0	0–10	0	0–20	0.059
Animals with avoidance distance > 50 cm[1]	20	0–50	20	0–90	0.429

[1] Prevalence = percentage of animals affected on a given day;
[2] Incidence = cases per 100 animals during the last 12 months.

Discussion

To our knowledge, this is the first study assessing dairy cattle welfare by applying a comprehensive assessment protocol in Kosovo. Despite voluntary participation, it was possible to include farms from all seven regions in Kosovo, allowing a representative overview of herds with at least 15 cows and thus those considered commercial (> 10 cows). Of course, participating farmers and veterinarians might have been more interested in animal welfare than typical members of each stakeholder group, however, since this is the case for all on-farm studies based on voluntary participation, our results allow a valid comparison.

As the Welfare Quality® protocol was used, a considerable range of animal welfare issues was covered using established methods, which enables comparison with other studies, where cows in tie-stall systems were assessed. Furthermore, only one trained assessor collected all the data, which fostered coherent data collection.

Welfare state (animal-based indicators)

The most prevalent welfare measures relate to the physical state of the animals and show a relationship between the tie-stall system, poor bedding quality and a lack of exercise. As an example, a median of more than 90% of the animals were considered dirty at the lower and upper hindleg as well as the udder. Soiling of animals due to defaecation in the lying area is a well-known problem in tie-stalls and is further influenced by the amount of bedding provided and the cleaning frequency. Similar poor hygienic conditions have been found in Macedonia and Serbia (Ostojić-Andrić *et al* 2011; Radeski *et al* 2015) whereas their prevalence was found to be lower in Romania (Popescu *et al* 2013, 2014) and Switzerland (Regula *et al* 2004). Maintaining animal cleanliness is considered crucial to prevent health problems such as inflammation of the skin, itching, mastitis and lameness (Zurbrigg *et al* 2005). Interestingly, the prevalence of animals with dirty lower legs and hindquarter decreased significantly over the 10–12-month interval between Visits I and II ($P = 0.001$ and $P = 0.005$, respectively). Although no intervention measures were discussed after Visit I, this might be explained by a change in behaviour due to the mere presence of and the perception of being observed by a researcher; so-called Hawthorne effect (McCambridge *et al* 2014). Accordingly, the increased awareness of farmers may have led to changes regarding, eg the hygienic and health status of the animals. Also, dietary change leading to firmer faeces cannot be excluded as a further factor leading to a reduction in dirty animals. Temperature and humidity might have an effect on resting area and animal cleanliness although both visits were carried out in the winter season meaning seasonality is unlikely to have influenced our results.

Integument alterations are the result of different types of physical trauma caused by the housing environment, and this is even more visible in the closely confined tie-stall setting as compared to loose-housing systems (Rushen *et al* 2007). The high prevalence of integument alterations in the present study may be attributed to low amounts of litter (straw, sawdust), wet or abrasive lying surfaces (Kester *et al* 2014), or the absence of an outdoor run or pasture (Keil *et al* 2006). The prevalence of hairless spots and more severe integument alterations such as wounds, scabs and swellings, were higher than or comparable to those found in studies carried out in Macedonia and Romania (Popescu *et al* 2014; Radeski *et al* 2015).

Many authors consider lameness to be one of the most important welfare problems facing dairy cattle (Huxley 2013). Lameness indicates a painful condition which has a multifactorial origin, including management and design factors (Zurbrigg *et al* 2005). The prevalence of lameness (Visit I: 29.6%) was higher than reported in other tie-stall studies in Switzerland (21%; Regula *et al* 2004), Romania (21%; Popescu *et al* 2014) and Serbia (16%; Ostojić-Andrić *et al* 2011). Predisposing factors for lameness in tie-stalls include an absence of regular exercise (Mattiello *et al* 2005), poor hygiene and prolonged standing on a hard surface (Rushen *et al* 2007). In more than 50% of the

Table 6   Association between farmers' thresholds for interventions (ie prevalence or incidence at herd level) and outcomes of on-farm welfare assessment at Visit II (Dec 2014) (n = 30).

Welfare measure	Spearman rank correlation coefficient
Very lean animals	−0.25
Animals with dirty udder	−0.27
Animals with dirty hindquarter	0.04
Animals with dirty lower leg	0.31
Lame animals	0.28
Animals with digestive disorders/diarrhoea	−0.26
Animals with lesions/swellings	−0.07

observed farms in Kosovo, the animals were kept permanently tethered and only a few farms provided access to an outdoor run. In this situation, spending more time standing exposes the hoof to wet and dirty areas predisposing to claw disorders and subsequent lameness. In intensive production systems, high milk yield has been associated with the risk of developing sole ulcers and white line disease (Amory *et al* 2008; loose housing) or foot rot (Alban *et al* 1996; tie-stalls). However, the low level of productivity in the present study and thus low risk for production diseases further emphasises the role of environmental conditions on lameness. The significant reduction in the prevalence of lameness between Visits I and II ($P = 0.001$) may have a similar explanation to that of dirty animal prevalence.

The prevalence of very lean cows in Kosovo dairy farms was slightly lower compared to Romanian tie-stall farms (Popescu *et al* 2014), but higher than in a study comparing two housing systems in Serbia (Ostojić-Andrić *et al* 2011). With a median prevalence of almost 10% it cannot be considered a negligible problem and underfeeding in terms of feed quality and quantity might have played a major role since poor feed quality and a lack of authorised feed laboratories seemed to be one of the farmers' major concerns. However, lean cows may also be attributed to certain chronic health disorders such as lameness which may lead to changes in feeding behaviour with lame cows spending less time feeding than their non-lame counterparts (Norring *et al* 2014).

With the exception of vulvar discharge, low prevalences were recorded for other indicators of animal health, eg coughing, nasal discharge, ocular discharge and diarrhoea. The prevalence of vulvar discharge and incidence of dystocia appears to be relatively high compared with other studies (Popescu *et al* 2014; Radeski *et al* 2015). Concerning dystocia, the high incidence described in this study might be attributed to single cases in connection with low herd sizes, thus leading to relatively high calculated incidence values. Although the

median incidence for both downer cows and mortality was reported to be zero and thus similar to those in Romanian farms (Popescu *et al* 2014), 30 and 13% of farms, respectively, exceeded the alarm threshold as set by the Welfare Quality® protocol (2009). However, it should also be pointed out that incidences of dystocia, downer cows and mortality were only indirectly obtained by asking the farmers and the virtual lack of reliable on-farm records creates a risk of under- or overestimation.

Regarding behavioural measures of resting comfort, the average duration of lying down movements recorded in this study (5.7 s) can be considered a moderate problem (5.20–6.30 s; Welfare Quality® 2009). A similar moderate problem regarding lying down movements was also reported in Romania (Popescu *et al* 2014), and an even higher duration for this indicator was recorded in Serbia (Ostojić-Andrić *et al* 2011). Housing condition can have a substantial effect on the activity and resting behaviour of an animal in terms of movement being impaired during attempts to lie down and stand up (Haley *et al* 2001; Zurbrigg *et al* 2005). Here, more than half of the farms kept the animals in stalls with a width of 100 cm or less, and only few farms had a lying area width of up to 110 cm. The recommended tie-stall width is at least 121 cm (Zurbrigg *et al* 2005). Another crucial contributing factor for prolonged lying down movements was almost certainly the tendency for most of the participating farms to feature hard concrete lying areas with limited amounts of bedding. This is also reflected in the high median percentage of animals with hairless spots, scabs/wounds and swellings of 72.7 and 21.1%, respectively, which were located mostly at or around the tarsal joint. This discomfort around resting and physical conflict with the environment indicates substantial room for improvement as regards stall design (improving width and littering comfort; Kester *et al* 2014; Boyer & Vasseur 2021) and access to outdoor exercise (Keil *et al* 2006).

Compared to Romania, occurrence of agonistic behaviours during Visit I was higher than in tie-stall barns, but slightly lower than in loose-housed dairy herds (Popescu *et al* 2013, 2014). Agonistic interactions are more likely to occur in loose-housing systems (Laister *et al* 2009), since permanently tethered cows are less able to display dominance over herd-mates and compatible cows are specifically placed next to each other by the farmer.

The relationship between humans and animals is deemed an important feature of modern farming systems, with the ability to also affect productivity and animal welfare (Hemsworth 2003). In this study, the results for the avoidance distance towards an unknown person were in line with other assessments performed in tie-stall systems (Popescu *et al* 2014; Radeski 2015). The low avoidance distance indicates that the animals included in the observation did not experience aversive situations during handling from stockpersons (Waiblinger *et al* 2006).

Qualitative Behaviour Assessment (QBA) was used to assess cows' behavioural expression and body language. The QBA scores were slightly lower compared to observa-tions in tie-stalls in both Popescu *et al*'s studies (2013, 2014), suggesting a more negatively valenced behavioural expression. QBA appears to reveal consistently lower scores in tie-stalls compared to loose-housing systems, probably due to permanent tethering and the related restrictions in terms of narrow stall design, standing on hard concrete or lying areas with little amount of bedding having a potentially negative impact on behavioural expression (Popescu *et al* 2014). Additionally, painful conditions such as lameness or wounds and swellings, which were also frequently observed in the farms, may contribute to a nega-tively valenced affective state.

Provision of resources and management procedures

Water provision was diverse in participating farms. While some complied with the requirements of the Welfare Quality® protocol for dairy cows in terms of availability of drinkers and water flow (Welfare Quality® 2009), three farms failed to satisfy Welfare Quality® (2009) requirements in terms of permanent access to water (provided in buckets during feeding time only for some cows). According to Andersson *et al* (1984), inadequate water supply not only affects animal welfare, but also production through lower feed and water intake. To improve this, farmers need to be encouraged to provide permanent access to water for all cows.

The majority of study farms performed disbudding in calves at 2–3 weeks of age. In accordance with Cozzi *et al* (2015), disbudding was commonly performed using caustic paste and only a very low percentage of farmers used anaesthesia or analgesia. Given the painfulness of disbudding, this indicates an area where calf welfare should be sought to be improved.

Farmers' and veterinarians' view regarding intervention thresholds

Large variation was found in the views of farmers and veterinarians as regards intervention thresholds for different welfare indicators. For the median intervention level for the different welfare indicators, both groups of respondents referred to the lower end of the scale, medians mostly ranging between 0 and 10%, for most of the welfare indicators. Although farmers and veterinarians agreed in 8 out of 14 measures on the intervention levels, differences were found for important health and welfare issues. For example, regarding lameness and mastitis, the veterinar-ians' median intervention level was zero tolerance (at the farm level), while farmers appeared more permissive, setting the threshold at 10%. From the veterinarians' point of view, lameness and mastitis are deemed effectively treatable and tend to be viewed as core tasks. Farmers, however, may view both more as unavoidable production diseases of farm animals (Mulligan & Doherty 2008; Ritter *et al* 2017). The farmers were nevertheless stricter as regards the prevalence of very lean animals, perhaps due to none of the investigated farms showing a prevalence of very lean cows above 10%. Another difference between the groups was seen with incidence of dystocia, with a 0%

level of acceptability set by the farmers, compared to 10% from the veterinarians. Apparently, for veterinarians, dystocia is a regular occurrence. Despite the minimum threshold given by the farmers, the level of dystocia in participating farms was relatively high, often exceeding the alarm threshold set by the Welfare Quality® protocol (2009). When comparing intervention thresholds set by both farmers and veterinarians with the actual, on-farm occurrences, major discrepancies were detected whereby average on-farm prevalences proved substantially higher than suggested thresholds, eg for animal cleanliness, lameness and integument alterations (see Tables 2 and 5).

There was also no meaningful pattern of correlation between on-farm welfare assessment findings (Visit II) and farmer thresholds, ie the proposed thresholds did not match reality on the farms as obtained from the animal-based welfare assessment. These weak correlations raise the question of how farmers perceive welfare problems. On the one hand they appear aware of the importance for welfare of proposing thresholds which are much lower than that seen on-farm (eg dirty hindquarters). Social desirability might also have played a role (Lusk & Norwood 2010) as the farmers might have considered it opportune to suggest stricter intervention levels than they may regard relevant and/or realistic. On the other hand, for example, regarding lameness, farmers may not be aware of the proportion of animals affected (Whay *et al* 2002) and, as such, do not regard it as a major problem (Leach *et al* 2010).

Animal welfare implications and conclusion

Taking the small scale of the enrolled farms into account, the implementation of the Welfare Quality® protocol appears to be feasible, especially with regard to the animal-based measures which can be considered practical and well accepted by the farmers in Kosovo. The main areas of concern are cleanliness, lameness, and integument alterations which require improved tie-stall dimensions and management routines in terms of provision of bedding and cleaning. Despite comparatively high prevalences, farmers and veterinarians suggested rather low intervention levels for most welfare indicators and their perspective re-intervention levels appears to be less affected by the on-farm situation. To improve welfare, close co-operation between farmers and veterinarians or other advisors in terms of awareness and feasibility of investing in farm buildings and incorporating changes of the daily management routine (eg more bedding, higher cleaning frequency) are considered necessary.

Declaration of interest

None.

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