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Animal welfare assessment and potential strategies to improve dairy cattle welfare in Kosovo

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A doctoral thesis submitted to the University of Natural Resources and Life Sciences, Vienna, for the award of the Doctor rerum naturalium technicarum degree

Vienna, January 2017

Acknowledgements

I would like to thank all the people who contributed in some way to the work described in this thesis. I am grateful to all of those with whom I have had the pleasure to work with during the PhD project, without them this project would not have been possible.

First and foremost I would like to express my deep sense of gratitude to my supervisor *Christoph Winckler* for valuable guidance and kind supervision given to me throughout my PhD studies. Thank you for providing me personal and professional guidance and teaching me a great deal about both scientific research and life in general.

I express my sincere thanks to *Christine Leeb*, for her encouragement and supervisory role during the whole study process and supporting me whenever I needed it in various ways.

I sincerely thank *Ardita Jahja* for her support and motivation at any time. I wish to express appreciation to the professors from University of Prishtina, Faculty of Agriculture and Veterinary: *Skender Muji* and *Behlul Behluli* for their kindest support in the process of recruiting farms. I would like to thank *Katharine Leach* for the time spent on revising my thesis and useful comments during the writing process.

Special thanks go to my colleagues who were always so helpful in numerous ways: *Verena Größbacher*, *Anke Gutmann*, *Gwendolyn Rudolph*, *Katharina Schodl* and *Lukas Tremetsberger*. In particular, many thanks go to *Daniela Kottik* for her friendship and willingness to support me at any time with various technical and administrative stuff.

I gratefully thank all farmers participating in the study for their time and effort.

I am immensely obliged to thank my parents *Litafete* and *Hilmi*, my wife *Nita* and my sisters *Linda*, *Ardiana* and *Franciska* for supporting me spiritually during writing the thesis and my life in general.

This work would not have been possible without the financial support of the OEAD-Scholarship and HigherKOS. The present study was part of the HigherKOS programme financed by ADA (Austrian Development Agency). The text represents the author's view and does not necessarily represent a position of the funding bodies, who will not be liable for the use made of such information.

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List of Abbreviations

AD	Absence of disease
ADF	Avoidance Distance
AHW	Animal health and welfare
AI	Absence of injury
APIMP	Absence of pain induced by management procedure
APT	Absence of prolonged thirst
AW	Animal Welfare
Bcs	Body condition score
BWAP	Bristol Welfare Assessment Protocol
CAR	Comfort around resting
CU	Chasing up
DP	Displacement
EM	Ease of movement
EOB	Expression of other behaviour
ESB	Expression of social behaviour
EU	European Union
FAO	Food and Agricultural Organization
GHAR	Good human animal relationship
Ha	Hectare
HB	Head butt
Kg	Kilogram
L	Liter
PES	Positive emotional state
QBA	Qualitative behaviour assessment
RSPCA	Royal Society for the Prevention of Cruelty to Animals
TPB	Theory of planned behaviour
UK	United Kingdom

Summary

In recent years, concerns about dairy cattle welfare have been raised in the Western Balkan region, but on-farm welfare assessment and/or improvement studies are rare. The present thesis covers the first study on dairy cattle welfare in Kosovo, where dairy cattle husbandry mostly takes place in comparatively small holdings with low productivity and tie stalls as the most prevalent housing system. The aims of this study were a) to investigate the attitudes of dairy farmers towards animal welfare and the implementation of welfare improvement measures, b) to assess the welfare state of dairy cattle in commercial farms in Kosovo, c) to implement improvement plans to increase the level of welfare in dairy cattle and, d) to study the opinions of farmers and veterinarians regarding intervention thresholds and animal welfare standards. It was conducted on in total 30 dairy farms with tie stalls (average herd size 27 cows) and data collection was based on questionnaires and the Welfare Quality® assessment protocol for dairy cattle. Per farm, in total four visits were carried out during the period November 2013 to April 2015 (interview – welfare assessment – assessment/provision of feedback/development of plan – re-assessment for evaluation). Related to d), data from veterinarians was obtained using an online questionnaire.

a) In terms of indicators of animal welfare, the 30 farmers mostly referred to the health state but also emphasized the provision of favourable environments (e.g. feed provision and hygiene) and thus resource-based indicators. Financial restrictions were regarded the most important issue impairing the improvement of animal welfare. In line with the indicators of welfare, taking care of the animals' health and providing animals with a favourable environment were considered the most important means of improving animal welfare, closely followed by the humane treatment of animals and investing in motivation and wellbeing at work. However, feasibility to implement measures was consistently scored lower than importance. Attitudinal components as regards importance/perceived behaviour control, subjective norms and general attitudes towards welfare were obtained from Principal Component Analysis. Based on structural path modelling, subjective norms were identified as the strongest predictor for the intentions, while attitude was only very weakly associated with intentions. There was no direct link between perceived behaviour control and intentions, but perceived behaviour control indirectly linked with intentions through the associations with subjective norms.

b) Application of the Welfare Quality® assessment protocol was feasible in the farms studied, and the animal based-measures may be considered practical and well accepted by the farmers. The major areas of concern identified relate to comfort around resting (i.e. cleanliness, time needed to lie down, animals lying partly outside the lying area) and injuries (e.g. skin alterations, swellings) including lameness. Additionally, as regards management aspects and the provision of resources, disbudding of calves is mostly performed without anaesthesia and most farms do not provide access to an outdoor run or to pasture.

c) Results of the assessment from the third visit were reported to the farmers during the visit and possible changes of the housing and/or management discussed in order to agree on farm-specific measures to be implemented. The farmers tended to focus on one specific area with hygiene and comfort measures around the resting area being most frequently addressed followed by lameness

interventions. After a time period of four months, implementation rate was 36% and mainly low-cost measures addressing cleanliness had been put into practice. In the farms, which had implemented measures, significant improvements were achieved regarding animal cleanliness as well as severe integument alterations (lesions and swellings).

d) The importance attributed to most of the welfare criteria used in the present study did not differ between farmers and veterinarians but behavioural parameters were rated lower than health related measures. Regarding intervention levels, farmers and veterinarians agreed in the majority of the measures (8 out of 14), but differences were also found for important health and welfare issues (e.g. lameness, mastitis). Interestingly, major discrepancies were found for some measures between the intervention thresholds set by the farmers/veterinarians and the true on-farm situation, such that average on-farm prevalences were substantially higher than the suggested thresholds (e.g. for animal cleanliness, lameness and skin alterations). In general, farmers estimated costs of implementation of measures higher than veterinarians.

In conclusion, given the weak association between attitudes and subjective norms, communication and collaboration between relevant stakeholders and farmers should be promoted; this also includes (continuing) education of agricultural advisors and veterinarians in terms of animal welfare and its dissemination. The risk factors for the main welfare outcomes such as cleanliness or lameness are well known and investments in farm buildings (including amendments of existing barns) and incorporating changes of the daily management routine are considered necessary. To ensure the effectiveness of health and welfare planning under the farming conditions in Kosovo, long-term studies and cooperation with advisory services are recommended. The use of animal-based welfare assessment protocols by cattle practitioners and the state veterinary service is considered promising.

Zusammenfassung

In den vergangenen Jahren ist in der westlichen Balkanregion das Interesse an Tierwohl von Milchkühen gestiegen, es gibt jedoch nur wenige Praxisstudien dazu. Die vorliegende Studie befasst sich mit Tierwohl von Milchkühen im Kosovo, wo Milchviehhaltung überwiegend in vergleichsweise kleinen Betrieben mit Anbindehaltung und auf einem niedrigen Leistungsniveau stattfindet. Die Ziele dieser Arbeit waren, a) die Einstellungen von Landwirten im Kosovo gegenüber Tierwohl und diesbezüglichen Verbesserungsmaßnahmen sowie b) den Wohlergehensstatus von Milchkühen im Kosovo zu untersuchen, c) Verbesserungsmaßnahmen in Praxisbetrieben zu implementieren und d), die Meinungen von Landwirten und Tierärzten zu Interventionsschwellen Tierwohlstandards zu erfassen. Die Datenerhebung in insgesamt 30 Betrieben (mittlere Herdengröße 27 Kühe) basierte auf Fragebögen und dem Welfare Quality® Protokoll für Milchkühe. Je Betrieb fanden zwischen November 2013 und April 2015 vier Besuche statt (Interview – Erfassung Wohlergehen – Erfassung Wohlergehen/Rückmeldung/Planerstellung – wiederholte Erhebung/Interview). Zusätzlich wurden Tierärzte bezüglich d) mittels Online-Erhebung befragt.

a) Die 30 Landwirte bezogen sich hinsichtlich Indikatoren für Tierwohl vor allem auf den Gesundheitszustand, betonten aber auch ressourcenbezogene Parameter wie Fütterung und Hygienemaßnahmen. Die ökonomische Situation wurde als Haupthemmnis für die Umsetzung von Maßnahmen zur Verbesserung des Tierwohls genannt. In Übereinstimmung mit den Indikatoren für Tierwohl sahen die Befragten die Erhaltung der Tiergesundheit sowie günstige Haltungsbedingungen als wichtigste Maßnahmen zur Verbesserung des Tierwohls an, gefolgt von angemessenem Umgang mit den Tieren und Berücksichtigung der Motivation der Tierhalter sowie deren Wohlbefindens. Die Machbarkeit von Ansätzen zur Tierwohlverbesserung wurde jedoch durchgehend geringer eingestuft als deren Wichtigkeit. Einstellungskomponenten bezüglich Wichtigkeit/Beeinflussbarkeit, subjektiven Normen und allgemeiner Einstellung wurden durch Hauptkomponentenanalyse ermittelt. Ein Strukturgleichungsmodell ergab, dass die Einschätzung der subjektiven Normen die stärkste Beziehung zur Intention, Maßnahmen umzusetzen, aufwies; dagegen lag nur eine schwache Beziehung der Einstellungskomponenten zur Intention vor. Die Intention, Maßnahmen umzusetzen, war nicht direkt mit der Einschätzung der Beeinflussbarkeit verbunden, indirekt bestand aber ein Einfluss durch den Zusammenhang zwischen Einschätzung der Beeinflussbarkeit und Einschätzung der subjektiven Normen.

b) Die Anwendung des Welfare Quality® Protokolls in den Untersuchungsbetrieben erwies sich als problemlos und die tierbezogenen Maessgrößen wurden gut von den Landwirten angenommen. Als Hauptproblembereiche wurden der Liegekomfort (z.B. Tierverschmutzung, Dauer des Abiegens, Liegen teilweise außerhalb des Liegebereichs) und Schäden (z.B. Hautveränderungen, Schwellungen) einschließlich Lahmheit ermittelt. Zusätzlich sind die Entfernung der Hornanlage von Kälbern ohne Betäubung sowie der fehlende Zugang zu Laufhöfen oder Weide als kritisch zu betrachten.

c) Die Ergebnisse des dritten Betriebsbesuchs wurden unmittelbar zurückgemeldet, mögliche Änderungen der Haltung oder des Managements diskutiert und betriebsspezifische Maßnahmen vereinbart. Die Landwirte wählten in der Regel nur einen Bereich aus, vor allem Hygiene bzw.

Komfort des Liegebereichs gefolgt von Lahmheitsintervention. Die Umsetzungsrate der vereinbarten Maßnahmen betrug nach vier Monaten 36%; überwiegend wurden mit geringen Kosten verbundene Maßnahmen zur Verbesserung der Tiersauberkeit umgesetzt. In Betrieben, die tatsächlich solche Maßnahmen implementiert hatten, ging im Beobachtungszeitraum der Anteil verschmutzter Tiere sowie der Anteil von Tieren mit hochgradigen Integumentveränderungen (Hautläsionen und Schwellungen) signifikant zurück.

d) Landwirte und Tierärzte unterschieden sich nicht hinsichtlich der Bedeutung, die den meisten Tierwohlkriterien zugemessen wurde, aber Verhaltensparameter wurden als weniger wichtig eingeschätzt als Parameter der Tiergesundheit. Im Hinblick auf Interventionsschwellen stimmten Landwirte und Tierärzte in 8 von 14 Kriterien überein, für wichtige Indikatoren des Tierwohls lagen aber auch Unterschiede vor (z.B. Lahmheit, Mastitis). Interessanterweise bestanden teilweise deutliche Diskrepanzen zwischen den angegebenen Schwellenwerten und der tatsächlichen Situation in den Betrieben, z.B. erheblich höhere mittlere Prävalenzen für Tierverschmutzung, Lahmheit, Integumentveränderungen im Vergleich zu den vorgeschlagenen Schwellenwerten. Landwirte schätzten die Kosten für die Umsetzung von Verbesserungsmaßnahmen höher ein als Tierärzte.

Schlussfolgerungen: Angesichts der schwachen Beziehung zwischen der Einstellung gegenüber Tierwohl und der Einschätzung der subjektiven Normen sollten Zusammenarbeit und Kommunikation zwischen Landwirten und den relevanten anderen Beteiligten verstärkt werden. Dies schließt auch die (Weiter-)bildung von landwirtschaftlichen Beratern und Tierärzten hinsichtlich Tierwohl und dessen Vermittlung ein. Die Einflussfaktoren auf die identifizierten Problembereiche sind gut bekannt; ihre Umsetzung erfordert Maßnahmen in der Haltungstechnik (einschließlich Adaptierung bestehender Gebäude) und Veränderungen in den Managementroutinen. Längerfristige Studien zur Herdengesundheits- und Wohlergehensplanung im Kosovo sind in Zusammenarbeit mit den Beratungsdiensten wünschenswert.

1 Introduction

Throughout the world interest in the animal welfare topic is continuing to grow. Concerns about animal welfare have raised the efforts to intensify measures and thus safeguard and improve the welfare of animals. Animal husbandry practices have improved constantly. To ensure competitiveness farmers have increased herd sizes and production intensity by adopting changes in housing, nutrition and care of animals (Majewski and Harvey, 2012) with dairy cattle being one of the main species affected. However these changes to increase production, affecting rearing systems and animal health have led to public concerns by provoking the greater debate of 'unnaturalness' of modern farms (Keeling et al., 2011). In many European countries governments have responded to public concerns by adapting legal regulations and laying down minimum standards for animal welfare. Simultaneously research increasingly understood animals' needs by developing tools for animal welfare assessment. In numerous scientific approaches measurements were developed to assess various indicators of animal wellbeing starting with the Animal index needs at the beginning of the process (Bartussek et al., 2000) to more recent developments such as the Welfare Quality® protocol for dairy cattle (Welfare Quality®, 2009). The Welfare Quality® protocol comprises numerous welfare measures with special focus on animals 'animal based measures' and to a lesser extent on 'resource based measures' focusing on management and resources provided to animals. These two approaches of gathering information are considered essential for the overall evaluation at farm level (Botreau et al., 2009). The Welfare Quality® protocol is still being developed in an ongoing process, discussing and evaluating difficulties and different approaches to on-farm welfare assessments (Johnsen et al., 2001, Bracke, 2007, Knierim and Winckler, 2009). However, to sustain the implementation and to improve the welfare of dairy cows the opinion of stakeholders is essential. It is necessary to determine to what extent stakeholders are ready to contribute in implementing animal welfare measures and to what extent they are ready to react towards different indicators of animal welfare. Furthermore assessing and improving animal welfare highlighted the opinion of stakeholders towards this topic. Especially in recent years numerous studies were carried out with the aim of understanding and conceptualizing animal welfare improvements from stakeholders' point of view (Heleski et al., 2004, Heleski and Zanella, 2006, Kauppinen et al., 2010, Kirchner et al., 2014c).

In Kosovo the majority of dairy cows are kept in small and medium sized farms with tie stalls. Cattle farmers in Kosovo have little or no knowledge about animal welfare and existing standards in their region. This may results in the unsatisfactory welfare status of animals, emergence of chronic health problems and low production. Although AW legislation in Kosovo is laying down minimum standards, the implementation of standards is minimal due to limited capacities and lack of knowledge among competent authorities.

The Welfare Quality® protocol was set out to develop scientifically sound tools to assess animal welfare of dairy cows in Kosovo. Therefore, the objectives of the present study constitute the evaluation of farmers' attitudes towards animal welfare, the implementation of the Welfare Quality® protocol on commercial dairy farms with tie stalls and on defining possible improvement strategies. Furthermore, this study aims to evaluate opinions of stakeholders (farmers and veterinarians) regarding intervention threshold of different welfare problems on dairy farms.

1.1 Concept of Animal Welfare

Animal welfare became a prominent societal issue in the last century starting in the UK. Societal concerns were raised on husbandry conditions of animals in intensive 'modern farming' systems and on the animals' ability to live a natural life (Veissier and Forkman, 2008, Keeling et al., 2011). Later on legislation was adapted and many European governments prohibited certain practices as response to public concerns of animal welfare. Among the earliest EU countries regulating different problems for example 'behaviour' by law were Sweden and Switzerland, with similar animal welfare legislations being adopted later in other European countries (Keeling et al., 2011). The scientific interest in animal welfare gradually increased in the 1960s after the publication of Harrison's book 'Animal Machine' (Harrison, 1966), followed by the publication of the 'Brambell Report' 'Command Paper 2836' (Brambell, 1965) by the British government. Despite the fact that an animal was suffering in intensive agriculture, both publications have raised the fact that animals are sentient beings and have the ability to feel pain and stress. The first origins of the concept of animal welfare derived from the Brambell report claiming that 'Animal Welfare' is wide term embracing both physical and mental wellbeing, therefore scientific evidence regarding the feelings of animals must be taken into account Command Paper 2836 (Brambell, 1965). This report appreciated the importance of understanding sentience as an essential part of welfare assessments (Duncan, 2006). The early 1980s became a progressive period where behavioural scientist accepted the importance of feelings in animal welfare and considered it an invisible component of animal welfare (Dawkins, 1980, Duncan and Dawkins, 1983, Duncan, 2006). Since then scientific approaches were developed attempting to determine numerous factors involved in the quality of life of animals (Keeling et al., 2011).

The concept of animal welfare can be seen from different perspectives with different stakeholders putting emphasis on different aspects of animal welfare, raising the impression there is no generally accepted definition of animal welfare (Keeling et al., 2011). Although the scientific concept of animal welfare is still developing, the most common and comprehensive concept was derived from the five freedoms developed by the Brambell Report Committee (Brambell, 1965). Animal welfare is a multidimensional concept embracing both physical and mental states, with the *physical* state referring to biological needs and good health while the *mental* state refers to subjective feelings (Veissier and Forkman, 2008).

These aspects are included in the official definition of the World Organization for Animal Health (Veissier and Forkman, 2008, Keeling et al., 2011) and are an integral part of animal health and food quality (Horgan and Gavinelli, 2006).

Concerns over animal welfare have encouraged science to design assessment tools to address the key elements of animal welfare issues e.g. the Welfare Quality® protocol (Welfare Quality®, 2009). Attempting to recognize and define animal's needs is however still an ongoing process. New techniques to assess animal welfare and to validate measures are constantly developing (Whay, 2007, Knierim and Winckler, 2009). Although there is no unified assessment tool the rate of adoption is considered impressive, as the assessment tool has been applied in various situations and environments in which animals are kept (Whay, 2007).

1.2 On farm Animal Health and Welfare Assessment (AHW)

Several protocols have been developed with the aim of creating assessment schemes for obtaining the outcomes from measurements into the husbandry system. The majority of protocols are designed to obtain information from farm management and assessment with focus on animals (Heath et al., 2014). On-farm assessment schemes of health and welfare were mainly based on certain parameters that could be divided in two categories: parameters from environment and management (e.g. feeding, drinking facilities, space allowance, length of the stall) and parameters recording the reaction of animals to a specific environment (behaviour, health and physiology) (Johnsen et al., 2001, Whay et al., 2003, Botreau et al., 2007, Botreau et al., 2009).

First attempts to create a tool to investigate or certify the welfare of animals took place in the 1980's known as the 'Animal Needs Index' (Bartussek, 1999, Bartussek et al., 2000). The Animal Needs Index was developed in Austria, followed by a revised version in Germany (Sundrum et al., 1994), however both systems assessed the impact of the housing system on animal welfare. This index system has mainly been developed to assess animal welfare of organically farmed cattle, pigs and laying hens with the primary focus on environmental and management parameters and thus neglecting animal based parameters (Johnsen et al., 2001). The format of creating the welfare assessment tool was continued by the Bristol Welfare Assessment Protocol (BWAP) as certification scheme. This protocol was developed based on application of animal based parameters for dairy cattle, pigs and laying hens in UK. The aim of BWAP was to improve the certification process of livestock production by assessing welfare with animal based parameters (Main et al., 2007). Due to feasibility the BWAP protocol included mainly clinical parameters of animals and to a lesser extent behavioural parameters. According to Main et al. (2007) the critical feature of this system was the concept of guidelines of each parameter. In practice BWAP was not considered a finite version of welfare-relevant parameters. However it can be considered a generic description of methodology with valuable use in assessing compliance with welfare legislation, farm assurance standards and further research. In that aspect some parameters were added and amended for the Welfare Quality® protocol (Leeb et al., 2004). Another assessment tool developed was AssureWell (2010-2015) as collaboration between the Soil Association and the University of Bristol (AssureWell, 2012). The AssureWell project developed a system of welfare assessment, which can be included in farm assurance schemes. The AssureWell protocol was incorporated in the Royal Society for the Prevention of Cruelty to Animals (RSPCA) assurance scheme with the aim to detect, monitor and improve welfare issue in cooperation with the farmers by using the benchmarking method (Main and Mullan, 2011).

Between 2004 and 2009 the European Welfare Quality project was designed as a tool of an overall welfare assessment of cattle, pigs and poultry on farm and at slaughter. This assessment tool was designed to help relevant stakeholders to identify welfare problems and to monitor the progress for certain welfare parameters (Botreau et al., 2009). At the same time it may also facilitate advice for potential improvements (Knierim and Winckler, 2009).

The Welfare Quality® protocol was developed as an assessment system that converts welfare measures into summary information at unite level (Welfare Quality®, 2009). According to (Botreau et al., 2009) the Welfare Quality® assessment involves numerous welfare measures focused primarily on animals and to a lesser extent on resources or management features. Regarding the assessment the welfare criteria were required to be exhaustive, minimal, independent, agreed

upon (by all stakeholders) and legible (Botreau et al., 2007). In this context the Welfare Quality® protocol comprised four main principles split into twelve independent welfare criteria with measures selected to assess these criteria (Welfare Quality®, 2009). Twelve criteria scores were integrated into 4 principles for further aggregation into a single evaluation (Botreau et al., 2009). The welfare assessment protocol used both approaches of data collection: animal and resource based measurements. Animal based measurements were directly assessed at the animal and consisted of direct observation to record health and behaviour (Whay et al., 2003). This approach provides direct answers on how animals are coping within their environment. The resource based measurement is an indirect way of measuring animal welfare (Whay, 2007) by obtaining information on resources of which animals have been provided with (Hörning, 2001). The Welfare Quality® protocol is scientifically robust and covers the aspects that reflect the opinions of stakeholders including natural scientists, social scientists and the general public (Blokhuys et al., 2010, Heath et al., 2014). The Welfare Quality® protocol involve the measures often debated and criticized regarding what and how measures are taken, collected and interpreted. Major criticism was raised towards resource-based measures and behaviour observation in terms of validity, reliability and feasibility (Knierim and Winckler, 2009, Vasseur et al., 2013, de Vries et al., 2013). However recent studies of on-farm welfare assessments have shown potentially useful tools to assess the welfare of animals. Further developed tests could serve to overcome the reluctance in feasibility of certain measures that could be included in the future (Andreasen and Forkman, 2012, de Vries et al., 2013, Andreasen et al., 2013, Tremetsberger et al., 2015).

1.3 Welfare issues in dairy farming

An increasing demand in milk production drives dairy farmers to expand herd sizes, not contingent on housing conditions (grassed based system vs. indoor housing system) and management. This developmental trend induces a permanently increasing interest in welfare issues of dairy cows by the relevant actors such as consumers, trade and legislators (Logue and Mayne, 2014) as well as farmers. Nowadays concerns on the welfare of animals are nothing out of the ordinary (Rushen et al., 2007a), however the focus of these concerns changed over time. Traditionally absences of illness or injury were regarded as parameters for high animal welfare. Recently welfare concerns were increasingly addressing ‘affective states’ of animals through understanding and examining positive mental states (Fraser, 2008, Bertenshaw et al., 2008, Von Keyserlingk et al., 2009). Over the past decade the livestock research constituted a general increase in publication of papers related to various welfare issues (Millman et al., 2004, Tremetsberger and Winckler, 2015). The main focus of welfare issues regarding dairy cows were lameness (Leach et al., 2009, Cook and Nordlund, 2009, Blackie et al., 2011, Main et al., 2012, Whay et al., 2012, Richert et al., 2013, Leach et al., 2013) and udder health (Busato et al., 2000, Cook, 2002, Fall et al., 2008, Cook and Nordlund, 2009, Ivemeyer et al., 2012, Tremetsberger et al., 2015). In addition behavioural issues investigated by research were resting behaviour (Tucker et al., 2009, Ledgerwood et al., 2010), positive behaviour (Boissy et al., 2007, Proctor and Carder, 2014) as well as the relationship between behaviour and common problems such as mastitis and lameness (Palmer et al., 2012, Sepúlveda-Varas et al., 2014). These were increasingly included to evaluate the welfare status of dairy cows.

Research findings in many countries substantiate that lameness of dairy cows is yet a continuing problem. Lameness is a painful condition impairing the welfare of cows (Rushen et al., 2007c, Rutherford et al., 2009) and thus is considered one of the major welfare issues in dairy farming. Lameness is multifactorial conditioned and can lead to distress experienced by the cows, low milk production (Archer et al., 2010, Reader et al., 2011), low fertility (Hultgren et al., 2004) and early culling (Booth et al., 2004). Reported lameness prevalences in European countries often exceed expert intervention thresholds, ranging from 19% in organic dairy farming in Germany (March et al., 2008), 31% in Simmental dairy farming in Austria (Dippel et al., 2009) and 36% in the UK (Barker et al., 2010). Furthermore in Balkan countries lameness is reported with high prevalence even though housing, management, and herd sizes of farms differ from developed countries in the EU (Ostojic-Andric et al., 2011, Popescu et al., 2014, Radeski et al., 2015). Mastitis can be considered with the same level of importance as lameness, which occurs frequently, ranging from 25-40 cases per 100 cows (Fourichon et al., 2001, Lam et al., 2013). Mastitis is an infection of the mammary gland caused by different types of bacteria that often associate as a painful disease in dairy cows (Rushen et al., 2007a, Siivonen et al., 2011). In addition to economic losses, mastitis potentially leads to changed behaviour such as impaired feed intake (Fogsgaard et al., 2012) and reduced duration of lying down (Medrano-Galarza et al., 2012), potentially leading to highly impaired welfare of cows.

Many reproductive problems are associated with different forms of illnesses such as calving difficulties, lameness, metritis (Rushen et al., 2007a) as well as behaviour (Lopez et al., 2004) that can potentially lead to reduced fertility. Reduced reproductive performance in modern dairy breeds is considered a welfare concern due to inability of the animal to cope with its environment (Oltenacu and Broom, 2010). The calving difficulties, known as dystocia, are another common issue with clear implications for animal welfare. Dystocia is a painful condition (Huxley and Whay, 2006) potentially leading to impaired development and fitness of the calf followed by death (Tenhagen et al., 2007) as well as stillbirths (Meyer et al., 2001). Moreover, dystocia is likely to cause reduced productivity (Barrier and Haskell, 2011) and behavioural changes such as reducing feed and water intake as well as increasing standing bouts before calving (Proudfoot et al., 2009). Breeding and genetic selection enhanced traits for likelihood of higher milk yields, although high milk production often leads to concomitant metabolic stress due to high energy demands and mobilization of body reserves (Oltenacu and Broom, 2010). However, the immediate and long-term impacts of these and further issues on dairy cow welfare need further investigation for a more thorough understanding. Especially new and improved automated assessment technologies as well as the combination of techniques show potential to substantially improve the detection of behavioural changes thus identifying welfare impairments (Caja et al., 2016). Attempts to assess health and welfare of dairy cows on farm started to develop since at the end of the 1990s (Andreasen et al., 2013). Scientists in cooperation with farmers, veterinarians and agricultural advisors have focused on identifying and creating improvement strategies particularly focused on lameness (Whay et al., 2003, Whay et al., 2012) and udder health (Ivemeyer et al., 2009, Tremetsberger et al., 2015). So far implementations have not reached a satisfying level e.g. Bell et al. (2009) reported that advisory support on risk factors of lameness did not reduce lameness on 30 dairy farms over the one-year period. Similar results were reported in studies trying to improve udder health where only partial advances of

management factors were achieved during a one year extension program (Ivemeyer et al., 2009). Thus further efforts on identifying risk factors and promoting and encouraging implementation changes in animals' favor are needed.

The assessment of dairy cow welfare states in Balkan countries has received little attention until now, however the recent studies from Balkan countries pointed out the influences of housing systems on cow comfort and health conditions. The majority of cows is kept in tie stalls and experiences many problems with comfort around resting, collision with housing equipment and poor hygiene, potentially leading to mastitis, lameness and general poor welfare (Ostojic-Andric et al., 2011, Vučemilo et al., 2012, Popescu et al., 2014). Therefore, greater attention on ensuring the welfare of dairy cows must be directed on enforcement of legislation and expansion of research activities regarding welfare assessments to identify the issues impairing the welfare of dairy cows.

1.4 Health and Welfare improvement strategy

The livestock sector was suffering from several diseases with high prevalence's such as lameness and mastitis, which often exceeded expert intervention thresholds and were faced with criticism of animal welfare standards (Whay et al., 2003, Leach et al., 2009, Barker et al., 2010, Tremetsberger et al., 2015). The health and welfare improvement strategy is considered as a tool for early detection of problems on farms. It originated in the United Kingdom and was first introduced in the 1990s (Gratzer, 2011). The health and welfare improvement strategy is a way of starting a process to detect and solve problems, although degree of implementation with effectiveness will be measured in a continuous process after long monitoring periods. Nowadays research is conducted on new methods to solve problems through dissemination of knowledge and collaboration with farmers and advisors as main actors. This created an improved strategy to contribute to health promotion and disease prevention in livestock production (Vaarst et al., 2010).

The challenge of approaching farmers in order to encourage them to make changes on their farms is often linked with their behaviour and perception of the specific problems e.g. lameness and mastitis (Vaarst et al., 2011). It is clearly known that attitudes often differ from the behaviour of the farmers, thus they might give deviating responses compared to their actions (Whay and Main, 2010). Techniques to assess animal health and welfare are developing and improving constantly. The assurance scheme of health and welfare planning can detect and prevent various issues through active management of diseases, through monitoring of health and welfare and thus find farm specific solutions (Atkinson and Neale, 2008).

Health and welfare planning facilitates evaluation of the current situation and enables farmers to achieve disease reductions and to systematically set health targets (Vaarst et al., 2011). Indeed knowledge of the current situation can help to identify the problems and risk factors, and based on the outcomes it can result in more efficient improvement strategies (Whay, 2007). According to (Tremetsberger and Winckler, 2015) the concept of health and improvement strategies basically rely on three key elements: (1) assessment of health and welfare state (current situation), (2) feedback report and advice on issues (related health and welfare) and (3) constant review and adaption (re-assessment of the farm).

The health and improvement strategy was implemented mainly on organic farms but could also be implemented on conventional farms. However, the animal health and improvement strategy should be an active tool for animal health and welfare planning, embedded in a continuous process.

1.5 Dairy Farming in Western Balkan

Mainly numerous small holders and low productivity farms dominate the Western Balkan region. Agriculture in the Western Balkan region holds the potential of inexpensive labor, a favorable climate and close proximity to the EU (Lampietti et al., 2009).

However the economic transition in the Western Balkan (Albania, Kosovo, Macedonia, Serbia, Montenegro, Croatia and Bosnia and Herzegovina) induced changes in the farming system within the last two decades. During this time period, animals were transferred from large collective farms to many small private households, increasing the importance of subsistence farming in low cost production systems for many families in rural areas (Kuipers et al., 2014). Characteristics such as low productivity, small scale herd size, low income, poor infrastructure and lack of improvement in husbandry systems are present in almost all regions of the Western Balkan. Highlands predominantly characterize the Albanian topography. Small ruminants account for the largest part of livestock production with 64% of the total livestock population. Small ruminants are kept in the highlands, while the cattle are kept mostly in the lowlands. Farm sizes are very small. 98% of the cattle population is situated on small-scale farms with 1-2 cows per farm, while the number of farms adopting intensive production is very limited (Acrotass-Consortium, 2006). The level of productivity has still not been fully utilized, however in recent years milk production increased up to 1.07 Mio tons per year. This increase in production is most likely due to increasing numbers of highly productive animals such as Jersey and Holstein with average milk yields of 2900 kg per year. However the milk production is still very low compared to EU countries (Acrotass-Consortium, 2006). In Serbia the cattle population has decreased to 18.6% of the total livestock population within the last decade. In Serbia milk is still considered one of the major livestock products (Aleksić et al., 2009). Despite fluctuations of the cattle population, the increase of milk productivity of dairy cows was attributed to genetic improvement (Aleksić et al., 2007). Furthermore the most dominant breeds with approximately 70% of the total number are Domestic Spotted and Simmental (Aleksić et al., 2009). Regarding farm size, farms in Serbia are slightly larger than farms in Croatia, where 55% of farms had herd sizes of up to 15 cows, followed by 15% of farms keeping up to 30 cows and only 8% of farms had herd sizes from 30 up to 100 dairy cows (Bogdanović et al., 2013). The dairy sector in Croatia tended to be comparable with its neighbor countries. Similar to Serbia the dominant breed is Simmental, followed by Holstein and Brown Swiss. Regarding herd sizes, 92.2% of the dairy cows population was kept in small sized farms or so called modernized traditional farm with less than 15 cows per farm, whereas only 7.7% were small conventional dairy farms with more than 16 dairy cows (Ivanković et al., 2014). The overall milk production in both Serbia and Croatia ranked from 2500 to 4000 L milk yield per cow and year (Kovacic and Bozic, 2009, van Berkum, 2009).

Similar to its' neighbor countries Macedonia is characterized by small scale farming structures and low productivity. Nevertheless the dairy sector as well as dairy products are considered the

most developed subsector in Macedonia (Krstevska, 2008). The cattle population in Macedonia is estimated to be 238.000 cows. 50% are dairy cows producing with an annual milk yield of 2.928 L per cow (Radeski et al., 2015). Approximately 91% of dairy farms had less than 10 dairy cows in 2005, 6% of farms had less than 20 dairy cows with, 2% represented farms with less than 50 dairy cows, whereas only 1% of farms had more than 50 dairy cows in the herd (Krstevska, 2008). Also today the farming structure is mainly constituted by family households and dominated by traditional farms with up to 3 cows and by family farms with 15 -20 dairy cows, whereas only 1% of farms had larger herds than 50 cows (Radeski et al., 2015).

In Bosnia and Herzegovina the dairy sector was facing several obstacles within the last decades such as low shares of collected milk, inefficient organization of milk producers and very small farms with poor infrastructure and lack of cooling storage facilities. Today small farm sizes constitute the majority of bovine animals in Bosnia, with very small herds ranging from 1 up to 4 cows per farm accounting for 93% of the cattle population. Only a very low percentage of 0.75% represents herd sizes ranging from 11 to 30 cows with an average milk yield of 2490 L per year (Sakic and Crnkic, 2014).

Similar to Macedonia, in Montenegro cattle farming is considered a significant subsector of livestock farming (Markovic and Liesbeth, 2012). The dairy sector is rather similar to other neighbor countries with 98% of the cattle population being held on family farms with herd sizes of up to 3 cows whereas only 2% of the cattle population were owned by business entities. The breed structure comprises 50% crossbreeds and 40% dairy breeds (Brown Swiss, Holstein and Simmental). Total milk yield of the dairy cows population in Montenegro was estimated at 2500 L milk per cow and year (Markovic and Liesbeth, 2012).

In the Western Balkan 46% of the population lives in rural areas (Lampietti et al., 2009). As structures across Western Balkan countries are similar and share the same concerns of the dairy subsector, a greater investment in projects is needed to raise awareness and stimulate the rural economy.

1.6 Dairy farming in Kosovo

After the war in 1999 the dairy sector in Kosovo was considered the fastest-developing sector of agriculture. Still today the dairy sector is one of the most promising sectors to establish a sustainable economic growth in Kosovo (Nushi and Selimi, 2009).

Dairy farming in Kosovo is mainly concentrated established in the private sector since the public sector collapsed in the period of 1990 to 1999, cooperatives dissolved and dairy supply chain productions were destroyed. Under those circumstances many families started working individually and became self-sufficient units, producing just enough to meet their consumption needs (USAID, 2007).

In Kosovo the majority of dairy farming is represented by small scale farms (ASK, 2015). The cattle population of Kosovo estimated to be 261.689 cattle with 51% dairy cows (ASK, 2015). 56% of dairy cattle are on smallholdings with 1-2 cows, 42 % are kept on farms with herd sizes of 3 to 9 cows, whereas only 1.2% are on farms with herds of more than 20 dairy cows (MAFRD, 2013, ASK, 2015).

Soon after the war in 1999 many international organizations such as the Food and Agricultural Organization (FAO) and the World Bank supported Kosovo with donations to increase and improve the livestock population through restocking projects by importing heifers from dual purpose breeds (Bytyqi et al., 2007). Today the dominating breeds in Kosovo dairy farming are Holstein Friesian and Red Holstein, Brown Swiss, Simmental and Montbéliarde (Bytyqi et al., 2009). The housing conditions of farms in Kosovo are considered one of the major obstacles as the vast number of farms keeps animals permanently tethered (tie-stall), and the ratio of farms with access to outdoor run and pasture is very low. However loose housing systems were only recently introduced and are often not feasible for farmers in Kosovo.

The raw milk distribution network in Kosovo is organized in two levels. The first level represents 55 milk collection points which supply the six top processing dairies (Nushi and Selimi, 2009). The small farms with up to 10 cows send their milk to the nearest milk collection point. The second level represents the larger farms with more than 10 dairy cows, where the milk collector from the dairy comes directly to the farm. The annual milk yield varies from 1500 to 5000L at larger farms with Simmental and Holstein breed, however the average milk yield is estimated to be around 2.200 liters per cow and year (Nushi and Selimi, 2009). However farmers with insufficient resources are often reluctant to meet the requirements of high productivity breeds, thus causing high risks of metabolic disorders due to inadequate feeding regimes and high risks of reproductive disorders (Bytyqi et al., 2007). According to (USAID, 2007) eighty-five percent of the milk produced in Kosovo is consumed by the farming family or goes to unregulated local markets (green markets). Only fifteen percent of the produced milk flows through commercial channels to processors and domestic markets. At this stage Kosovo's capacity is limited to cover only 30% of the total consumption. Therefore to fill this gap Kosovo imports relatively high percentages of processed milk from abroad accounting for approximately 70% of the total consumption (Nushi and Selimi, 2009).

Nevertheless, increasing the capacity of dairy farms is essential for the dairy sector. Intensification by improving sustainable systems in the dairy sector is necessary, laying special emphasis on developing the rural economy and utilizing natural resources.

1.7 Farmers' attitudes towards Animal Welfare of dairy cows

Dairy cattle play an important role in terms of production throughout the world. Today dairy cattle are kept in a variety of housing conditions, management, and climates. Each type of housing has different impacts on the welfare of dairy cattle. The various housing systems and herd sizes determine the herdsman's dedication and relation with the animals, which is crucial for their welfare. Animal husbandry practice has become increasingly intensified by increasing production. Thus in time living conditions became a public concern and were intensively addressed with regards to animal welfare by sometimes superimposing the well-being of farm animals even in the absence of welfare among humans (Hansson and Lagerkvist, 2016). On the other hand studies indicated that wellbeing and job satisfaction of humans are a key point in interactions with animals (Waiblinger et al., 2002). Animal welfare science has tried to connect the bridge between farms and public by approaching scientifically certain welfare problems raised by public concerns. Different studies were carried out with the aim of knowing attitudes of different stakeholders such

as consumers (Frewer et al., 2005, Spooner et al., 2014, De Backer and Hudders, 2015), students and faculty members (Heleski et al., 2004, Heleski and Zanella, 2006), veterinarians (Sabuncuoglu and Coban, 2008). However the opinion of farmers and their representations towards animal welfare were rarely heard (Kauppinen et al., 2010).

In principle attitudes and behaviour of caregivers reflect upon animals behaviour, health, welfare and even production (Waiblinger et al., 2002, Hemsworth, 2003). The stockperson is largely responsible for animal care with frequent and close contact with animals. By knowing this fact, the welfare status of animals is strongly link with attitudes of the caregivers, although measuring attitudes and behaviour of caregivers is considered the best approach in implementing changes towards improvement of animal welfare.

Knowing solely the attitudes of the caretakers was insufficient as some actions may not correspond with their attitudes (Heleski et al., 2004). The Theory of planned behaviour (TPB) described that questions of attitudes connected with behaviours, better explained human behaviour than attitudes towards a given phenomenon. Perceiving behavioural beliefs combined with outcome evaluations help to produce overall attitudes towards positive or negative behaviour (Ajzen, 2011).

However nowadays surveys focusing on different aspects of animal welfare attitudes of farmers are intensively growing in many developed countries (Lensink et al., 2000, Bourlakis et al., 2007, Kielland et al., 2010, Kauppinen et al., 2010, Kirchner et al., 2014c).

In Eastern European countries the topic of animal welfare became prominent rather late. In non-EU Balkan countries animal welfare is still considered at the initial stage in terms of societal awareness and research activities. In Kosovo first attempts of integrating knowledge regarding animal welfare was introduced in 2012 by incorporating the topic in the curricula at the Faculty of Agriculture and Veterinary Pristina. Aims were to raise awareness about the importance of animal welfare in all stakeholders including farmers, students, researchers, local and central government as well as consumers.

2 Research Questions and Objectives

The topic of animal welfare is very novel in Kosovo. First attempts to integrate informations and knowledge on animal welfare in Kosovo has started rather late at the beginning of 2012. Taking this knowledge gap into account, the overall objective of this PhD project was to provide a better understanding of animal health and welfare. Further aims were to find possibilities supporting the increasing livestock productivity, stimulating the rural economy in Kosovo, reducing rural poverty and ensuring food security as well as ensuring the sustainable management of natural resources.

The specific research questions of the present thesis were:

- a) What are the attitudes of farmers towards animal welfare and towards the implementation of improvement measures?
- b) What is the level of welfare in dairy cattle in commercial farms in Kosovo?
- c) Which potential improvement strategies should be followed to increase the level of welfare in dairy cattle?
- d) What are the opinions of stakeholders regarding intervention level towards different welfare indicators?

The research project has been based on:

- evaluating attitudes of farmers towards animal welfare and towards the implementation of improvement strategies.
- reviewing existing welfare assessment protocols with regard to feasibility of application in Kosovo and amendments if necessary;
- assessing the state of dairy cattle welfare in commercial farms using these protocols;
- investigating opportunities and potential barriers to welfare improvements;
- encouraging implementation of animal welfare improvements on commercial farms.

3 Animals, material and methods

3.1 Overall study design

The study was carried out on 30 commercial dairy farms with tie stalls in Kosovo. The study design comprises four visits each of 30 selected dairy farms during the time period from November 2013 until April 2015. The study approach was based on four main stages: (1) selection of farms and interviews with the farmers, (2) implementation of the Welfare Quality® protocol, (3) reassessment of the farms, giving the feedback report and implementing the potential improvement strategy and (4) the final re-assessment of the farms for possible changes, interviews with the farmers and veterinarians.

Farms were selected according to the following criteria: minimum number of dairy cows, regions, farm design and willingness of farmers to participate. The first farm visit comprised introduction, detailed information of the project and interviews with the farmers regarding attitudes towards animal welfare. On the second visit data were collected and the Welfare Quality® protocol was applied on all 30 selected dairy farms. During the third visit farms were re-assessed after initial analysis of data, definition of risk factors and preparation of the feedback report. The re-assessment of the farms was based on the defined risk factors: the focus of the assessment was on clinical scoring, reporting the initial and current results via benchmarking method and discussing the possibility of implementing the improvement strategy with farmers. Four months after implementation of the improvement strategy the final visit was conducted to re-assess farms and evaluate the current situation for possible changes. Finally interviews with the farmers and veterinarians were conducted referring to the animal welfare standards and intervention level.

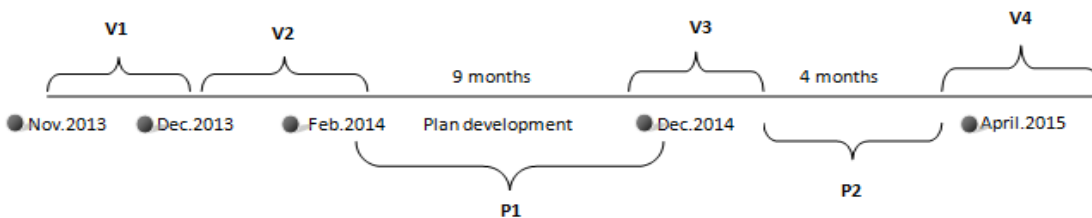


Figure 1. Schematic description of time schedule for on-farm data collection on 30 dairy farms in Kosovo. V1 First visit, V2 Second visit, V3 Third Visit and V4 Fourth Visit, P1 time period of plan development, P2 study period for implementation changes

Table 1. Description of main activity during study period. All the visits were carried out in a total of 30 dairy farms in tie stalls, on the same dairy farms. Visits in the farms =V, P= period (processing data and study period of implementing changes)

Time period	Visit/Period	Activity
November 2013	V1	Introduction of the project to the farmers Interview with the farmers regarding attitude towards Animal Welfare
December 2013 to February 2014	V2	Implementation of Welfare Quality® protocol (Welfare Quality®, 2009)
March 2014 to November 2014	P1	Processing and analyzing data Preparing the feedback report and plan development
December 2014	V3	Re-assessment of the farms with focus on clinical scoring Giving feedback reports to the farmers Implementing the improvement strategies previously agreed upon
January 2015 to March 2015	P2	Study period for implementation of changes
April 2015	V4	Re-assessment of clinical scoring on farms Evaluation of current animal welfare situation for possible changes Interviews with farmers and veterinarians regarding the intervention level

3.1.1 Introducing the project to the farmers

This project was approached by identifying farms in all regions of Kosovo through a contact list from the Ministry of Agriculture of the Republic of Kosovo and through lists from previous projects supported from the Faculty of Agriculture and Veterinary Medicine Pristina.

Farmers were first approached by phone calls during which appointments with the farmers were arranged. We visited every farmer with interest in this project and presented the purpose and steps of the project in detail. Following selection of farmers fulfilling the requirements (see below) and willing to further participate in the project, we conducted interviews and arranged a date for the next visit to implement the on-farm welfare assessment protocol.

3.1.2 Selection of farms

This study was conducted on 30 commercial dairy cattle farms with tie-stalls. This is fairly representative of Kosovo dairy farming as the majority of farms in Kosovo have tie-stall housing, as cubicle housing is in the initial stage of introduction and very low in numbers. The selection of farms was based on the following criteria:

- a) Minimum number of cows
- b) Regions
- c) Farm design
- d) Willingness of the farmers to participate in this project
 - a) In Kosovo commercial dairy farming is characterised by small scale farms of 5 to 20 cows, thus the minimum number of cows was the first selection criterion. Only farms with more than 15 cows were taken into account. The minimum number of 15 cows was considered to be statistically representative.
 - b) Farms were selected according to region, with the aim of including all regions and municipalities in Kosovo. The objective was to provide a better survey and overview of the aspects of the welfare states of dairy cows, as well as to increase the understanding of conditions and challenges of the dairy sector in different parts of Kosovo.
 - c) The farm design was taken into account to facilitate the implementation of the Welfare Quality® Protocol. It was crucial that the construction design of the farms was suitable to conduct behaviour observations, allow assessors to easily observe the animals of given groups, as well as provide space to measure Avoidance Distance (ADF) and observe other behaviours e.g. Qualitative behaviour assessment (QBA) and agonistic behaviour (Welfare Quality®, 2009).
 - d) Considering that this project consisted of four main visits, motivation and willingness of the farmers to participate in the project were considered crucial. As farmers were entrusted with the task of implementing the Welfare Quality® protocol, the willingness of farmers to participate impacted on the selection and distribution of farms over all regions of Kosovo see (Figure 1).

3.1.3 Geographical distribution of selected farms

Farms were selected in seven regions of Kosovo in order to better represent the overall welfare status of dairy cows.



Figure 2. Geographical distribution of selected farms in Kosovo

22 out of 30 selected farms were situated in the Dukagjini region. The Dukagjini region is located in southwestern Kosovo, distinguished from the rest of Kosovo by its climate and tradition in agriculture and livestock production. The Dukagjini region is characterized by fertile arable land, with water for irrigation provided from numerous small rivers. The Mediterranean climate facilitates excellent conditions for fields with high fertility, thus the Dukagjini region can be described as the most developed part of Kosovo in terms of the agricultural and dairy sector (Riinvest, 2004). The remaining selected farms were located in the east and northeast of Kosovo. These regions are less developed in the agricultural and dairy sector as compared to the Dukagjini region.

3.2 Farm characteristics

On all dairy farms cows were kept in tethered housing, on 76% of farms dairy cows were provided with straw bedding, 10% of farms provided sawdust bedding, while 10% of farms provided cows with rubber mats. On 80% of farms feedstuff was distributed by hand, whereas 20% farms with larger herd sizes supplied feedstuff by tractor. On all farms cows were provided with water in drinking bowls, with one drinking bowl serving two cows. In this study, the majority of the farms obtained water from natural resources or from regional water companies.

Table 2. General characteristics of assessed farms: Mean herd size (min-max), mean daily milk yield per unit, mean land use per animal production in ha, % of farms offering access to an outdoor run and % farms offering access to pasture

Country n=farms	mean number of cows per herd	mean daily milk yield per cow (L)	mean land used for animal production in /ha	Access to out door run (% of farms)	access to pasture (% of farms)
Kosovo n=30	27 (15-55)	13.7 (6.6-19.3)	37.5 (10-150)	40	6

Herd sizes varied between regions e.g. the smallest herds with a minimum of 15 cows were located in the central region of Kosovo while the largest herd sizes of up to 55 cows were located mainly in the south-western part of Kosovo. In all herds the predominant breeds were Holstein and Simmental followed by Brown Swiss and Montbéliarde.

The daily milk yield per cow ranged from a minimum of 6.6 L in the smallest herd, up to 19.3 L in the largest herd, with total average of 13.7 L milk yield per day. The land use per farm included leased land ranging from 10 ha to 150 ha with the mean of 37.5 ha per farm.

44% of farms offered access to an outdoor run. The number of days per year ranged from 180 to 300 days, while the number of hours spent in the outdoor run ranged up to four hours per day. 6% of farms offer access to pasture with number of days ranging from 180-210 days per year. Cows spent approx. 4 hours per day on pasture.

3.3 Development of questionnaire regarding attitudes of farmers towards animal welfare

The questionnaire was designed based on literature and contained both qualitative and quantitative questions. Qualitative questions were designed similar to Kirchner et al. (2014c), whereas quantitative questions were based on the questionnaire by Kauppinen et al. (2010).

Quantitative questions were first translated from Swedish into English, and then from English into Albanian. The questionnaire in Albanian was amended following preliminary testing with one dairy cattle farmer and two professors from the Faculty of Agriculture and Veterinary Medicine Pristina in order to get the feedback for certain questions and to avoid bias due to the translation.

The final version of the questionnaire comprised four main sections:

The first section of the questionnaire was focused on general information with primarily closed questions on herd and farm size, management, background, and economic issues such as farm income, milk price etc. (16 items). The second section primarily consisted of qualitative open questions aiming to evaluate the attitudes of farmers towards animal welfare e.g. *'What does the term animal welfare mean to you?'* (10 items).

The third section was primarily based on the theory of planned behaviour (TPB) (Ajzen, 2002, Kauppinen et al., 2010, Ajzen, 2011), posing questions of specific attitudes (important), behaviour control (easiness), subjective norms, general attitudes and intentions. In total 67 items were determined in these five subsections. Quantitative questions were organised on a Likert scale from 1 to 8 in two patterns e.g. for importance of specific attitude (1 'very important' to 7 'not important at all' and 8 'don't know') and for easiness of behaviour control (1 'very easy' to 7 'not

easy at all' and 8 'don't know'). Further questions covered intention and planning for the future with seven possible answers on a Likert scale (1 'very likely' to 7 'very unlikely'). Questions reflecting the opinion of stakeholders in comparison to farmers' attitudes were organised in three subsections: their opinions, emphasising animal welfare and understanding animal welfare. Answers could range from 1 to 8 (1 'very much' to 7 'not at all' and 8 'don't know'). In general attitudes, the Likert scale ranges from (1 'strongly agree' to 7 'strongly disagree' and 8 'don't know'). Four open questions were set at the end of this section regarding to the general the importance of animal welfare; e.g. what are impair factors and type of support in order to improve animal welfare.

The final part of the questionnaire included questions relating to feedback of results and interviewer information. Farmers were asked about preferences of receiving feedback. Other questions were answered by the interviewers about time and atmosphere during the interview with the farmers.

3.3.1 Interviews with the farmers

Interviews were carried out during the first farm visit (V1), after the farmers agreed to participate in the project. All 30 farmers were interviewed on their attitudes towards animal welfare. Each interview lasted for approx. 45 min, with a maximum of three interviews carried out per day depending on the location of farms. Interviews were started with a general discussion followed by further explanations on the content of the questionnaire.

The questionnaire was read by the interviewer with farmers answering closed questions on general information about the farm. In the second part of the questionnaire farmers were asked open questions without interpreting the respondent's answers. The answers given by the farmers were written down by the interviewer. Quantitative questions covered the importance and easiness of different measures to improve animal welfare and were organized in four subsections: a) providing animals with favorable environment b) taking care of animals' about health c) treating animals humanely and d) investing in farmers' wellbeing at work. Secondly we enquired the intention of farmers to improve animal welfare. Thirdly farmers estimated the significance of opinions of different stakeholders regarding animal welfare. Fourthly farmers depicted concerns about the role of farmers towards animal welfare. In case of uncertainties sections were further explained by the interviewer. Answers were provided on a Likert scale.

3.4 Data collection on farm

Data of the on-farm welfare assessment were collected in the course of the second, third and fourth farm visit. The second visit was carried out by one assessor and one assistant whereas the third and fourth visit we carried out by one assessor only. The on-farm welfare assessment started in the early in the morning and lasted approx. 4-6 hours depending on the herd size. During the second and third visit the welfare assessment lasted for 2-4 hours (**Table 3**).

Table 3. Description of on-farm data collection during four visits

Data collection on farm	Methods of using	Time spend per farm	Number of farms assessed per day	Number of assessor
N=30 farms	(Welfare Quality® protocol)	(hours)		
First visit (V1) (Nov.2013-Dec.2013)	Interview with farmers regarding attitudes towards animal welfare	1-1.5	1-2	2
Second visit (V2) (Dec.2013-Feb.2014)	ADF, QBA, Social agonistic behaviour, Clinical Scoring, Resource questionnaire and management questionnaire	4-6	1	2
Third visit (V3) (Dec.2014)	Clinical scoring Feedback report & Improvement strategy	2-4	2	1
Fourth visit (V4) (April.2015)	Clinical scoring Interview with the farmers	2-4	2	1

3.4.1 On-farm data collection tool

The Welfare Quality® protocol (Welfare Quality®, 2009) was integrated in the HigherKOS project with aims to implement the Welfare Quality® protocol for dairy cows on commercial farms in Kosovo and Macedonia. Three assessors from Kosovo and two assessors from Macedonia participated in a four-day training course of the Welfare Quality® protocol for dairy cattle.

The training course took place in July 2013 in Vienna supported by the University of Natural Resources and Life Sciences. It comprised classroom training as well as on-farm training on three different farms, aimed to prepare the attendees to independently apply the protocol in their home countries. The training further aim to test inter-observer agreements, as this is a prerequisite for reliable data collection. Satisfactory agreement was achieved for the measures between the assessors, furthermore additional explanations were provided and hands-on training was carried out.

3.4.2 Practical approach to implementing on-farm welfare assessment

Welfare Quality® protocol was used as a tool to assess the welfare of dairy cows kept in tie stalls. The Welfare Quality® protocol for tie stalls was structured in two main sections:

- Animal-based measurements:
Behaviour observation
Clinical scoring (animal inspection)
- Resource based measurements:
- Check list
- Interview (farm management, detailed information of animals kept in the housing system)

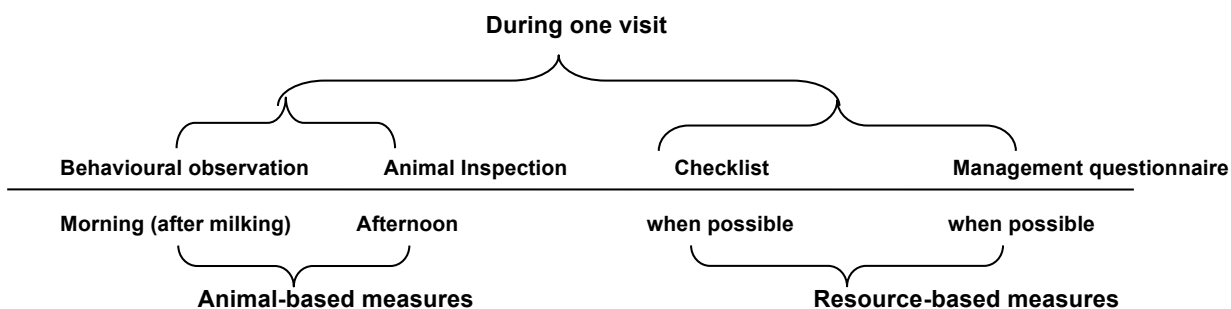


Figure 3. Schematic representation of implementing the Welfare Quality® protocol within one-day farm visits

The Welfare Quality® protocol was carried out within one-day visits based on the steps displayed in (Figure 3). The observations included lactating cows, dry cows and pregnant heifers kept with dairy cows.

3.5 Animal health and welfare (AHW)

3.5.1 Overall description of the on-farm welfare assessment

Welfare assessments started early in the morning after the cows were milked. At first the assessors received general information from the farmer or manager regarding management of the lactating cows, dry cows and heifers. Subsequently a brief investigation of the farm was carried out evaluating structure and layout of the barn, counting the number of animals and dividing the barn into segments for behaviour observation. Thereafter the Welfare Quality® protocol was executed starting with assessment of ADF. In the second step QBA was carried out, beginning with assessing the number of segments in the barn followed by observations of each segment for 20 minutes in total. Thereafter 120 minutes of behaviour observation to assess resting, agonistic and social behaviour was carried out, followed by identifying the number of animals per segment. Then clinical scoring was carried out of animals present in the barn with aid of a checklist. For practical and technical reason milk somatic cell count was not evaluated in this study. In the final step the management was assessed via questionnaire with the farmers or farm managers.

Animal –based measures

The animal based parameters were used to gain direct insights into how animals are coping with their environment (Whay, 2007). The direct animal observation was based on the Welfare Quality® protocol for dairy cattle (Welfare Quality®, 2009). All animal-based parameters are described in (Table 4 and Table 6).

Behavioural observations

Avoidance Distance (ADF)

Avoidance distance (ADF) was assessed in each group after the morning milking. The test was performed according to the Welfare Quality® protocol (Welfare Quality®, 2009). The assessor started approaching the focal cow from a distance of 2 meters. On some farms cows were approached from an angle of 45° instead of from the front due to limited space. Cows were

approached with the speed of one step per second. The objective was to record the distance between the hand of the assessor and the muzzle of the animal at the moment of withdrawal. ADF was carried out with a minimum of 70% of cows per farm. The sequence of focal cows was chosen according to high distance between cows, thus avoiding any habituation effect.

Qualitative Behaviour Assessment (QBA)

QBA was assessed after completing ADF at selected the observation points, depending on size and structure of the farm. The duration of observation was divided by the number of segments selected per farm. 20 descriptors were determined after observations using a visual analogue scale.

Observation of resting, social and agonistic behaviour

This measure was assessed by dividing the barn into segments and assessing a maximum of 25 cows per segment as defined by the protocol (Welfare Quality®, 2009). Social Behaviour was observed with consideration of the segments of the barn and including repetitions. At the beginning and end of observations in each segment the number of cows lying or standing was recorded. The total duration of observing social and agonistic behaviour was 120 min. During this time other parameters were simultaneously recorded such as coughing and sneezing (absence of disease), duration of lying down and colliding with the housing equipment (comfort around resting area).

Table 4. Description of parameters assessed with behaviour observation

Behaviour observation	
Parameter	
Avoidance distance (ADF)	<p>The assessor stood in the feed bunk at a distance of 2 m in front of the animals and ascertaining the animal was attentive or taking notice of assessors</p> <p>The assessor approached the animal at a speed of one step per second with approx. lengths of 60 cm per step and with the arm held overhead in an angle of 45° from the body.</p> <p>Withdrawal was recorded when the animal moved back and turned the head to the side etc.</p>
Qualitative behaviour assessment (QBA)	<p>The assessors selected between one and eight points depending on herd size and structure of the farm. Animals were observed from appropriate points and the expressive quality of their behaviour was assessed at group level.</p> <p>After 20 min of observation the observer scored 20 descriptors from minimum to maximum using an analogue visual scale.</p>

Agonistic behaviour

Parameter	Description
Head butt (HB)	Interaction of cows with physical contact. One cow was hitting, butting, thrusting, striking or pushing the receiver with the forehead, horns or horn base for a forceful movement
Displacement (DP)	Interaction of cows with physical contact. One cow was hitting, butting, thrusting, striking or pushing the receiver with the forehead, horns or horn base with a forceful movement As result the receiver was stepping at least one step aside or moving ahead from the drinker where it had just been drinking
Chasing-up (CU)	One cow used physical contact (e.g. butting, pushing, shoving) against a lying cow, making the receiver rise

Table 5. Methodological approach of behaviour observations

Applied Measures	Animal observation per farm	Animal observation/segment	Segment/farm	Minute/segment
N=30 farms	(min-max)	(min-max)	(min-max)	(min-max)
Kosovo				
Qualitative behaviour assessment (QBA)	14-55	5-15	2-4	5-10
Social/Agonistic behaviour	/	5-15	2-4	15-30
Avoidance Distance ADF	10-32	/	/	/
Lying down events	3-11	/	/	/

The QBA was conducted on all cows present in the barn, with the median number of 27 animals observed per farm. The avoidance distance test (ADF) ranged from 10 animals in small herds up to 32 animals in large herds with median of 14 animals tested per farm. Lying down events were measured ranging from 3-11 events with a mean number of 6 events observed per farm.

3.5.2 Clinical scoring

The animals were clinically assessed according to the Welfare Quality[®] Protocol (e.g. hygiene, body condition scores and health parameters e.g. lameness prevalence). All clinical assessments were carried out visually from a distance of approximately 0.5 m from the animal. Animals were assessed from one side only with assessments lasting for approx. 3 min per cow. Cows were assessed individually for the parameters described in (Table 6). At the unit level all animals were included in the observation (lactating cows, dry cows, and pregnant heifers kept with dairy cows). In units with a maximum of 30 dairy cows all animals were included. In units with more than 30 cows at least 70% of the herd were included.

Table 6. Description of parameters of clinical scoring in tie stalls based on the Welfare Quality® protocol (Welfare Quality®, 2009). The parameters mortality, dystocia and downer cows were assessed based on farmers' records for the previous 12 months.

Parameter	Method and Definition
Body condition score (BCS)	3-category rating scale -Very lean (BCS1) = deep tail cavity, deep back bone, transverse process sharp, spine and ribs prominent -Normal (BSC 0) = tail cavity, backbone and ribs well covered
	-Very fat (BCS 2) = tail head cavity full of fatty tissue, convex between backbone and hipbones, transverse processes not discernible, fat patches visible under the skin.
Body condition score (BCS) 'Dual purpose'	3-category rating scale -Very lean (BCS 1) = Cavity around tail head, depression between hipbone and backbones, distinguishable transverse processes, tail head, spine and ribs visible.
	-Normal (BCS 0)= tail cavity, backbone, traverses, ribs well covered -Very fat (BCS 2) =tail head fully fat, convex hipbone and backbones, traverse processes discernible, fat patches visible under the skin.
Cleanliness of lower leg	0-No dirt or minor splashing 2-Separate or continuous plaques of dirt above coronary band.
Cleanliness of hind quarters	0-No dirt or minor splashing 2-Separate or continuous plaques of dirt
Cleanliness of udder	0-No dirt or minor splashing 2-Distinct plaques of dirt on udder or any dirt on and around the teats
Lameness	Based upon the indicators: Resting -resting a foot Standing - on the edge of the step Stepping - weight shifting between feet Reluctance - bearing weight on one foot when moving 0 -Not lame: cow showing none of the indicators listed above 2 -Lame:cow showing at least one of the four indicators

Parameter	Method and Definition
Integument Alterations	Hairless patches: >2 cm are numbered -area with hair loss, skin not damaged
	Body regions: tarsus, hind quarter, flank udder, side, neck shoulder, back, carpus.
Severe integument alterations	Number of: -Lesions -Swellings
	Body regions: tarsus, hind quarter, flank udder, side, neck shoulder, back, carpus
Ocular discharge	Visible flow/discharge (wet or dry) from the eye, minimum length 3 cm
	0-No evidence of ocular discharge 2-evidence of ocular discharge
Nasal discharge	Visible flow discharge from nostrils: transparent to yellow /green and often thick consistency.
	0-no evidence of nasal discharge 2-evidence of nasal discharge
Hampered Respiration	Hampered respiration rate is defined as deep and labored or overly difficult breathing.
	0-No evidence of hampered respiration 2-Evidence of hampered respiration
Diarrhea	Diarrhea as loose watery manure below the tail head on both sides of the tail, area affected at least size of a hand.
	0-No evidence of Diarrhea 2- Evidence of Diarrhea

The data below were based on the farmers' own estimates

Mortality	Mortality 'uncontrolled death', euthanasia, emergency slaughter, diseases or accidents.
	Counting cases during the previous 12 months. Data was collected by asking the manager of the animal unit.
Dystocia	Dystocia was defined as the number of calving requiring major assistance during the previous 12 months. Data was collected by asking the manager of the animal unit.
	Data was collected by asking the manager of the animal unit.
Downer cow	Number of cases of non-ambulatory cows during the previous 12 months.
	Data was collected by asking the manager of the animal unit.

Across all selected farms the number of cows varied from 15 at the smallest farm up to 55 cows at the largest farm with a mean of 27 cows per farm. The clinical scoring was carried out on all farms.

Table 7. Mean and min-max number of cows assessed per herd at n=30 farms

Mean number of cows per herd	Mean number animals observed for clinical scoring	Mean number of animals tested for Avoidance Distance	Number of assessors
27 (15-55)	20 (14-33)	15 (10-32)	1

3.5.3 Resource-based measures

The resource-based measures were recorded in each segment where observations of animals took place. The measurement of the parameters was carried out in the afternoon after the behaviour observations and clinical scoring. The parameters were assessed using a checklist based on the Welfare Quality® protocol.

Table 8. Overview of selected resource-based parameters partly based on Welfare Quality ® (2009).

Parameters	Method and definition
Water supply	Evaluation of: type of water bowl, number of water points, water functioning, dimensions, cleanliness. Water flow test 10L/min
Resting area	Evaluation of: length, width, type floor of resting area, thickness of mattress, litter, hardness of mattress, cleanliness.
Tethering model	Evaluation of: type of tether, length of tether, free moving space at front, back, left and right, free moving vertically, tight tethering.
Feed bunk/Crib	Evaluation of type of crib wall, height and depth of crib wall, cleanliness, food amount, food quality.
Light& Ventilation	Weather, lighting, climate, ventilation.
Outdoor run /Pasture	Activity area available, surface of outdoor run, facilities, wind protection, fence, boundary.

The measuring of each parameter listed above was carried out in the afternoon after finishing with the behaviour observation and clinical scoring. The parameters were measured using a resource questionnaire based on the Welfare Quality® protocol.

3.5.4 Management Questionnaire

The management questionnaire comprised questions describing the daily management routine on the farms. This information was obtained by interviewing the farmers or managers of the farm for 20-35 minutes. The questionnaire was included in the resource checklist. The questionnaire was carried out after conducting the Welfare Quality® protocol or after behaviour observations depending on the availability of the farmer.

Table 9. Overview of issues addressed in the interviews with farmers/managers.

Area	Questions
<i>Calving Management</i>	<p>where does calving take place</p> <p>what percentage of calvings do you observe, assist and intervene</p> <p>are cows allowed to lick and let their calves suckle</p> <p>how often do you clean the calving pen</p>
<i>Health management strategies</i>	<p>how often do you clean the stall</p> <p>how often do you litter the stall and what is the amount of litter used per day</p> <p>how often do you check/clean the drinkers and concentrate feeders</p>
<i>Health management strategies</i>	<p>presence of hospital pen</p> <p>maintenance of hospital pen</p> <p>number of animals bought per year</p> <p>presence of special area (quarantine)</p> <p>existence of a health plan</p>
<i>Preventive measures</i>	<p>frequency of claw trimming</p> <p>availability of adequate facilities for claw trimmer</p> <p>control of subclinical mastitis</p> <p>milking machine maintenance</p> <p>availability of farm records of disease incidences</p>
<i>Feeding management</i>	<p>feeding ad libitum/ not ad libitum</p> <p>daytime of feeding</p> <p>analysis of feed quality</p> <p>calculation of feeding rations</p>
<i>Management related to comfort behaviour</i>	<p>access to pasture/outdoor run</p> <p>percentage of replacements per year and group</p> <p>average age of herd</p> <p>accommodation type within category</p>
<i>Contact with animal/ maintenance of equipment</i>	<p>regular milkers/stockpersons working with animals</p> <p>management of stock person</p> <p>daytime of milking</p>

3.6 Improvement strategy

Study design

The improvement strategy consisted of two visits (V3 and V4) each of all 30 farms included in the previous welfare assessment.

The first visits (**V3**) were carried out in December 2014, 9 months after the initial implementation of the Welfare Quality® protocol (**V2**). The aims of the improvement strategy were:

- Re-assessment of the farms (clinical scoring only), in-situ calculation of the results and comparison with previous results of the report
- Reporting to farmers of the obtained results (Feedback report presented by the Benchmarking method)
- Discussing results and possible agreements to implement changes.

The final farm visit (V4) to collect data was carried out in April 2015 (Figure 1), four months after agreement with the farmers to implement the chosen measures. The aim of the visit was to assess the animal welfare situation on farms for possible improvements.

3.6.1 Development of plan, re-assessment and Feedback report (V3)

For each farm risk factors were identified based on the initial data analysis. The majority of identified risk factors derived from poor housing conditions and management of farms. By reason of these risk factors the farm visits were focused on clinical scoring only (Table 6).

Farms were visited by one assessor in December 2014, with two farm visits carried out per day on average depending on the distance between farms. A farm visit consisted of:

- Re-assessment of the farm with immediate calculation of results and comparison with the initial assessment for possible improvements.
- Presenting the feedback report to the farmer with results of the initial assessment and current assessment in form of a written report.

The re-assessment was carried out by following the Welfare Quality® protocol. After obtaining the data, in-situ calculations were carried out and the aggregated results were set in the report for comparison with the previous assessments of clinical scoring.

The report was organised by the benchmarking method, presenting measures against the mean of all peer farms.

Farmers were provided with the written report for face-to-face discussions with the assessor. The feedback report comprised seven pages covering the following AHW issues: lameness prevalence, integument alteration, hygiene, clinical parameters e.g. vulvar discharge and behaviour (ADF, agonistic behaviour).

Each of these parameters was provided with pictures for illustration. During the face-to-face discussions farmers decided where taking measures was essential and selected one or more areas to prioritize and include in the personal agreement. Farmers based their decisions on their individual situation and selected measures, which appeared suitable and affordable for them. The goals and actions to be taken by the farmers were developed and written down in the feedback form.

At the end of the discussion each farmer was provided with a brochure based on scientific literature providing advice on health and impact of good management of certain parameters. The

brochure comprised information of risk factors with explanation of the problem and recommendations for addressing problems.

3.6.2 Focus area of AHWP

The focus areas were based on the health and welfare indicators, where single measures were used and allocated to 5 focus area (Table 10). Although the majority of AHW problems on farms derived from these areas, farmers prioritized the area they considered important, regardless of evidence of problems in other areas. Parameters of animal behaviour appeared to be less important for farmers. Prevalence of health indicators such as diarrhea, hampered respiration, nasal discharge, ocular discharge was low. Thus taking measures for these parameters was not necessary and during conversation these issues were not prioritized.

Table 10. Overview of focus areas and assigned measures for health and welfare improvement

Focus area	Sub area	Examples of measures
Comfort around resting	Increasing cow comfort	Checking tethering system, improving divider between individual lying areas
	Improving lying area	Increasing amount of bedding to a minimum of 2.5 kg per day/increasing frequency to add bedding during the day
	Maintenance of dry lying area	Checking water bowls for malfunctions, cleaning the manure canal
Hygiene	Changing the cleaning program	General cleaning of lying area at least 3 time per day
	Routine cleaning	Increasing cleaning frequency on the back side of lying area to several times per day
	Short term cleaning	After each cleaning sequence adding of bedding material
	Adding more bedding	
Leg health	Hoof maintenance/regular trimming	More frequent claw trimming /appropriate treatment for lesions and swellings
	Floor surface	Ensuring of dry lying area/adding sufficient amount of bedding
	Hygiene	Increasing frequency of floor cleaning
	Feeding	Decreasing the amount of concentrates fed to affected cows
Housing facilities	Improving drinkers	Checking of water bowl functionality/check of water pipes
	Changing tethering system	Redesign of tethering system/checking the length of chains for space allowance Providing animals with synthetic collars
Feeding ration	Balanced ration	Checking the feeding quality/consulting animal nutritionist
	Attention to lean cows	Special ration for lean cows
		Monitoring situation during feeding for agonistic behaviour
		Replacing position of cows in case of unequal dominance

3.6.3 Re-assessment of farms

The final visits were carried out in April 2015 on all farms participating. The aim of the fourth visit was to evaluate improvements on farms based on the agreements discussed four months previously (third farm visit; see Table 1).

On each farm the welfare assessment of clinical scoring was carried out (Table 6). At the end of assessments the focus areas were evaluated by addressing improvement measures through questionnaires with closed questions (yes/no; e.g. is there enough bedding, lying area is partly dirty or clean).

Thereafter farmers/farm managers were interviewed using a questionnaire based on the Welfare Quality® protocol (Table 8), addressing the management routine and linked measures.

Including all activities of the re-assessment listed above the duration of farm visits was approx. 2-4 hours (Table 3), depending on herd size. The whole process of re-assessments lasted for one month, with a maximum of two farm visits carried out per day.

3.7 Development of stakeholders questionnaire regarding animal welfare standards (farmers and veterinarians)

The questionnaire was designed to assess the opinion of farmers and veterinarians regarding the level of various welfare indicators that should require intervention. The questionnaire addressed the degree to which farmers and veterinarians are ready to have specific welfare standards introduced. The questionnaire was mainly based on the Welfare Quality® protocol by developing the questions from welfare parameters. The questionnaire contained 40 items, using predominantly multiple choice answers, ordinal questions and response scales. These questions were organised in five main parts:

- 1) Information on personal data (e.g. living place, age, gender and educational background) and general knowledge on animal welfare using multiple-choice answers (6 items).
- 2) Opinion of respondents regarding importance/intervention level of welfare parameters using multiple choice answers, ordinal questions, yes/no questions, Likert scales with eight levels (ranging from 1 'no importance' to 8 'very high importance') and response scale regarding to the degree of a given problem beyond which intervention should take place (percentage ranging from 0% up to 100%; 27 items) (see Appendix 2).
- 3) Information on implementation costs and evaluating the respondents' opinion and willingness to implement changes on their farms using Likert scales (ranging from 1 'no costs' up to 8 'very high costs'; 2 items).
- 4) Information and opinion on future perspectives regarding animal welfare using closed questions (yes/no) and multiple-choice answers (8 items).
- 5) Information on feedback and evaluation using Likert scales and multiple choices answers (3 items).

3.7.1 Interview with the stakeholders

The questionnaire was designed and organised in two forms of distribution: a hard copy and an online questionnaire.

The hard copy questionnaire was given to all farmers participating in the project. The interviews with the farmers were carried out during the last visit V4 after finishing the on-farm-assessments and lasted approximately 15-20 min. Farmers completed the questionnaire with the assessor present to provide further technical explanations if necessary.

The electronic version (online version) of the questionnaire was designed for the Veterinary Chamber and Veterinary Agency in Kosovo. The aim was to carry out the questionnaire with state and practical veterinarians. The announcement and the online questionnaire were distributed via email to a list of all members in the Veterinary Chamber and Veterinary Agency.

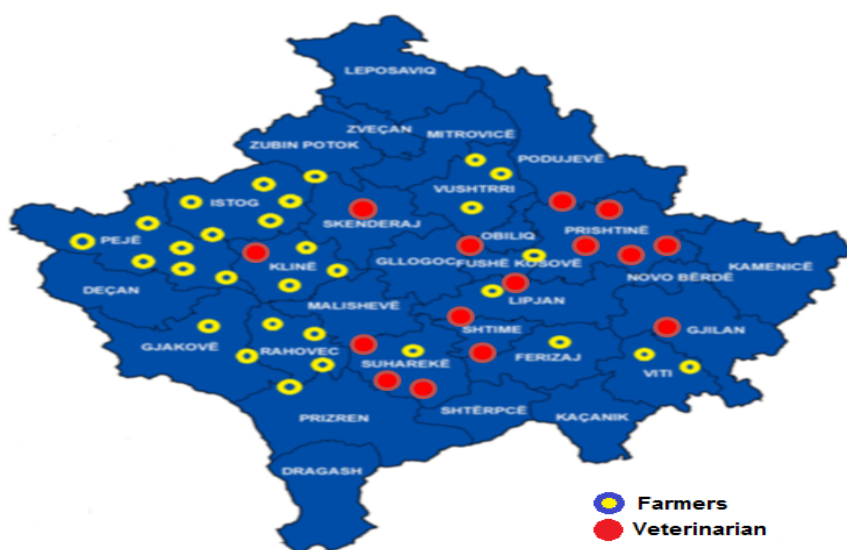


Figure 4. The geographical Distribution of respondents from Kosovo

The questionnaire was answered by 45 respondents. Two thirds of the respondents were farmers whereas the remaining 33% were veterinarians from different regions in Kosovo (Figure 1). The majority of the respondents were 30-50 years old. Regarding the gender distribution, only one respondent was female, the majority of respondents were male (98%).

4 Data analysis

4.1 Statistical analysis of farmers' attitudes questionnaire

4.1.1 Qualitative data analysis

The procedure of analyzing open questions was carried out separately for each question. In the first step the original answers for each question were computed and processed in Microsoft Word 2010. Secondly subset categories were developed and named based on the content of answers. The answers were analyzed based on context of respondents with each statement being coded with initials according to allocated category. After all responses were coded, the coding statements were allocated to the respective themes. In the revision step reliability was assured by checking all sentences for necessity of renaming and regrouping. In the final step all statements were counted in the respective categories.

The majority of questions was responded to in short answers, thus entering of data and analysis were carried out in Microsoft Excel 2010. Comparative statistical analysis such as Chi-square Test was not performed in this study as only one category of respondents (Farmers) were interviewed.

4.1.2 Quantitative data analysis

Raw data were transferred from Microsoft Excel 2010 into SPSS Statistics 21 (SPSS Inc., Chicago, IL, USA) and analyzed. Data were divided into four sections (attitude patterns of importance and easiness, providing animals with favorable environments, taking care of animals' health, treating animals humanely). The means of sections were tested for significant differences using *Wilcoxon test*. Similarly data from subjective norms (e.g. Wholesale/Dairy a,b,c) were tested for significant differences of means between units using *Wilcoxon test*. The remaining descriptive data were presented with mean and standard deviation.

Further analysis of data was conducted using Principal Component Analysis (PCA) with Varimax rotation, when variables could be summarized. The questionnaire consisted of multiple templates of units. We used a similar methodology as (Kauppinen et al., 2010) and treated templates as separate units in the PCA analysis (Attitudes, perceived behavioural control and subjective norms). The unit concerning Intention was not processed in the PCA analysis. The variables with communalities below 0.3 were excluded from PCA analysis. In total 63 variables were processed in the PCA analysis deriving from 30 respondents (farmers) and excluding the unit of 'Intention'. No missing values were present.

The formulated components included in the PCA were based on the following criteria: components with loadings exceeding 0.3, but without loadings of any other components in the respective cases; components with highest loadings exceeding 0.5 and other loadings with less than 0.4 of any other components in the respective cases were also included (Kauppinen et al., 2010). Overall components with eigenvalues below 1.0 were not considered representative for this study. Reliability was tested for each component using Cronbach's α test. The consistency was sufficient for the majority of components with exception of 'Economically driven farmers' (Cronbach's $\alpha < 0.5$) probably due to weak consistencies or low number of items (Schmitt, 1996, Tavakol and Dennick, 2011).

Each component was labeled based on the content of variables involved in the components e.g. '*Farmer wellbeing and Animal Welfare*'; with the average of variables representing the response means.

Spearman rank correlations were used to assess associations between components of specific and general attitudes, perceived behaviour control, subjective norms and intentions with untransformed variables. We utilized *Spearman correlation* method for testing the correlations. Significance levels were set at $p=0.05$, considering only correlation coefficients of 0.3 or higher.

The Structural Equation Model (SEM) was applied for testing the theory of planned behaviour using Amos Graphics 23. We implemented the path modeling structure using components from PCA. The formulated component from (PCA) serves as latent variables to build the fourth representative measurement for structural path modelling (see Figure 11). The latent variables were arranged depending on question groups in the questionnaire for example six components of the group Subjective norms (Wholesale/retail trade, Research and other expert, Agricultural adviser/Veterinarian, Slaughterhouse/dairy, Consumer, Other farmers). The variable attitude was used to describe specific attitudes and general attitudes. For the structural equation path model SEM was tested with the maximum likelihood estimation method to assure adaptability of the theory of planned behaviour TPB (Ajzen, 2011). The applicability of the structural equation model (SEM) was evaluated using the comparative fit index (CFI) and the root square error of approximation (RMSEA).

4.2 Statistical analysis of baseline study (on-farm welfare assessment)

Data were processed using Microsoft Excel 2010. For further analysis data were transformed in SPSS version 21 (SPSS Inc., Chicago, IL, USA).

The statistical analysis was based on descriptive statistical indicators (mean, median, standard deviation, minimum and maximum) for the 33 assessed measures, as well as for the scores of the 10 criteria: (APH) absence of prolonged hunger, (APT) absence of prolonged thirst, (CAR) comfort around resting, (EM) ease of movement, (AI) absence of injury, (APIMP) absence of pain induced by management procedure, (ESB) expression of social behaviour, (EOB) expression of other behaviour, (GHAR) good human animal relationship, (PES) positive emotional state, and for the scores of the welfare principles: good feeding, good housing, and appropriate behaviour.

(AD) absence of disease was excluded from the calculation due to missing data for the parameter mastitis.

4.3 Statistical analysis regarding improvement of welfare state

Raw data of farms were entered into Microsoft Excel 2010. Statistical analysis was carried out at the farm level using the statistical software SPSS Statistics version 21 (SPSS Inc., Chicago, IL, USA).

Parameters were tested for normal distribution of data by Q-Q plots. Farm characteristics recorded in December 2014 and April 2015 were compared using *Wilcoxon test* for not normally distributed data, whereas *t-test* was used for normally distributed data. Farms were allocated to 1 of 3 groups to analyze the effectiveness of the health and welfare planning approach. The 'Implementation group' included farms where implementations were discussed, chosen (written

down in the plan) and executed during the study period. The 'non-implementation group' contained farms where a specific focus area was selected and agreed upon during discussion, but it was not implemented. Farms where none of the respective focus areas were chosen in the discussion were treated as 'Control Group'.

Linear Mixed models were used to analyze health and welfare indicators to evaluate the effect between groups.

The model effect was derived from affiliation of group effects (implementation vs. non-implementation vs. control) and their interactions; the recording period (V3 vs. V4) was included as a factor. The implementation group was not represented in the focus area of lameness parameters thus comparisons were carried out between control and non-implementation groups.

Additionally non-implementation groups and implementation groups were compared using Linear mixed models.

Data were transformed when necessary using *log10* or *sqrt* whereas the residuals were graphically checked for normal distribution using Q-Q plots.

Mean prevalence of parameters was obtained from non-transformed data, and model effects for parameters were obtained from transformed data.

For the parameters where no agreement was achieved by the farmers, such as percentage of thin cows, nasal discharge, ocular discharge, diarrhea and vulvar discharge, the comparison between visits V3 and V4 was carried out by using *Wilcoxon test*.

4.4 Statistical analysis regarding to welfare standards questionnaire

Data were processed in Microsoft Excel 2010 using pivot tables to calculate, summarize and save answers for optional questions of the groups of farmers and veterinarians. Thereafter data were transformed and analyzed with SPSS Statistics 21 (SPSS Inc., Chicago, IL, USA).

All data were treated separately (farmers vs. veterinarians) and evaluated for descriptive statistical analysis. Two sample T-test were used to evaluate possible differences between farmers and veterinarians with regard to the questions on animal welfare and implementation costs. Results of questions with regard to intervention levels of welfare indicators were evaluated only with descriptive analysis by presenting the range, mean and median.

5 Results

5.1 Farmers' attitudes towards animal welfare

5.1.1 General information on the interviewees (closed questions)

The average age of the respondents was 39.8 years with 94% of the respondents being male and 6% female. The vast majority of the respondents (90%) were the owner of the farm. For most of the farmers the dairy farm constituted the main income with 53% of farmers generating 75% and more of the total income, whereas, only 10% of the farms generated only 25% income from dairy farming.

The main motivation for dairy farming are business reasons with 40% followed by 33% of the farmers who state that they inherited the farm and run it out of tradition; 23% of the farmers have started recently running the farm due to market demands. The majority of the dairy farms are run by family members with a mean of 2.7 family members working routinely with dairy cows. Furthermore, the proportion of farms with employed stockpersons was relatively low with 30% of the farms having one employed stockperson.

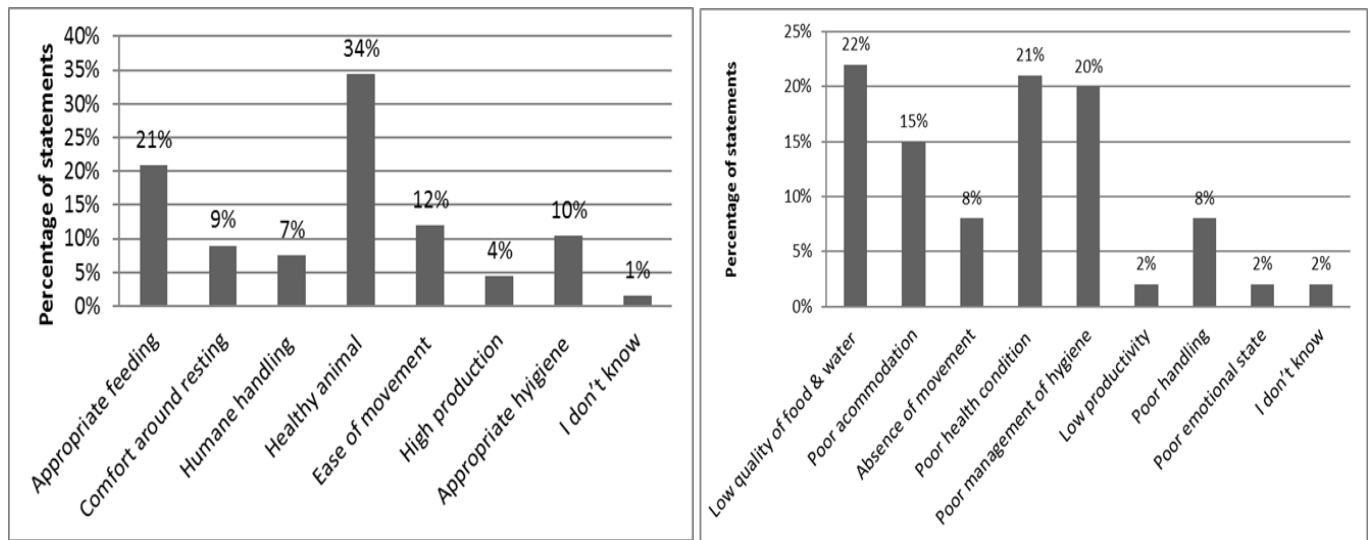
Regarding the professional skills of the farmers, they mainly rely on family knowledge (47%) followed by additional courses, which serve as knowledge resource (43%). Only 3% of the farmers have an education in agriculture (e.g. high school) and 7 % of the famers possess a University degree.

The milk distribution from the farms to the market is organised basically in two ways; 83% of the farmers cooperate directly with a dairy factory, whereas 17% of the farmers send the milk to local small collection points.

5.1.2 Farmers' understanding of animal welfare (Open questions)

Regarding the recognition of a good state of welfare, 34% of the statements referred to healthy animals, whereas 21% of the statements related to the aspect of appropriate feeding as a key factor for good animal welfare (multiple answers possible). All other statements were mentioned in relatively low numbers and they emphasise ease of movement and comfort around resting but also appropriate hygiene, humane treatment of animals as well as the production level as indicators of good animal welfare (Figure 5). The most important farmer statements about recognising poor animal welfare comprised poor feeding, poor health condition and poor management of hygiene, followed by poor accommodation and poor handling (Figure 6).

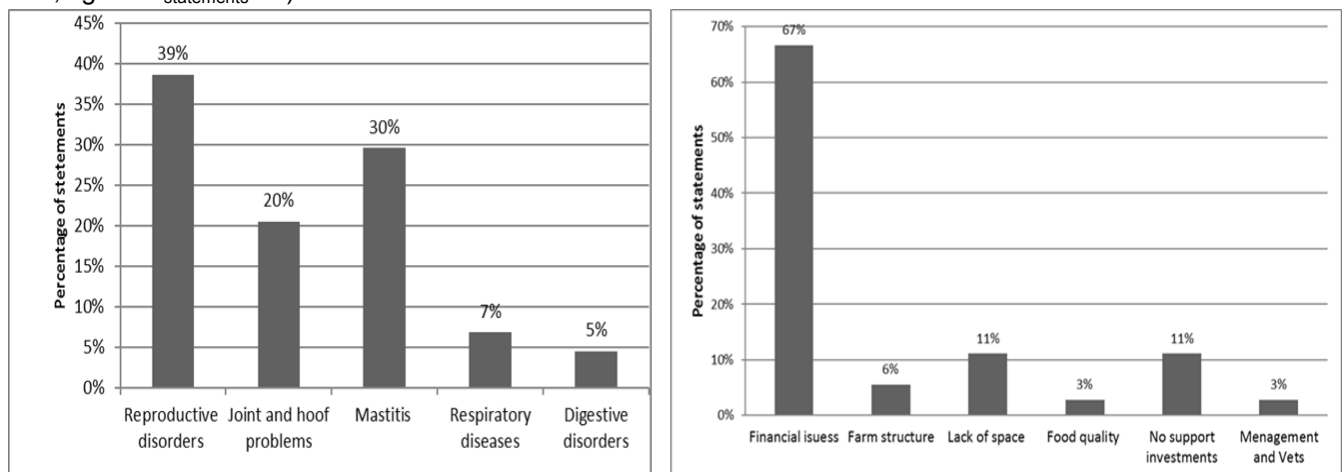
Figure 5 and Figure 6. Indicators of good (Fig. 5, left) and poor state of welfare (Fig. 6, right) in dairy cows as stated by 30 farmers (multiple answers possible, fig. 5 $n_{\text{statements}} = 67$, fig. 6 $n_{\text{statements}} = 59$).



Furthermore, the main cattle diseases that farmers face commonly are reproductive disorders and mastitis followed by leg problems, respiratory and digestive disorders (Figure 7).

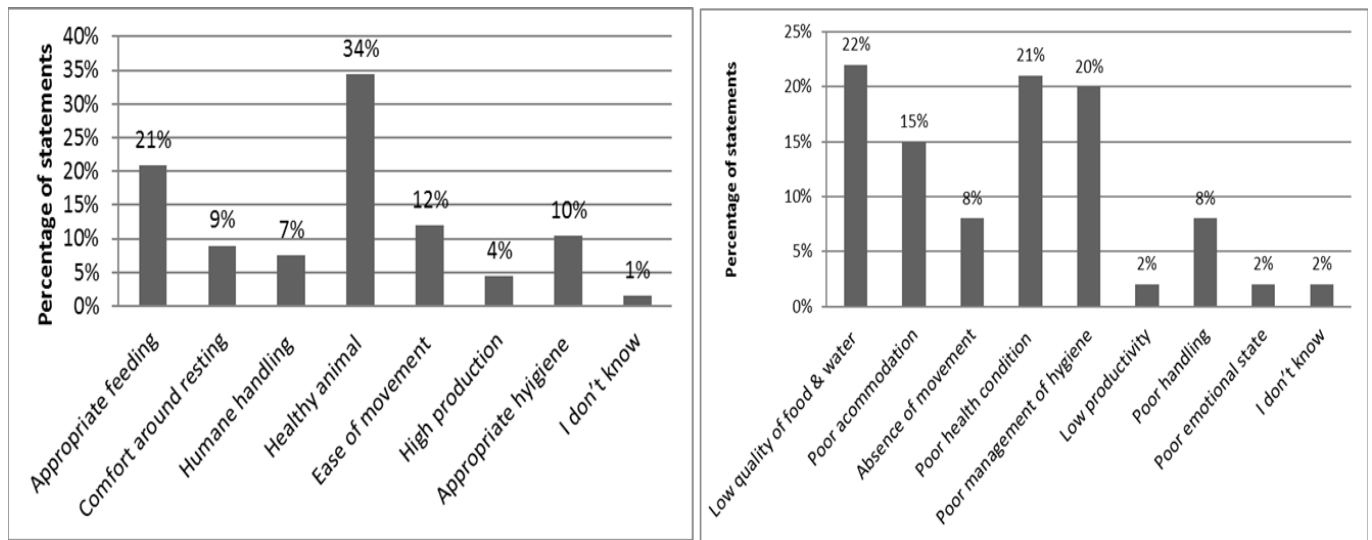
Financial restrictions are by far the most important issue impairing the improvement of animal welfare (stated by 67% of farmers); other statements in this regard referred to e.g. '*lack of space*' and '*farm structure*' (both 11%, respectively; Figure 8).

Figure 7 and Figure 8. Main disease facing commonly (Fig. 7, left) and factors that impair welfare improvement (Fig. 8, right) in dairy cows as stated by 30 farmers (multiple answers possible fig. 7 $n_{\text{statements}} = 32$, fig. 8 $n_{\text{statements}} = 36$).



According to the farmers, the most important welfare problems are related to housing conditions including poor hygiene conditions, use of tie stall systems and lack of space for movement. This is followed by health disorders such as joint and hoof problems (Figure 9). As the most important issues to increase dairy cow welfare, farmers mentioned switching to loose housing systems,

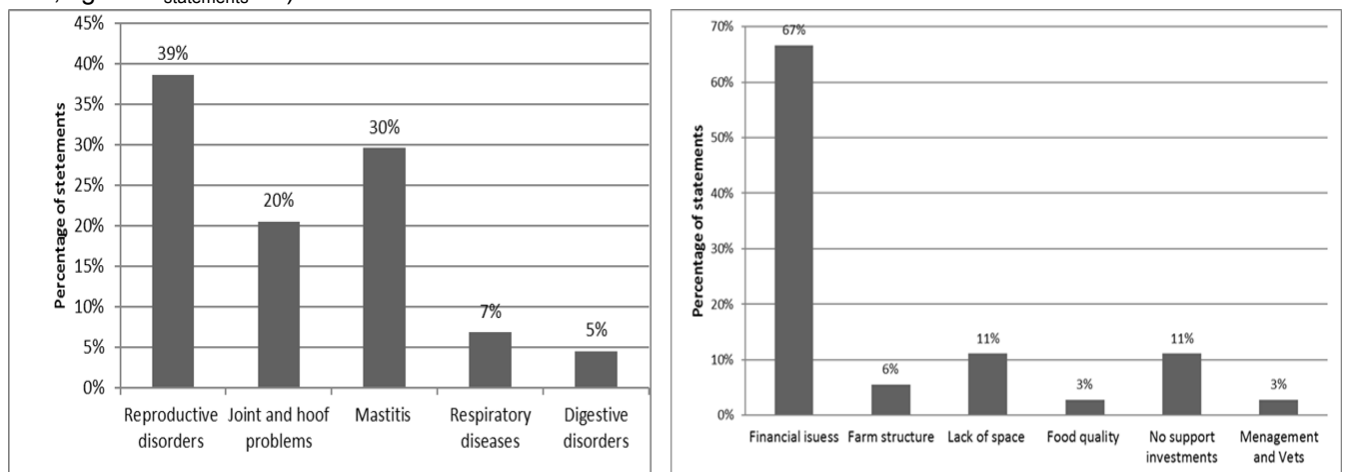
Figure 5 and Figure 6. Indicators of good (Fig. 5, left) and poor state of welfare (Fig. 6, right) in dairy cows as stated by 30 farmers (multiple answers possible, fig. 5 $n_{\text{statements}} = 67$, fig. 6 $n_{\text{statements}} = 59$).



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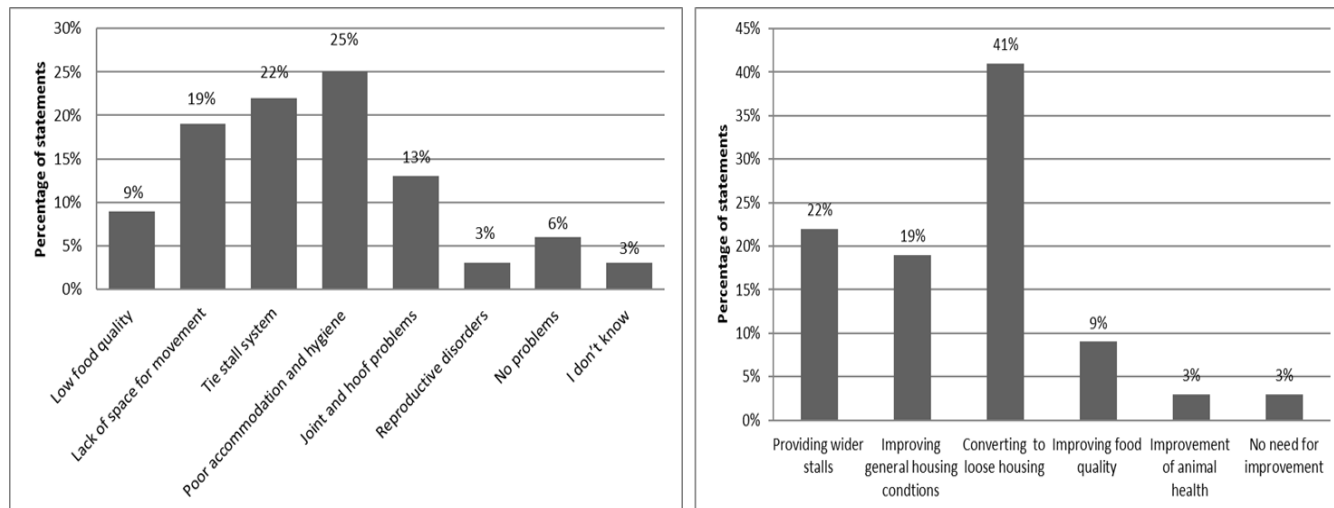
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According to the farmers, the most important welfare problems are related to housing conditions including poor hygiene conditions, use of tie stall systems and lack of space for movement. This is followed by health disorders such as joint and hoof problems (Figure 9). As the most important issues to increase dairy cow welfare, farmers mentioned switching to loose housing systems,

providing wider stalls and improving the general housing conditions (e.g. renovating and farm extension, Figure 10).

Figure 9 and Figure 10 . Major obstacles of welfare (Fig.9 left) and important things to increase welfare (Fig.10, right) in dairy cows as stated by 30 farmers (fig 9 $n_{statements}=44$, fig 10 $n_{statements}=32$).



5.1.3 Perceptions of farmers in the context of improvement of animal welfare (Likert scales)

According to the farmers' reflections, taking care of the animals' health and providing animals with a favourable environment are considered the most important means of improving animal welfare, closely followed by the humane treatment of animals and investing in motivation and wellbeing at work (average scores 1.60 to 1.98; Table 11). However, despite the importance of these measures, these measures were estimated to be more difficult to implement (Table 11); the scores for easiness were always higher than those for importance.

The veterinarian, researchers and experts and other farmers were most influential as regards the subjective norms, whereas slaughterhouse/dairy and consumers were perceived as having the lowest influence (Table 11). Regarding the level of general attitudes, animal welfare seems to be one of the most important issues in the daily work followed by finding it mentally rewarding to improve animal welfare and an obligation to treat animals well. However, farmers agreed to some extent that animal welfare should not cost too much money. The farmers largely disagreed that farmer must not attach to his/her animals and that talking to animals is trivial, whereas they agreed that promoting animal welfare is important for the future.

Table 11. Mean response for importance and easiness, intention, subjective norms and general attitude of 30 farmers (means, standard deviation as well as significance level for differences between importance and easiness; response means may range from 1=very important/very easy to 7=very unimportant/not easy at all presented on the Likert scale).

		Mean	SD	p
The importance and easiness of improving animal welfare				
<i>7 answering options: 1=very important/easy - 7 very unimportant/not easy at all</i>				
Providing the animals with a favorable environment	importance	1.60	0.07	0.033
	easiness	3.11	0.83	
Taking care of animals' health	importance	1.59	0.12	0.065
	easiness	2.32	0.42	
Treating animals humanely	importance	1.71	0.44	0.011
	easiness	1.94	0.36	
Investing in your own motivation and wellbeing at work	importance	1.98	0.28	0.035
	easiness	3.00	0.79	
The farmers intentions to improve animal welfare on their farms in the near future				
<i>7 answering options: 1=very likely - 7 very unlikely</i>				
In the near future how likely are you to				
Build or restructure facilities that improve animal welfare on the farm		2.00	1.50	
Take care of animals health and treat diseases more intensively		1.53	0.62	
Treat the animals more humanely		1.20	0.40	
Take times off for leisure and holidays		2.06	1.01	
The subjective norms				
<i>Each part includes 3 sub questions with 8 answering options: 1=very much - 7 not at all and 8 don't know</i>				
How much does the opinion of these stakeholders affect your activities?				
How much does this stakeholder emphasize the importance of animal welfare?				
How much does this stakeholder understand the issue of animal welfare?				
Slaughterhouse/dairy		7.38	0.53	
Wholesale/retail trade		7.13	0.39	
Veterinarian		2.86	0.39	
Consumer		7.34	0.36	
Agricultural adviser		5.20	0.33	
Researchers and specialists		3.85	0.13	
Other farmers		3.70	0.80	
The general attitudes				
<i>7 answering options: 1=strongly agree - 7=strongly disagree</i>				
Animal welfare is the most important issue in my work		1.16	0.37	
I always do my best to the welfare of my animals		1.36	0.49	
Improving animal welfare is economically profitable		1.73	0.58	
It is mentally rewarding to improve animal welfare		1.36	0.49	

	Mean	SD	<i>p</i>
A farmer is obligated to treat her/his animals well	1.46	1.33	
A high yields is evidence of good animal welfare	1.66	0.92	
Animal welfare should not cost too much money	2.60	1.58	
A farmer must not become connect to her/his animals	4.96	1.93	
Talking to animals is trivial	6.16	1.80	
Promoting animal welfare is important for the future	1.43	0.50	

5.1.4 Attitudinal components revealed from Principal Component Analysis

The questions regarding importance of and easiness to implement measures to improve animal welfare were grouped into four components. The specific attitudes regarding importance constitute Human wellbeing and animal welfare, Management of health and disease, Relaxed working with animals/dealing with sick animals and Favourable environment. For easiness of implementation (Perceived behaviour control) similar components were obtained with the exception of the third component (Relaxed working with animals).

The highest loadings with regard to specific attitudes were found for the 'Human wellbeing and animal welfare' component, whereas the lowest loadings were found for the 'Management of health and disease' component. Regarding perceived behaviour control (easiness to implement measures) higher loadings were obtained in component 'Management of health and disease' while lower loadings belonged to the 'Human wellbeing and animal welfare' component. Total explained variance was 68.0% and 73.6% for the specific attitudes and perceived behaviour control components, respectively. The response means for the specific attitude components were lower and more homogeneous than the ones for the perceived behaviour control components (Table 12).

Table 12. Attitudinal components for specific attitude (importance) and perceived behaviour control (easiness) as obtained from PCA (n=30; communalities, loadings, eigenvalues, variance explained, Cronbach's α , response mean and standard deviation of the response mean; response means may range from 1=very important/very easy to 7=very unimportant/not easy at all presented on the Likert scale).

	Communality	Farmer wellbeing and animal welfare	Management of health and disease	Relaxed working with animals/dealing with sick animals	Favorable environment
The importance of improving animal welfare by					
Investing in the farmers motivation and wellbeing at work	0.92	0.93			
The farmer enjoying his/her work	0.93	0.92			
Talking to and stroking animals	0.80	0.80			
Keeping the animals and pens/barns clean	0.70	0.61			

	Communality	Farmer wellbeing and animal welfare	Management of health and disease	Relaxed working with animals/dealing with sick animals	Favorable environment
To observe their health and manage disease	0.76		0.87		
Keeping eye on the behaviour of animal	0.69		0.76		
Treating the animals humanely	0.57		0.60		
Alleviating pain and euthanizing sick animals	0.60			0.77	
To keep work schedule without haste	0.63			0.72	
Using more litter/rooting material	0.59				0.71
Giving animals more space to move around	0.72				0.83
Eigenvalue		4.19	1.86	1.57	1.39
Variance explained % (total 68.0%)		32.24	14.30	12.10	10.70
Cronbach's α		0.87	0.70	0.52	0.55
Response mean		1.78	1.62	1.58	1.68
Response standard deviation		0.24	0.12	0.07	0.12
The easiness of improving animal welfare by				Relaxed working with animals	
Investing in farmers motivation and wellbeing at work	0.78	0.86			
Farmers enjoying his/her work	0.81	0.84			
Talking to and stroking animals	0.75	0.79			
To prevent violence against animals	0.49	0.66			
Providing animal with favorable environment	0.81		0.89		
To observe animal health and manage disease	0.75		0.70		
Keeping eye on the behaviour of animal	0.84			0.88	
To keep work schedule without haste	0.70			0.68	
Improving quality of the bedding	0.80				0.76
Giving animals more space to move around	0.64				0.74
Eigenvalue		3.01	2.07	1.21	1.06
Variance explained % (total 73.6%)		30.1	20.68	12.12	10.63
Cronbach's α		0.81	0.68	0.51	0.50
Response mean		2.40	3.27	1.98	3.47
Response standard deviation		0.71	0.59	0.12	0.33

In Table 13 components of subjective norms are shown (Wholesale/retail trade, Researchers and other experts, Agricultural adviser/Veterinarian, Slaughterhouse/dairy, Consumers and Other farmers). With the exception of Agricultural Adviser and Veterinarian all subjective norms were loaded in separate components. Loadings were relatively high for most components with the highest loadings in the component 'Agricultural adviser/ Veterinarian' while the lowest loadings were found in the same component. The variance explained ranges from 5.1% up to 24.8% accounting for a total variance explained of 84.4% (Table 13).

Table 13. Components of subjective norms as obtained from PCA (n=30; communalities, loadings, eigenvalues, variance explained, Cronbach's α , response mean and standard deviation of the response mean; a) How much - opinion of stakeholders affect your activities, b) stakeholders emphasise the importance of animal welfare, c) stakeholder understand the issue of animal welfare? Response means may range from 1=very much - 7 not at all and 8 don't know presented on the Likert scale)

The subjective norms		Communality	Wholesale/retail trade	Researchers other experts	Agricultural adviser /Veterinarian	Slaughterhouse/dairy	Consumer	Other farmers
Slaughterhouse/dairy	a	0.80				0.84		
	b	0.79				0.82		
	c	0.81				0.72		
Wholesale/retail trade	a	0.75	0.92					
	b	0.94	0.88					
	c	0.82	0.81					
Veterinarian	a	0.62			0.35			
	b	0.75			0.39			
	c	0.75			0.30			
Consumer	a	0.91					0.94	
	b	0.96					0.88	
	c	0.76					0.82	
Agricultural adviser	a	0.91			0.96			
	b	0.96			0.92			
	c	0.91			0.92			
Researchers& specialists	a	0.94		0.94				
	b	0.95		0.94				
	c	0.96		0.93				
Other farmers	a	0.77						0.88
	b	0.92						0.80
	c	0.75						0.70
Eigenvalue			5.21	3.92	3.58	2.21	1.73	1.07
Variance explained % (total 84.4%)			24.8	18.7	17.0	10.5	8.2	5.1
Cronbach's α			0.89	0.99	0.87	0.74	0.84	0.83
Response mean			7.13	3.86	4.03	7.39	7.34	3.70
Response standard deviation			0.39	0.13	1.32	0.53	0.37	0.80

Regarding general attitude, Principal Component Analysis revealed two components: ‘Empathic Farmer’ and ‘Economically driven’ (Table 14). The highest and lowest loadings were found in the first component, whereas loadings differed to a lesser extent in the second component. The total variance explained was 53.6%.

Table 14. Components of general attitude as obtained from PCA (n=30; communalities, loadings, eigenvalues, variance explained, Cronbach’s α , response mean and standard deviation of the response mean response; means may range from 1= strongly agree to 7= strongly disagree presented on the Likert scale).

The general attitude	Communalities	Empathic farmer	Economically driven
Promoting animal welfare is important for the future	0.76	0.85	
I always do my best to improve the welfare of my animals	0.74	0.81	
It is mentally rewarding to improve welfare	0.38	0.55	
Animal welfare is the most important issue in my work	0.49		0.69
A high yield is evidence of good animal welfare	0.53		0.65
Improving animal welfare is economically profitable	0.46		0.60
A farmer is obliged to treat his/her animals well	0.40		0.57
Eigenvalue		2.40	1.36
Variance explained % (total 53.6 %)		34.2	19.4
Cronbach’s α		0.66	0.42
Response mean		1.40	1.51
Response standard deviation		0.04	0.25

5.1.5 Correlations between attitudinal components

Only few associations between components of specific (Table 12) and general attitude (Table 14), perceived behaviour control (Table 12) subjective norms (Table 13) and intentions (Table 11) were found. The general attitude component ‘Economically driven’ positively correlated with the specific attitude components ‘Management of health and disease’ ($r_s=0.43$, $p=0.005$) as well as ‘Relaxed working with animals’ ($p=0.47$, $p=0.001$) from the component of perceived behaviour control. Regarding the subjective norms, ‘Agricultural adviser/Veterinarian’ positively correlated with perceived behaviour control components ‘Favourable environment’ ($p=0.50$, $p=0.001$).

Considering the intention part, only one connection was found between ‘Take care of animals health and treat diseases more intensively’ with the specific attitude ‘Relaxed working with animals’ ($p=0.37$, $p=0.043$).

5.1.6 Structural Equation Model of attitudes

The structural path model with direct connections between perceived behaviour control and intention which follows the Theory of Planned Behaviour, did not provide a good fit of the data. However, avoiding direct connections between perceived behaviour control and intentions and allowing for correlations between the perceived behaviour control, attitude and subjective norms the modified structural path model (Figure 11) provided an appropriate fit of data ($X^2 = 1.376$ df. 1 $P = 0.010$, RMSEA = 0.046, CFI = 0.925).

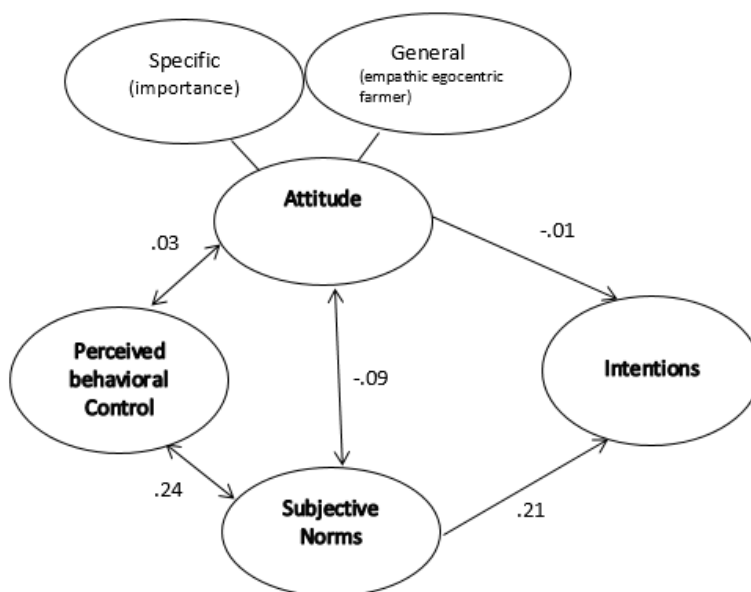


Figure 11. Structural path modelling between all measures presented above, regression weights (single-headed arrows) and correlations (double-headed arrows). The pathmodelling was based on Kauppinen et al. (2010).

Subjective norms were the strongest predictor for the intentions, while attitude was only very weakly associated with intentions. There was no direct link between perceived behaviour control and intentions. Perceived behaviour control indirectly linked with intentions through the associations with subjective norms (Figure 11).

5.2 Baseline animal welfare state in the project farms

5.2.1 Assessment at measures level

Regarding the 'Good Feeding' Principle, the mean prevalence of very lean cows was 8.2% with the percentage ranging from 0 to 25%. Water was provided through water bowls and in each farm one cow had access to two water bowls. Regarding functionality of the water bowls, the median water flow was 10.1 L/min with a minimum of 5.2 L/min and a maximum of 15.9 L/min.

With respect to the 'Good housing' principle, the mean prevalence of dirty animals was 91.6%, 95.7% and 94.1% at the udders, hindquarters and lower hindlegs, respectively. Variation between farms was low with 75-100%, 79.2-100% and 62.5-100% for dirty udders, hindquarters and lower hindlegs, respectively. The mean duration of lying down movements was 5.7s. 40% of the investigated farms provided access to an outdoor run with an average of 78 days per year.

In the 'Good Health' principle, the mean prevalence of lame cows was 37.8%. Mild and severe skin alterations were found in 68.7% and 29.8% of the animals, respectively. The coughing frequency was less than 1 cough per animal per 15 minutes. Other health disorders such as nasal discharge, ocular discharge, hampered respiration and diarrhoea were found to have mean prevalences between 0 and 2%; mean prevalence of vulvar discharge was 7.6%. Mean incidences of dystocia and downer cows were estimated to be 8% and 3.6%, respectively. The mean mortality rate was reported to be 2.5%. From the investigated farms, 56% of farms practised disbudding of calves, predominantly using caustic paste (15/17 farms). Only 3% of farms reported to use anesthetics for the disbudding procedure. Tail docking was not performed in any investigated farm.

With regard to the 'Appropriate behaviour principle, the mean frequency of agonistic behaviours was 0.8 per animal per hour. Only two out of 30 farms provided access to pasture with a maximum of 210 days per year. The avoidance distance results show that on average 40% of animals could be touched, whereas 53.8% of the animals had an avoidance distance of <50 cm, while avoidance distances of >50-100 cm and >100 cm were achieved in rather low percentages with 5.5% and 0.7, respectively. Mean Qualitative Behaviour Assessment scores (positive emotional state) ranged from -5.00 to -1.26 with a mean of -3.05 (Table 15).

5.2.2 Assessment at criterion and principle level

According to the prevalence of lean cows, the average score for 'Absence of prolonged hunger' was 59.8 with a range from 26 to 100 across farms. The score for 'absence of prolonged thirst' was on average 38.8 with a range from 32 to 100, resulting in an average score for the principle 'Good Feeding' of 37.7. Regarding the principle 'Good housing', the average score was 24.2 and farms ranged between 11.0 and 39.4 points. The highest average score was reached for the 'Comfort around resting' criterion (32.3), followed by 'Ease of movement' (21.2). Due to unavailable data on somatic cell counts, it was not possible to compute the criterion score for 'Absence of Disease' and the principle score for 'Good health'. However, the criteria scores for 'Absence of injuries' and 'Absence of pain induced by management procedure' were calculated. The highest mean score was reached in the criterion 'Absence of pain induced by management procedure' with 57.8 (range 20 to 100) whereas the mean criterion score for 'Absence of Injuries' was 23.2 ranging from 4.2 up to 73. The scores for the 'Appropriate behaviour' principle averaged 21.9 with a range from 16.0 to 31.2. Within this principle, the 'Expression of social behaviour' criterion scored highest (mean 82.2, range 34.6 to 93.8). Scores for 'Expression of other behaviours' represented by 'Access to pasture' was zero in all farms due to restriction in most of the farms and lack of time of access to the pasture. The scores for the criterion 'Good human-animal relationship' were on average of 70.9 (range 51.5 to 84.1). The criterion scores for 'Positive emotional state' ranged between 14 and 39.4 with an average score of 26.3.

Table 15. Results of the baseline Welfare Quality assessment in 30 dairy farms at the measure level (carried out from Dec. 2013 to Feb. 2014; mean, median, standard deviation, minimum-maximum).

			Mean	Median	Std. Dev	Min	Max
Principle	Criteria	Measures					
Good Feeding	Absence of prolonged hunger	% of very lean animals	8.2	6.7	6.4	0.0	25
	Absence of prolonged thirst	water flow L/min	10.2	10.1	2.7	5.18	15.9
		% of animals with dirty udder	91.6	93.3	8.5	75	100
		% of animals with dirty hindquarter	95.7	100	6.1	79.2	100
Good Housing	Comfort around resting	% of animals with dirty lower leg	94.1	96	8.5	62.5	100
		duration of lying down movements (s)	5.7	5.7	1.0	4.1	7.7
		% of animals colliding with housing equipment when lying down	22.1	18.3	19.3	0.0	75
		% of animals lying partly outside the lying area	7.8	1.9	13.9	0.0	66
	Ease of movement	days/year in loafing area	78	0	103	0.0	300
		hours/day in loafing area	1.7	0	2.1	0.0	6
Good Health	Absence of injury	% of lame animals	37.8	29.6	21.6	0.0	85
		% of animals with mild integument alteration	68.7	72.7	21.2	18.8	95
		% of animals with severe integument alteration	29.8	21.1	21.5	4.2	81.3
	Absence of disease	number of coughs per animal in 15 min	0.36	0.33	0.19	0.05	1.00
		% animals with nasal discharge	2.0	0.0	3.2	0.0	12.5
		% animals with ocular discharge	0.0	0.0	0.0	0.0	0.0
		% animals with hampered respiration	0.2	0.0	1.2	0.0	6.7
		% animals with diarrhea	1.2	0.0	3.4	0.0	12.5
		% animals with vulvar discharge	7.6	6.3	8.0	0.0	40
		mortality (%) during one year	2.5	0.0	5.8	0.0	31.3
		% of dystocia cows during one year	8.1	7.0	6.4	0.0	25
		% of downer cows during one year	3.6	0.0	5.0	0.0	18.7

			Mean	Median	Std. Dev	Min	Max
Principle	Criteria	Measures					
	Absence of pain induced by management procedures	disbudding	Please see table.16				
		dehorning					
		tail docking	No tail docking				
Appropriate behaviour	Expression of social behaviours	number of head butts, displacements and chasing-ups per animal and hour	0.8	0.6	0.5	0.3	2.5
		access to pasture					
	Expression of other behaviours	days/year	13	0	50	0	210
		hours/day	0.2	0	1	0	4
		% of animals touched	39.9	40	12.7	18	62
	Good human-animal relationship	% of animals approached <50cm	53.8	53.5	13.1	31.5	78.5
		% of animals approached >50-100cm	4.5	5.4	5.5	0.0	16.6
		% of animals approached >100cm	0.7	0.0	2.2	0.0	8.3
	Positive emotional state	qualitative behaviour assessment	-3.1	-2.9	0.8	-1.3	-5.0

Table 16. Disbudding/dehorning procedures in 30 dairy farms in Kosovo (percentage of each procedure and proportion of farms)

Methods	N=30 farms	% of farms	No. of farms
Disbudding	Management procedure		
	Disbudding of calves	56	17/30
	- disbudding using thermocautery	6.7	2/30
	- disbudded using caustic paste	50	15/30
	- Use of analgesics	30	10/30
	- Use of anesthetics	3.3	1/30
Dehorning	Dehorning of heifers/adult cattle	0	0/30

Table 17. Descriptive statistics for Welfare Quality principle and criteria scores in 30 dairy farms in Kosovo (mean, median, standard deviation, minimum, maximum)

Principles and criteria	Mean	Median	St.dev	Min	Max
Principle 'Good Feeding'	37.7	35.3	8.2	27.6	68.2
Criterion: <i>Absence of prolonged hunger</i>	59.8	58.4	22.4	26.0	100
Criterion: <i>Absence of prolonged thirst</i>	38.8	32.0	20.8	32.0	100
Principle 'Good Housing'	24.2	24.3	8.2	10.9	39.4
Criterion: <i>Comfort around resting</i>	32.3	35.0	15.6	8.63	53.8
Criterion: <i>Ease of movement</i>	21.2	15	8.3	15.0	32.0
Principle 'Good Health' *	-	-	-	-	-
Criterion: <i>Absence of injuries</i>	23.2	24.8	14.6	4.23	73.1
Criterion: <i>Absence of disease*</i>	-	-	-	-	-
Criterion: <i>Absence of pain induced by management procedures</i>	57.8	45	38.4	20.0	100
Principle 'Appropriate Behaviour'	21.9	21.3	3.8	16.0	31.2
Criterion: <i>Expression of social behaviour</i>	82.2	86.5	13.3	34.6	93.8
Criterion: <i>Expression of other behaviour</i>	0	0	0	0	0
Criterion: <i>Good human animal relationship</i>	70.9	71.7	7.9	51.5	84.1
Criterion: <i>Positive emotional state</i>	26.3	27.1	5.4	14.0	39.4

* calculation of scores not possible due to missing data

5.3 Implementation of improvement measures and effects thereof

5.3.1 Focus areas and improvement measures

In the 30 dairy farms, in total 5 different focus areas were discussed (Table 18). These areas were comfort around resting/injuries, cleanliness, provision of water, claw health and feeding. In 6 out of the 30 dairy farms, no addressed welfare issue was achieved for any of these areas, whereas 24 farms agreed for addressing different AHW issues, cleanliness (21 farms) and comfort around resting/injuries (18 farms) being the most prevalent ones. In total 56 measures addressed the 5 focus areas. The median number of measures per focus area addressed was mostly 1.

Table 18. Number of farms addressing different focus areas, total number as well as median and range per farm of measures agreed upon and total number as well as median and range per farm of implemented measures in the animal health and welfare plans.

Focus areas as regards improvement	No. of farms addressing focus area	Total number of measures agreed upon	Median and range of number of measures agreed upon	Total number of implemented measures	Median and range of number of implemented measures
Comfort around resting /injuries	18	18	1 (-)	5	1 (-)
Cleanliness	21	24	1 (1-2)	14	2 (1-2)
Provision of water	2	3	1.5 (1-2)	0	0
Claw health	5	8	1 (1-3)	1	1 (0-1)
Feeding	1	3	3	0	0
Total	24	56	1 (1-3)	20	1(1-2)

In total 20 measures were implemented in 3 of the 5 focus areas (no implementation for provision of water and feeding). The largest degree of implementation was found for the area 'cleanliness' with 14 measures implemented (70%) followed by 'Comfort around resting/injuries' with 5 implemented measures (25%) (**Table 18**).

Table 19. Numbers of farms with agreed measures and implemented measures for different focus areas

Focus areas	Agreed measures	Implemented measures	No. Farms
Comfort around resting /injuries	Increasing amount of bedding to a minimum of 2.5 kg/day	Increasing amount of bedding to a minimum of 2.5 kg/day	4
	Checking tethering system, improving divider between lying areas	Checking tethering system, improving divider between lying areas	1
	Checking waster bowls for malfunctions		
	Cleaning manure canal		
Cleanliness	General cleaning of lying area at least 3 times per day	General cleaning of lying area at least 3 times per day	9
	Increasing cleaning frequency on the back of lying area to several times per day	Increasing cleaning frequency on the back of lying area to several times per day	5
	Removing more often the manure form collecting canal		
Health Leg	More frequent claw trimming	Claw trimming	1
	Appropriate treatment for lesion and swellings	-	
	Assuring of dry lying area/adding sufficient amount of bedding	-	
	Increase frequency of floor cleaning	-	
	Decreasing the amount of concentrates fed to affected cows	-	
Housing	Checking of water bowl	-	

Focus areas	Agreed measures	Implemented measures	No. Farms
Facilities	functionality/check of water pipes		
	Redesign of tethering system/checking the length of chains for space allowance	-	
	Providing animals with synthetic collars	-	
Feeding	Checking feeding quality/consulting animal nutritionist	-	
	Special rations for lean cows	-	
	Monitoring situation during feeding for agonistic behaviour	-	
	Replacing position of cows in case of unequal dominance	-	
		-	

5.3.2 Changes in health and welfare parameters following the implementation of improvement measures

When considering control, non-implementation and implementation groups (Table 20, Model A), both group and time had a significant effect on the percentage of animals with dirty lower hindleg, hindquarter and udder, respectively. The percentage of dirty animals decreased with time and implementation farms had a lower percentage of dirty animals. The decrease in dirty animals tended to be larger in implementation farms than in the two other groups ($p_{\text{group} \times \text{time}} < 0.10$ for both lower hind leg and udder). This effect became more pronounced ($p < 0.05$; $p < 0.10$ for hindquarter) when only taking implementation and non-implementation farms into account (Model B). Across all farms, no significant changes were observed for the parameter of mild integument alterations during the study period. Numerically, prevalence slightly decreased in the control and non-implementation groups, whereas it increased in the implementation group (model A). Comparing implementation and non-implementation farms only revealed a significant interaction in terms of decrease in non-implementation and increase in implementation farms ($p_{\text{group} \times \text{time}} = 0.045$; model B). In terms of severe integument alterations, in both control and non-implementation groups prevalence increased during the study period (December to April) while it decreased in the farms which had actually implemented measures ($p_{\text{group} \times \text{time}} = 0.044$ and 0.046 for model A and B, respectively). Regarding the percentage of lame cows, only control and non-implementation farms were compared (only one farm had implemented one measure in this focus area). Lameness prevalence was lower in control than non-implementation farms ($p_{\text{group}} = 0.001$), but there was no change in prevalence over time and no interaction effect.

Table 20. Health and welfare parameters for control, non-implementation and implementation groups (LSmean \pm SE) before (visit V3, December 2014) and after initiating the improvement process (visit V4, April 2015). Model effects are provided for the comparison of control, non-implementation and implementation groups (A) and the comparison of non-implementation and implementation groups only (B).

Parameter	Time	Model effects A					Model effects B			
		Control	Non implementation	Implementation	Group	Time	Group x Time	Group	Time	Group x Time
% of animals with dirty lower hindleg	V3	(n=9) 81.2 \pm 5.4	(n=12) 93.6 \pm 4.6	(n=9) 69.3 \pm 5.4	0.001	0.001	0.093	0.001	0.001	0.023
	V4	67.1 \pm 5.6	88.5 \pm 4.9	43.9 \pm 5.6						
% of animals with dirty hindquarter	V3	(n=9) 82.9 \pm 6.1	(n=12) 95.7 \pm 5.3	(n=9) 79.3 \pm 6.1	0.001	0.001	0.272	0.001	0.006	0.090
	V4	68.4 \pm 6.2	87.1 \pm 5.4	51.9 \pm 6.2						
% of animals with dirty udder	V3	(n=9) 80.8 \pm 4.3	(n=12) 95.1 \pm 3.7	(n=9) 80.8 \pm 4.3	0.001	0.004	0.063	0.001	0.001	0.027
	V4	77.9 \pm 5.4	87.8 \pm 4.7	56.5 \pm 5.4						
% of animals with mild integument alterations	V3	(n=12) 69.0 \pm 4.5	(n=13) 72.6 \pm 4.4	(n=5) 61.9 \pm 7.0	0.763	0.420	0.116	0.925	0.235	0.045
	V4	66.1 \pm 3.9	67.9 \pm 3.8	79.7 \pm 6.1						
% of animals with severe integument alterations	V3	(n=12) 22.4 \pm 5.2	(n=13) 23.9 \pm 5.0	(n=5) 34.9 \pm 8.1	0.920	0.741	0.044	0.680	0.422	0.046
	V4	33.6 \pm 3.9	31.3 \pm 3.8	20.2 \pm 6.1						
% of lame animals	V3	(n=25) 23.5 \pm 2.4	(n=4) 38.8 \pm 4.6	(n=1)* 31.5	0.001	0.708	0.559	-	-	-
	V4	19.1 \pm 2.3	39.8 \pm 4.5	16.0						

* not further considered for statistical analysis

For the remaining measures, only effects of time were explored (Table 21), since implementation of measures did not take place (e.g. with regard to feeding) or health issues such as respiratory disorders, diarrhea or vulvar discharge were not addressed. Across all farms, the prevalence of thin cows significantly decreased over the period time December to April ($p=0.024$), whereas for nasal and ocular discharge as well as diarrhea no such change was found. However, the percentage of animals with vulva discharge significantly increased during the study period ($p=0.045$).

Table 21. Health and welfare parameters before (visit V3, December 2014) and after initiating the improvement process (visit V4, April 2015), that were not addressed in the welfare improvement plans (n=30 farms, *Wilcoxon test*)

Time	% of very lean animals	% of animals with nasal discharge	% of animals with ocular discharge	% of animals with diarrhea	% of animals with vulvar discharge
V3	8.5 ± 6.1	1.2 ± 2.4	0.8 ± 0.4	0.3 ± 1.0	6.9 ± 6.1
V4	4.8 ± 7.4	1.7 ± 4.2	0.3 ± 1.0	1.3 ± 2.3	11.3 ± 8.7
p	0.024	0.802	0.285	0.091	0.045

5.4 Stakeholders' (farmers and veterinarians) opinion regarding welfare standards

The responding veterinarians were mostly located in the central and southeast part of Kosovo, while the farmers covered almost all regions of Kosovo (Figure 4). All veterinarians were male with 80% being 20 to 40 years old. The basic data for the interviewed farmers can be found in chapter 2.5.1.

5.4.1 Importance of different welfare criteria

All welfare criteria presented to the farmers and veterinarians were rated rather important (average scores for farmers: 6.9 to 8.0; for veterinarians: 6.2 to 8.0) (Table 22). There were no significant differences between farmers' and veterinarians' ratings and in both groups 'Social (agonistic) behaviour' was attributed the lowest score followed by 'Access to pasture'.

Table 22. Rating of importance of different welfare criteria (modified after the Welfare Quality assessment system) by farmers (n=30) and veterinarians (n=15) in Kosovo (Likert scale from 1 to 8, where 1-no importance and 8 –very high importance). *Differences between the two stakeholder groups were tested using a t-test*

Welfare criterion	Farmers				Veterinarians				p-value
	Mean	Median	Range	%score 7 or 8	Mean	Median	Range	% score 7 or 8	
Appropriate feed/ sufficient quantity	8	8	8	100	7.6	8	5--8	87	0.164
Water provision	7.9	8	7--8	100	8	8	8	100	0.334
Comfort around resting	7.9	8	7--8	100	7.6	8	6--8	86	0.136
Absence of injuries and disease	7.9	8	7--8	100	7.7	8	6--8	93	0.271
Social (agonistic) behaviour	6.9	7	2--8	70	6.2	7	2--8	53	0.617
Access to pasture	7.4	8	4--8	86	7.3	8	4--8	85	0.711

When specifically asked with regard to water provision, only 10% of the interviewed farmers agreed that one water bowl should be available per cow and the majority of farmers (90%) stated that it is sufficient if two cows share one water bowl. The veterinarians' responses were more variable, as 40% of the veterinarians declared that each cow should have access to its own water bowl and 33 % agreed that case each cow should have access to two water bowls. Both water flow and cleanliness of the water bowls was rated highly relevant by both stakeholder groups (Table 23).

Table 23. Importance of different aspects of provision of water in tie stall systems as allocated by farmers (n=30) and veterinarians (n=15).

Aspect of provision of water	Farmers %	Veterinarians %
Availability of water bowls		
One water bowl per cow (shared with neighboring cow)	10%	40%
One water bowl per two cows	90%	27%
Always two water bowls per cow (even if no neighboring cow)	0%	33%
Water flow in the water bowls		
Not relevant	3%	0%
Moderately relevant	10%	7%
Highly relevant	87%	93%
Cleanliness of water bowls		
Not relevant	0%	0%
Moderately relevant	3%	0%
Highly relevant	97%	100%

The vast majority of both farmers (97%) and veterinarians (87%) stated that loose housing systems provide better conditions to achieve a high welfare state. When asked how many days per year cows should be provided access to an outdoor loafing area or pasture and for how long per day this should be provided, the average farmers' opinion regarding loafing area and pasture was 215 and 188 days with an average of 6.8 hours and 6.8h per day respectively. On average, the veterinarians tended to deem more days appropriate (loafing area: 304, pasture: 221) and also thought that cows should spend more hours per day on the pasture (8.2h).

Table 24. Farmers' and veterinarians' opinion on housing systems as well as the provision of access to loafing area and pasture (farmers: n=30; veterinarians: n=15).

	Farmers %	Veterinarians %
Which housing system provides better standard of animal welfare		
Tie stall	3%	13%
Loose house	97%	87%
Access to loafing area		
Day	215 ± 99	304 ± 112
Hour	6.8 ± 4.0	5.9 ± 5.0
Access to pasture		
Day	189 ± 78	221 ± 89
Hour	6.8 ± 3.9	8.2 ± 5.0

The majority of the farmers (90%) considered disbudding as an acceptable procedure, while only 33.3% of veterinarians shared this opinion. Regarding dehorning, almost 50% of the farmers considered it as an acceptable procedure and 33% of them as not acceptable, whereas only 33% of veterinarians agreed with the dehorning procedure. Both farmers (86.2%) and veterinarians (80%) considered tail docking as an unacceptable procedure (see **Table 25**). 33.3% of the farmers and the majority of the veterinarians (73%) considered that disbudding and dehorning be performed using analgesics and anesthetics, whereas 44% of the farmers stated that disbudding and dehorning should be done without the use of analgesics and anesthetics.

Table 25. Acceptance of disbudding, dehorning and tail docking procedures as stated by farmers (n=30) and veterinarians (n=15)

	Farmers %	Veterinarian %
Attitude regarding disbudding		
Acceptable	90%	33.3%
Partly Acceptable	3.3%	46.6%
Not acceptable	6.6%	20%
Attitude regarding dehorning		
Acceptable	50%	33.3%
Partly Acceptable	16.6%	40%
Not acceptable	33%	26.6%
Attitude regarding tail docking		
Acceptable	3.4%	13.3%
Partly Acceptable	10.3%	6.6%
Not acceptable	86.2%	80%
Management procedure as regards disbudding, dehorning		
Use of anesthetics	13.3%	20%
Use of analgesics	10%	6.6%
Use of analgesics and anesthetics	33.3%	73.3%
Neither use of anesthetics nor analgesics	43.3%	0%

5.4.2 Intervention levels for selected welfare indicators

Both farmers and veterinarians were asked about their opinion towards the intervention level for certain welfare indicators. This threshold meant the degree of presence of a given problem (i.e. prevalence or incidence) beyond which intervention should take place. The median intervention levels as stated by the respondents ranged from 0% to 20% with a maximum of 50% (as regards 'Very lean animals', 'Lameness', 'Avoidance distance >50cm'; Table 26). Based on the median thresholds, farmers and veterinarians agreed in 8 out of 14 indicators, while in 3 cases each either farmers ('Dirty hindquarters', 'Lameness', 'Mastitis') or veterinarians ('Very lean animals', 'Digestive disorders/diarrhea', 'Dystocia') indicated higher median intervention levels than the other stakeholder group. However, farmers and veterinarians agreed in 'Zero tolerance' (i.e. any occurrence requires intervention) with regard to 'Respiratory problems', 'Downer cow syndrome' and 'Mortality'. A median threshold of 0% was also indicated for 'Dystocia' (farmers) and 'Lameness' (veterinarians).

Table 26. Thresholds (as regards percentage of animals affected, i.e. prevalence or incidence) for different welfare indicators beyond which intervention should take place (farmers: n=30, veterinarians: n=15).

Welfare indicator	Farmers			Veterinarian		
	Median	Min	Max	Median	Min	Max
Very lean animals	10	0	50	20	0	40
Dirty udder	10	0	30	10	0	20
Dirty hindquarter	20	0	30	10	0	30
Dirty lower hind leg	20	0	40	20	0	40
Lameness	10	0	50	0	0	20
Lesions/swellings	10	0	20	10	0	40
Digestive disorders/diarrhea	0	0	30	10	0	50
Mastitis	10	0	20	0	0	20
Respiratory problems	0	0	10	0	0	10
Dystocia	0	0	20	10	0	30
Downer cow syndrome	0	0	30	0	0	20
Mortality	0	0	10	0	0	20
Animals lying (partly) outside	10	10	50	10	0	30
Avoidance distance >50cm	20	0	50	20	0	90

5.4.3 Implementation costs

Farmers and veterinarians were asked about their opinion regarding the on-farm implementation costs of some animal welfare standards. In general, the farmers perceived costs for implementing measures aiming at dairy welfare improvement to be higher than the veterinarians. Significantly higher scores were found by farmers with regard to cost of feed provision (6.5 vs. 4.8), comfort around resting (6.3 vs. 3.7), switch to free-stall housing (7.4 vs. 4.4), access to pasture (5.0 vs. 2.6), maintaining a good health state (6.1 vs. 4.5) and use of anesthesia/analgesia for

management procedures such as dehorning (5.3 vs. 3.9; $p < 0.05$). Despite numerical differences in the allocated scores, farmers and veterinarians did not significantly differ in their opinion on costs related to water provision, access to an outdoor loafing area and somatic cell count testing.

Table 27. Opinions of farmers and veterinarians regarding the on-farm implementation costs of selected measures related to animal welfare (scale from 1- 8 with 1=no costs and 8=very high implementation costs; differences between the two stakeholder groups were tested using a t-test)

Implementation costs	Farmers				Veterinarians				p-value
	Mean	Median	Range	% score 7 or 8	Mean	Median	Range	% score 7 or 8	
Balanced diet and sufficient amount of feed	6.5	6	2--8	47	4.8	5	1--8	13	0.006
Water provision/number of drinkers per cow	3.8	4	1--8	10	3.2	3	1--8	13	0.365
Improvement of comfort around resting	6.3	7	1--8	60	3.7	4	1--7	7	0.002
Housing system (change to free stall)	7.4	8	2--8	83	4.4	5	1--8	20	0.001
Access to outdoor loafing area	5.1	5	1--8	33	3.3	3	1--7	7	0.054
Access to pasture	5.0	5	1--8	33	2.6	2	1--6	0	0.017
Safeguarding good health	6.1	7	1--8	60	4.5	5	1--7	13	0.030
Somatic cell count testing	4.2	3	1--8	20	3.8	4	1--7	7	0.252
Use of anesthesia/analgesia for management procedures such as dehorning	5.3	5	1--8	33	3.9	3	1--7	13	0.008

5.4.4 Future perspectives for dairy cattle welfare in Kosovo

The sections regarding future perspectives comprised questions, which address the possible future development of dairy cattle welfare standards in Kosovo. Almost all respondents from both groups agreed that animal welfare requires special attention and further development in Kosovo. Regarding the existing legislation on animal welfare, 36% of the responding farmers agreed that additional legislation for dairy cattle is needed; while 87% of the veterinarians shared this view. Furthermore 63% of farmers' believe that existing legislation is appropriate for implementation of welfare of dairy cattle. 86% of the veterinarians and 96% of the farmers agreed that dairy products from farms with higher welfare standards should achieve higher prices than those from other farms. In line with this, 80% of the veterinarians stated that they would be willing to pay higher prices at the market for dairy products originating from dairy farms with higher welfare standards. Furthermore, both groups agreed that farmer associations, the milk industry or other organisations

should create their own higher welfare standard for dairy cattle. Despite this view, 73% of the veterinarians believe that farmers' associations or the milk industry do not have the capacity and willingness to create private higher welfare standards. Regarding the responsibility for safeguarding and implementing the existing welfare standards on dairy farms in Kosovo, more than 80% of both stakeholder groups referred the responsibility to the State and Official veterinarians. Both groups also think that state and official veterinarians have the primary responsibility for improving the existing welfare standards on dairy farms in Kosovo.

6 Discussion

6.1 Farmers' attitudes on welfare

6.1.1 General Aspects

To our knowledge the present study is the first survey related to animal welfare in Kosovo. Similar studies have been carried out in different countries focusing on attitudes towards veal calves (Lensink et al., 2000), veterinarian and agricultural advisor perception of dairy calf health and welfare (Ellingsen et al., 2012), the effects of use and non-use values of animal welfare on farmers (Hansson and Lagerkvist, 2016), perceptions of human-animal relationship (Bertenshaw and Rowlinson, 2009), as well as attitudes and expectations of beef farmers towards the Welfare Quality assessment system (Kirchner et al., 2014c).

The purpose of this survey was to determine the knowledge and attitudes of dairy farmers in Kosovo towards animal welfare. Attitude may be seen as the central component for understanding and evaluating the behaviour and decision making of farmers towards animal welfare (Hansson and Lagerkvist, 2014). However, this survey does not necessarily provide a representative opinion of dairy farmers in Kosovo, since convenience sampling was used when recruiting the farms. The interview was carried out by visiting each farmer personally; the interview focused on the farmers' opinions and intentions to improve animal welfare, but measures that already been taken for improvement of animal welfare or healthcare prevention were not addressed.

Although an Albanian term exists for 'welfare', the farmers most likely faced the technical term 'animal welfare' for the first time. The topic of animal welfare is relatively new, not just to the farmers but also at most levels of society and relevant institutions in Kosovo. This knowledge gap and absence of respective information was reflected in the interviews with the dairy farmers. The farmers were more cooperative during the quantitative part of the interview (i.e. addressing issues such as: favourable environment, taking care of animal health) presumably because the quantitative interview contained more aspects the farmer deal with in everyday life. In general, the qualitative interview seemed to be more difficult for the farmers. For many questions, the farmers were reluctant to engage in a wider discussion and therefore the answers were often very short.

6.1.2 Farmers' understanding of animal welfare

Farmers mostly referred to the aspect of health condition of their animals and building structure when describing the indicators of animal welfare. For example, recognising good animal welfare farmers referred to the healthy animal, the majority of the mentioned statements centred around resource-based measures. With the same pattern of resource-based indicators farmers referring to poor animal welfare by emphasising low quality of food and water, poor health condition and poor management of hygiene. In contrast farmers from different EU countries (Austria, Germany and Italy) regarding association of term good animal welfare mostly referred to animal-based measures ('Animal') such as health, external appearance or general wellbeing of the animals. With the same point of view, they referred by judging poor state of welfare in terms of external appearance, signs of disease etc. (Kirchner et al., 2009). This way of conceptualizing good animal

welfare was reported also from Finnish farmers by Kauppinen et al. (2010) that farmers think regarding good animal welfare in terms of animal health and comfort. Similar perceptions regarding good animal welfare whereas also reported by Te Velde et al. (2002) from Dutch farmers where farmers often link good welfare to good health. Nevertheless, farmers do not always refer to associations of good welfare with health state, often tending to portrait animal welfare in terms of fundamental needs such as provision of water, food, housing and human animal relationship (Vanhonacker et al., 2008). However, considering that the interview with open questions related to animal welfare was carried out most likely for first time, farmers often do mix up resource based and animal based measures for both good and poor welfare state. This may be due to lack of information rather than by different opinion about meaning of animal welfare (Keeling et al., 2011). In farmers opinion, housing condition including poor hygiene, tie stall and lack of space for movement followed by health disorders such as joint and hoof problems were more emphasized and regarded as a most important welfare problems. This was especially true because farmers are faced daily with mentioned problems due to inappropriate stall design, and management of hygiene. It can be considered as similar perception in terms of general awareness of welfare problems from the study conducted in three EU countries where farmers often prioritise implementing changes in management and housing work load (Kirchner et al., 2009). Farmer perceptions regarding space allowance are in a line with previous attitudes of pig farmers (Bourlakis et al., 2007) and livestock farmers (Vanhonacker et al., 2008) pointed at various problems, such as space requirements and switch towards production system that gives more ability to manage and to engage natural behaviour of an animals. However from both perspectives of farmers involved in our study, implementing those changes require huge investments and potentially may jeopardize the continuity of their farm.

6.1.3 Farmers' view on welfare improvement

The survey was based on (Kauppinen et al., 2010) with the aim of assessing the farmers' perceptions and their willingness as regards animal welfare improvement.

Taking care of animals' health and providing animals with favourable environment was regarded slightly more important than e.g. investing in the farmers' own wellbeing at work. A similar picture was found for Finnish farmers, who considered taking care of the animals' health and their own well-being the most important means (Kauppinen et al., 2010). In general, putting actions aiming at welfare improvement in practice was regarded more difficult for all four areas addressed. The farmers' perception that providing the animals with favourable environment is difficult, matches with the open statements made by the farmers when asked for the major obstacles for an increased welfare. For example, the most frequently mentioned problems in terms of housing environment were the poor status of the buildings connected with poor hygiene, the high prevalence of tie stall systems as well as the generally low space allowance per animal. Again, the perception of easiness of implementation of measures for welfare improvement relative to the perception of importance was similar to the evaluation by Finnish farmers (Kauppinen et al., 2010). In line with the scores given for easiness, taking care of the animals' health as well as treating the animals more humanely was considered more likely to be implemented in the near future than building new housing facilities or taking more time off for leisure.

As regards the subjective norms, only veterinarians, researchers and other specialists as well as other farmers were attributed a certain influence. In contrast, Finnish farmers seemed to be influenced to a greater extent by different stakeholder groups and the most influential actors on decision making regarding animal welfare were veterinarians, slaughterhouse/dairies, and agricultural advisors (Kauppinen et al., 2010). In the present study slaughterhouse/dairies, wholesale and consumers in Kosovo have been reported to have no or very little influence. It is clearly known that so far there is no sustain relationship between farmers and stakeholders such as: slaughterhouse/dairies, wholesale and consumers. Presumably this results in a knowledge gap or lack of public concern and consumer interest about origin of dairy product and under what conditions animals live. Last but not least; the lack of strategy that involves dairy farmers and other stakeholders on the debate regarding animal welfare may have played a role in low influence of other stakeholders.

At the general attitude level, farmers agreed strongly with most of the statements. Similar perceptions were reported also by Finish farmers who also disagreed with the statement that a farmers must not become attached/connect to her/his animals and that talking to animals is trivial (Kauppinen et al., 2010).

6.1.4 Attitudes, subjective norms and perceived behavioural control

We found 4 components each for specific attitudes and perceived behaviour control. The components differed from, Kauppinen et al. (2010), as regards both the number of components (only 3 for specific attitudes) and partly also the meaning. Related to specific attitudes, results similar to Kauppinen et al. (2010) were obtained for the component 'favourable environment', but with less items loading on the component in the present study. The component explaining most of the variance contains items that incorporate farmer well-being and animal welfare together while in Kauppinen et al. (2010) it only focused on farmer well-being (and explained less variance). In the component of management of health and disease contains aspect included in the humane treatment component of Kauppinen et al. (2010) but also has the health management connotations and resulted in less explained variance. Additionally component related to quality of work contain less items loading but involved also aspects of health management. Regarding behaviour control, we found similar components as for the specific attitudes (importance). Compared to Kauppinen et al. (2010), a similar though again not identical pattern was obtained.

Two components were obtained regarding general attitude in the present study: empathic and economically driven famers, which differ from Kauppinen et al. (2010) who found: empathic and reward seeking farmers, although in our case some items remain the same within the two components reported by Kauppinen et al. (2010) with similar variance explained for both components. However the main reason for different labelling in the component of 'economically driven farmers' is that high yield and economic profit are highlighted in two of the four items.

The two general attitude components were not used to describe distinct groups of farmers within the sample, the findings are to some extent in line with (Bock et al., 2007, Bourlakis et al., 2007) who distinguished two groups of farmers based on how they perceive animal welfare: farmers who mainly tend to achieve economic results by improving animal welfare and farmers who despite production tend to satisfy ethical and moral considerations by improving animal welfare. However, the focus on ethical and moral considerations may not be so pronounced in the Kosovo

farmers. Due to the fluctuations in the economic situation and a lack of public debate on animal welfare, also empathic farmers would probably have productivity as an ultimate goal. One could speculate that the level of empathy is based on a basic understanding of the animals' needs. More recently, also (Hansson and Lagerkvist, 2014) emphasized the importance of both use (productivity issues) and non-use values (other aspects) in motivating farmers towards improving animal welfare.

The reliability of the general attitude component 'Economically driven farmer' may be reduced due to a low Cronbach's alpha coefficient (<0.5). A greater coefficient will mean higher reliability in terms of consistency of a test, however it does not always mean a high degree of consistency. It might be affected by the number of items or by the length of the test (Tavakol and Dennick, 2011). Nevertheless, in some cases a low level of alpha might still be useful to interpret (Schmitt, 1996). However, the 'Economically driven farmers' component needs to be considered with caution.

In general, only few associations were found, and the ones found indicated only at most moderate associations. The specific attitude component 'management of health and disease' was associated with the general attitude component 'Economically driven farmer'. In other words, farmers giving importance to health (management) issues also emphasized economical aspects such as milk yield.

Farmers regarding it important to work in a relaxed way with animals and to deal with sick animals (specific attitude component) was associated with the intention to take care of the animals' health and to treat disease more intensively. This may also be seen in the light of the association between the general attitude 'Economically driven farmer' and the perceived behaviour control component 'Relaxed working with animals' (easiness). These farmer priorities can be explained as a preventative health care and willingness to spend time with animals and taking care of sick animals. This may be explained by the fact that care about animal welfare by humans will last as long as their own utility is influenced by conditions under which animals live (McInerney, 2004).

From the subjective norms, agricultural advisor/veterinarian associated with 'favourable environment' from perceived behavioural control (easiness). The higher role of the advisors is judged, the easier providing favourable environment is regarded. At this point finding the information received from the advisors/veterinarians seems to be useful and also feasible from farmers' point of view.

In our survey in accordance with, Kauppinen et al. (2010) there were no correlations of being 'an empathic farmer' with any of the intentions, which has been interpreted by Kauppinen et al. (2010) that genuine improvement of animal welfare is not necessarily associated with an empathic farmer. In our sample, empathic farmers may just be satisfied with the situation on their farms, which could be due to a lack of information regarding improving animal welfare. Similarly, the perception of easiness of improving animal welfare was not associated with any of the intentions. Furthermore, the specific attitudes (importance) and perceived behaviour control (easiness) were not correlated. As for the 'empathic farmer' attitude discussed above, allocating high importance to welfare related measures was not associated with the perception that is easy to implement. At the same time, the farmers considered it important to implement measures but difficult to incorporate in the daily life practice (see 6.1.3).

According to Ajzen (2002) the combination of attitude, subjective norms, and perceived behaviour control leads to the formation of the behaviour intention. The structural equation model (SEM) was used to evaluate interactions between these elements in terms of this Theory of planned

behaviour (TPB). SEM revealed a weak connection between farmer's attitude (specific and general attitudes were not further distinguished as input factors) and their intention as well as the perceived behaviour control (Figure 11). In general, the relations of all elements towards intentions were very low and there were no significant predictors. In the present study attitude has nothing to do with either perceived behaviour control or with intentions. SEM has revealed the only 'meaningful' associations (although not significant) between 'perceived behaviour control' and 'Subjective norms' and 'intentions'. Considering the fact that agricultural advisor & veterinarian mainly influence subjective norms, they can be regarded as main players in the animal welfare issues (in terms of how easy implementation is regarded and willingness of the farmer to implement something) but they do not influence the farmers' attitude. Most of the farmers were focused on animal health, which can be derived from believing on knowledge and credibility of veterinarian or agricultural advisor when the question is to improve things in the farm as a preventative for different issues. Furthermore intention to improve may primarily focus on health improvements, which stays in line with the strong focus on health (when describing good and poor welfare, also see Figure 5). However, despite of a relatively low number of stakeholder influencing on farmer's opinion, the subjective norms seems to play a crucial role on farmer's decision making.

6.2 On-farm welfare assessment

Study design

To our knowledge, this is the first study assessing dairy cattle welfare by applying a comprehensive assessment protocol in Kosovo. Since the topic animal welfare still has to be considered novel in Kosovo, there is a respective research gap. The aim of this project was to assess the current situation of welfare of dairy cows in Kosovo and furthermore to generate baseline data for future research in the field of animal welfare. Participation in the project was voluntary, but it was intended to cover all regions in Kosovo. Furthermore, other criteria were set e.g. regarding the herd size and housing system. A minimum of 15 cows was set as lower threshold for participating in the project. The minimum number was set according to the average size of the so called commercial farms in Kosovo, despite the fact that the total number of cows in commercial farms is lower than the total number of cows in household farms keeping less than 10 cows (MAFRD, 2013). The farms participating in the study do therefore not represent the entire population of dairy cows in Kosovo, but rather commercial farms with an average herd size above 15 dairy cows, which are considered to become more important for the dairy sector of Kosovo in future. Reasons for excluding smaller farms were also of statistical nature, e.g. regarding the interpretation of prevalences where already single affected animals can lead to high prevalences in small herds. Selecting farms with more than 15 cows therefore allowed to achieve reliable estimates of herd level prevalence for the different AHW parameters.

Considering that tie stalls can be found in far more than 90% of the dairy farms in Kosovo and that very few farms run loose housing systems, loose housed herds were not considered representative to include in our project. When selecting tie stall farms for the project, however, the design of the barns was considered in such a way that the design had to allow for the recording of the behavioural measures, especially in terms of avoidance distance recording (Welfare Quality®, 2009).

Data collection was based on the Welfare Quality® protocol (Welfare Quality®, 2009). This protocol consists mainly of animal-based parameters such as body condition, cleanliness, lameness or measures of social behaviour. To a lesser extent, information was also obtained through indirect measures, so called resource-based parameters e.g. access to pasture or outdoor run or management with regard to dehorning practices (Whay, 2007).

From the animal-based parameters in the Welfare Quality® protocol, the analysis of individual somatic cell count could not be applied in this study since there is no routine assessment of somatic cell count available in Kosovo. In the Welfare Quality® protocol (Welfare Quality®, 2009), the proportion of animals exceeding the 400,000 cell/ml limit is used as a proxy for mastitis incidence. Alternatively, data for mastitis (treatment) incidence might have been used, but also such information is not routinely recorded in the farms and was therefore not available for analysis. As a consequence, calculation of Welfare Quality scores for one criterion (Absence of disease) and one principle (Good health) (Botreau et al., 2007) as well as the allocation of an overall welfare level was not possible.

One trained assessor carried out all on-farm welfare assessments. The training course for conducting the Welfare Quality® protocol for dairy cattle took place in Vienna /Austria. It comprised classroom as well as on-farm training. Testing of the inter-observer reliability was set as a prerequisite for reliable data collection. According to (Knierim and Winckler, 2009, Gibbons et al., 2012, Vasseur et al., 2013) training is essential to reduce variation among assessors and improvement can only be achieved by intensifying training. During the training additional explanations were provided until satisfactory agreement was achieved for the measures. Intra-observer reliability was tested in two Macedonian farms with tie-stalls before implementing the assessment protocol in Kosovo. In order to safeguard intra-observer consistency it would have been preferable to repeat the test after conclusion of the farm visits, but practically in our case this was not feasible.

6.2.1 Animal welfare state at the parameter level

In this study, the major areas of concern with regard to welfare related to comfort around resting and injuries including lameness (Table 15).

Parameters addressing comfort around resting comprise cleanliness of the animals as well as behaviour around resting. In the investigated farms, the average prevalence of dirty animals ranged between 90% (soiling at the udder) and 95% (soiling at the hindquarter). Similar poor hygienic conditions have been found in Macedonia and Serbia (Ostojic-Andric et al., 2011, Radeski et al., 2015) whereas prevalence was lower in Romania (Popescu et al., 2013, Popescu et al., 2014) and Switzerland (Regula et al., 2004). Poor cleanliness of the animals may represent serious welfare problems. Maintaining animals clean is considered crucial for preventing health problems such as inflammation of the skin, itching, mastitis and lameness (Zurbrigg et al., 2005). According to Cook (2002), cattle housed under wet conditions and soiled with manure are more likely to suffer from infectious disease such as mastitis. High moisture content in the bedding area is a favourable environment for rapid growth of bacteria which contribute to the high population bacteria on teats end (Barbari et al., 2008). However also other factors influence the hygiene status such as barn design and the stockmen's cleaning routines (Cook, 2002).

Restricted access to outdoor areas in connection with a lack of space for movement in the tie-stalls exacerbates the hygienic situation where the cow defecates on the lying area (Villetta

Robichaud et al., 2011). Inappropriate design of the stall is another influencing factor. In our study, more than half of the farms kept the animals in stalls with a width of 100cm and less, and only few farms had a width of the lying area of up to 110 cm. The recommended width of tie-stalls is at least 121cm (Zurbrigg et al., 2005).

In the framework of on-farm welfare assessment, the measures of lying down duration, collision with barn equipment during lying down and lying partly or completely outside the lying area are considered suitable animal-based measures related to the resting behaviour, which may be recorded in a time period of approximately 2h during the farm visit (Plesch et al., 2010).

According to the evaluation within the Welfare Quality® protocol (Welfare Quality®, 2009) the average duration of the lying down movement recorded in this study (5.7s) is considered a moderate problem (5.20-6.30 s). A similar moderate problem regarding lying down movement was also reported in Romania (Popescu et al., 2014), but a higher duration for lying down movements was recorded in Serbia (Ostojic-Andric et al., 2011). Some studies emphasise that housing facilities can substantially affect the activity and resting behaviour of an animal as regards the impairment of movements during lying down and standing up sequences (Haley et al., 2001, Zurbrigg et al., 2005). Apart from the narrow stalls described above, one crucial factor for the prolonged lying down movements is likely to be the hard concrete surface of the lying area with very little amounts of bedding in most of the investigated farms.

Additionally, animals lying partly outside the lying area and collisions with the stall fittings during lying down have been found to be a serious and moderate problem, respectively, according to Welfare Quality® (2009). In addition to the narrow stalls, in most cases inappropriate, i.e. to short tying systems likely have led to restricted movements. Also other studies regarding resting comfort have reported that cows kept in tie stall are more likely to show a longer duration of lying down, and more frequent cases of collisions when lying down (Krohn and Munksgaard, 1993, Haley et al., 2000). Concerning the parameter lying partly or completely outside the bedding area, a slightly lower percentage was reported for Romania, whereas for the parameter of colliding with housing equipment during lying down slightly higher incidences were found (Popescu et al., 2014).

With regard to the criterion 'Absence of Injury', the average prevalence of mild integument alterations, i.e. hairless spots, was higher than in studies carried out in Macedonia and Romania (Popescu et al., 2014, Radeski et al., 2015). Prevalence of lesions and swellings were comparable to findings in Romania (Popescu et al., 2014) but lower than in Macedonian dairy farms (Radeski et al., 2015).

Many studies describe integument alteration as the result of a physical conflict between animals and their housing environment, and this is even more visible in the tie stall system (Rushen et al., 2007b, Brenninkmeyer et al., 2013). The high prevalence of integument alterations in the present study may therefore be attributed to low amounts of litter (straw, sawdust), wet or abrasive lying surfaces. Another influencing factor for integument alterations, i.e. hock lesions, is the absence of an outdoor run. Considering that certain housing factors are relevant for the development of hock lesions, access to outdoor exercise can potentially reduce the prevalence of hock lesion in tie-stall (Keil et al., 2006).

Many authors regard lameness as one of the most important welfare problems in dairy cattle (Whay et al., 2003, Huxley, 2013). Lameness indicates a painful condition which has a multifactorial origin including management factors and barn design (Zurbrigg et al., 2005). With

regard to lameness, the proportion of affected animals was 38% whereas in other studies the prevalence of lameness in tie stall system varied between 21% in Switzerland (Regula et al., 2004) and 20.6% in Romania (Popescu et al., 2014), while in Serbia the prevalence of severe lameness in tie stall has been reported to be 16.3% (Ostojic-Andric et al., 2011). Predisposing factors for lameness in tie-stalls are the absence of regular exercise, poor hygiene and prolonged standing on a hard surface. In more than 50% of the observed farms in Kosovo, the animals were kept tethered permanently, only few farms provided access to an outdoor run. According to (Rushen et al., 2007b), cows in tie-stalls tend to spend more time standing without feeding and this takes place mostly on a hard surface. In this situation spending more time standing will expose the hoof to wet and dirty areas, which predispose for the occurrence of claw disorders and subsequently lameness. Similarly, only few farms provided access to pasture. According to (Mattiello et al., 2005) even a short time spent at pasture may reduce the occurrence of lameness. Increasing amounts of grazing hours led to improvement on a wide spectrum of integument alterations but also reduced lameness prevalence (Burow et al., 2013).

The mean percentage of very lean cows in Kosovo dairy farms (8.2%) was slightly lower compared to Romanian tie stall farms (Popescu et al., 2014), but higher than in study comparing two housing systems in Serbia (Ostojic-Andric et al., 2011). There are many factors that might influence the occurrence of lean cows. Food quality and absence of authorised laboratories for feed assessment seems to be one of the major concerns of the farmers. However apart from the aspect of the food quality and quantity, the mean percentage of lean cow may be attributed also to certain chronic health disorders such as lameness which may lead to a change in feeding behaviour with lame cows spending less time feeding than non-lame cows (Gomez and Cook, 2010, Norring et al., 2014).

With regard to 'Absence of disease', low prevalences were recorded for all parameters of animal coughing, nasal discharge, ocular discharge, hampered respiration, diarrhoea except vulva discharge. However, the incidence of downer cows exceeded the alarm threshold as set by the Welfare Quality® protocol (Welfare Quality®, 2009), while average mortality rate as well as dystocia incidence were above the respective warning thresholds. Similar results have been found in Romanian farms as regards the occurrence of coughing, prevalences of nasal discharge, ocular discharge, hampered respiration and diarrhoea as well as mortality rate; the prevalence of vulvar discharge was lower in Romania, though (Popescu et al., 2014). Higher prevalences for ocular discharge and diarrhoea as well as a higher mortality rate were found in studies conducted in Serbia and Macedonia (Ostojic-Andric et al., 2011, Radeski et al., 2015).

The prevalence of vulvar discharge and incidence of dystocia appears to be relatively high compared with other studies. 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 values for the incidences/prevalences. However, it should also be taken into account that the information on these parameters was only indirectly obtained by asking the farmers and the almost complete lack of reliable respective records on the farms may also bear the risk of overestimation.

Considering that animals are sentient beings with abilities to behave according to different situations, from the animal welfare science point of view behaviour can be considered a very strong indicator that can tell us a lot about the health and mental state of animals (Olsson et al., 2011). The results obtained for the incidence of agonistic behaviours showed a higher frequency

of head butts per cow per hour than in Romanian tie stall barns but a slightly lower occurrence than in loose housed dairy herds in Romania (Popescu et al., 2013, Popescu et al., 2014). Head butts are more likely to occur in loose housing systems (Laister et al., 2009), considering the fact that cows kept permanently tethered are more restricted in showing dominance over submissive herd mates or that compatible cows are specifically placed next to each other by the farmer.

Studying the animals' feelings has received growing interest over the past decades by acknowledging that feelings are an integral part of animal welfare. It is well accepted that good welfare is not simply the absence of negative experience but is also strongly linked with positive experiences (Boissy et al., 2007). In this context, the relationship between humans and animals is considered as an important feature of modern farming systems and the human-animal interactions of stockpersons can affect the productivity and welfare status of an animal (Hemsworth, 2003). In this study, the results for avoidance distance towards an unknown person as a measure of human-animal relationship in Kosovo dairy farms were in line with other assessments performed in tie-stall systems (Popescu et al., 2014, Radeski et al., 2015). Most of the tested animals allowed to be touched or at least to be approached in the distance of less than 50 cm, whereas a very low percentage was assessed with a withdrawal distance of 50 to 100 cm or more. The results obtained for avoidance distance indicate that animals included in the observation do not experience an aversive situation during handling from stockpersons in the given farms (Waiblinger et al., 2006).

Qualitative behaviour assessment (QBA) was used to assess the behavioural expression and body language of the cows. The QBA results obtained in the present study (scores for emotional state dimension, which are calculated based on Principal Component Analysis of a reference dataset; (Welfare Quality®, 2009) were slightly lower compared with results obtained from observations in tie-stalls in both studies of (Popescu et al., 2013, Popescu et al., 2014). QBA appears to reveal consistently lower scores in tie-stalls compared to loose housing systems, probably due to the fact that permanent tethering, lack of movement and stance constantly restricted may have a negative impact on the behaviour of the cows (Popescu et al., 2014). Compared to the situation in Romanian farms, the emotional state in the Kosovo farms was however scored even worse.

In most of the observed farms the water flow rate fulfilled the minimum requirements for water bowls set by the Welfare Quality® protocol (Welfare Quality®, 2009). A water flow rate lower than 10L/min was recorded in one study in Macedonia (Radeski et al., 2015).

Regarding the management procedures, the present study revealed that 56% of the investigated farms perform the disbudding procedure in calves of 2-3 weeks of age. Almost all the farms performed disbudding procedure with caustic paste and only a very low percentage used anesthetics/analgesics during the procedure (Table 16). Tail docking was not carried out in any of the visited farms; similar results were found also in Macedonia (Radeski et al., 2015). Concerning the criterion of Expression of other behaviours, access to pasture was not provided in almost all farms; only two farms provided access to pasture. The lack of access to pasture may be also due to the reason that most of the farms were located in a village with limited space around the farm buildings. Another reason may also be the long distance between farm and pasture with inappropriate infrastructure for access to the pasture.

6.2.2 Welfare Quality criterion and principle scores

Apart from describing the single welfare measures, the Welfare Quality® protocol also allows to calculate aggregated welfare criterion and principle scores (Welfare Quality®, 2009). The scale used for these scores ranges from 0 to 100 with a score of 20 indicating the threshold for a just acceptable situation, which requires action, a score of 50 a somewhat neutral condition above which intervention may take place and a score of 80 constituting the threshold for an excellent situation.

The scores for the principle Good Feeding, which comprises the criteria Absence of prolonged hunger as well as Absence of prolonged thirst, were low with a mean score of only 37.7. Within this principle, the overall result was mainly driven by low scores for the Absence of prolonged thirst criterion. In the Welfare Quality® protocol, more emphasis has been put on the negative effects on welfare as regards the Absence of prolonged thirst criterion than on the Absence of prolonged hunger criterion, most likely because of the high water requirements of milking cows which consume higher quantities of water for milk production (Cardot et al., 2008). In the investigated farms the water provision was at least partly inappropriate in terms of quantity. Despite the fact that in some of the investigated farms the water flow matched the requirements of the Welfare Quality® protocol for dairy cows (Welfare Quality®, 2009), the availability of drinkers was often not satisfactory. In all Kosovo farms water was supplied by water bowls, where one water bowl served two cows. According to (Andersson et al., 1984), inadequate water supply is likely to affect the production in terms of both feed intake as well as milk yield. Water intake may be affected by the functionality of the drinking bowls and dominance. It has been shown that one water bowl per two cows might cause competition and subsequently the submissive cow may drink less water than the dominant one in every cow pair (Andersson et al., 1984). Furthermore water intake is influenced by milk production, dry matter intake and ambient temperature (Meyer et al., 2004).

The scores for 'Good Housing' included the criteria Comfort around resting and Ease of movement. The mean principle score for 'Good Housing' was only 24.2 points, originating from average scores of 32.3 and 21.2 for Comfort around resting and Ease of movement, respectively. The low score was given due to the fact that the majority of the farms kept the cows permanently tethered and with inappropriate housing conditions. According to the Welfare Quality® (2009), a cow is considered permanently tethered if it spends at least 18 hours tethered on a given day. Our results indicate that only (12 farms) provided access to an outdoor run with a maximum of 4 hours per day. These restrictions and inappropriate housing facilities with insufficient space to move freely due to tethering design and narrow stalls have an impact also on Comfort around resting and Ease of movement. Many studies indicated the importance of providing animals with appropriate housing facilities such as proper location to stand in 4 feet and to rise and lie down without any contact with the housing equipment (Zurbrigg et al., 2005). Other studies underline the importance of appropriate bedding and routine cleaning which plays a role in the cleanliness of the udder and preventing mastitis and other injuries (Barbari et al., 2008, Burow et al., 2013).

The highest/best average score, among the criteria contributing to the Good Health principle (no overall principle score computed due to the lack of information on mastitis incidence), was found for Absence of pain induced by management procedures. Within this criterion, there was a split between farms with farmers not carrying out disbudding and thus keeping horned animals achieving the best possible score. The other part of the farms obtained a low score of 20 due to

disbudding procedures which do not include the use of analgesia or anesthesia. Disbudding is considered a painful procedure without using anesthesia and analgesia but this practice also involves isolation and restraint which may result in psychological and behaviour responses. Using anesthesia and anti-inflammatory drugs before the procedure will reduce pain and stress whilst cortisol responses appear to be lower or virtually eliminated (Stafford and Mellor, 2011). Tail docking was not applied by any of the farms, therefore all the farms has reached the highest score.

Relatively low score was obtained to the Absence of Injury due to high prevalence of lameness and integument alterations.

The mean score for the Appropriate behaviour principle of 21.9 indicates a substantial room for improvement with regard to behavioural opportunities for the animals. This score was driven mainly by the Expression of other behaviour and Positive emotional state criteria. The dairy cows were kept tethered and only two farms in this study provided access to pasture but for a limited period of time only (4 hours/day). According to the Welfare Quality® protocol, animals should have access to pasture at least 6 hours per day to be considered for this criterion (Welfare Quality®, 2009) and thus the lowest possible score was obtained in all farms. For the criterion of Positive emotional state, a low average score was obtained as well. Also other studies emphasise lower results of Positive emotional state in tie stalls compared with loose housed herds (Popescu et al., 2014). Permanent tethering impairs interaction with herd mates and the environment and the long-term negative effects of poor resting comfort, lack of movement and reduced social interactions may be apparent in the body language. Within the Principle of Appropriate Behaviour, the criteria Expression of social behaviour (ESB) and Good human-animal relationship (GHAR) were allocated the highest average scores. Cattle are considered as social animals and their interactions may be categorized in both aggressive and affiliate behaviour (Tucker, 2009), however, the Welfare Quality® protocol only takes agonistic interactions into account. Permanent tethering inhibits many behaviours thus affecting the welfare of cows but as they are limited to move freely, the cows may display also less agonistic behaviours (Popescu et al., 2013). For the GHAR criterion, the avoidance distance of animals towards an unknown person was assessed. According to Waiblinger (2009), farm animals that withdraw from their own stock person at a greater distance react in the same manner to an unknown human, and when animals accept being touched by their familiar stock person they are also likely to allow a strange person to do so. In this context the withdrawal distance in farms studied was in general on a very satisfactory level. This may also be due to the fact that in tie-stall systems the withdrawal distance seems to be shorter than in loose housing system, due to frequent human- animal interaction during activities such as feeding, milking and cleaning the barns (Popescu et al., 2009).

6.3 Effect of improvement plans

Two farm visits were carried out in the time period from December 2014 to April 2015 with the aim to report the results to the farmers (provision of feedback), to discuss possible changes of the housing and/or management, to agree on farm-specific measures to be implemented and, during the final visit, to evaluate the effectiveness of implementing changes after a time period of four months.

6.3.1 Choice and implementation of improvement measures

The recognition of welfare problems by the farmers was assisted by the feedback report, which – based on the first assessment - contained the results from the own farm as well as from the other farmers participating in the project (benchmarking) based on the initial baseline assessment (Whay et al., 2003, Huxley et al., 2004, Ivemeyer et al., 2012, Kirchner et al., 2014a, Tremetsberger and Winckler, 2015). The current situation on the farm as regards the clinical measures such as cleanliness, lameness or skin alterations, which was assessed in the course of the same farm visit (V3) was also provided. Furthermore, parameters of poor AHW were highlighted with the aim to pay specific attention to the highlighted results. The feedback report has played an important role as a good starting point for discussion of the findings and it also gave the opportunity to further explain parameters which the farmers were not familiar with. Thus, the report was meant to support the farmers in choosing areas to be addressed and taking action. Despite discussions with the farmers about all parameters presented in the feedback, the final decision of the farmers was based on their willingness to work on the addressed measures. At the end of the discussion, a brochure with advice related to most of the parameters was given to each farmer regardless of the outcome of the health and welfare planning discussion. A similar approach has been used also in different EU countries (Ivemeyer et al., 2012, Kirchner et al., 2014b, Tremetsberger et al., 2015) where focus areas were chosen by the farmers and their ownership-driven commitment to engage in the addressed measures.

The farmers tended to focus on one specific area with hygiene and comfort measures around the resting area being the most frequently addressed area followed by lameness interventions. The farmers were more reluctant to select measures for lameness improvement, which may be attributed to a lack of knowledge and different perceptions and attitudes of the farmers (Main et al., 2012). Other studies report that farmers often neglect lameness prevalence (Whay et al., 2003, Barker et al., 2010). People from outside may perceive things differently than a person who works daily in the same environment (Vaarst et al., 2007, Vaarst et al., 2011). Other areas such as improvement of the feeding strategy or interventions on water supply (drinking points) were rarely chosen by the farmers. In other studies, the main areas chosen by the farmers focused more on udder health and metabolism/feeding followed by lameness (Gratzer, 2011, Ivemeyer et al., 2012, Tremetsberger et al., 2015). The low prevalences observed for some parameters such as nasal discharge, ocular discharge and diarrhea did not necessarily require interventions, which explains why no measures were addressed for these parameters.

The final visit was performed in April 2015 (V4), about four months after the previous visit. The final visit consisted only of re-assessment of the clinical parameters, checklist for management and housing and an interview with the farmer. It allowed to investigate whether the farmers had implemented any measures and if yes, which measures.

The implementation rate was 35.7%, i.e. 19 out of the total 56 measures addressing housing and management that had been agreed upon were put in place. This rate is lower than in other intervention studies. Using a similar approach, after a period of one year the implementation rate was 57% across 34 dairy farms in Austria (Tremetsberger et al., 2015) and about 50% in 39 Austrian organic dairy farms (Gratzer, 2011). The relatively low degree of implementation may be due to several factors. In the present study, in line with the most frequently chosen focus area the greatest degree of implementation of measures was obtained in the cleanliness area. Farmers tended to implement low-cost measures, which do not require high investments and rather consist

of changes in the routine management such as interventions focussing on cleanliness (e.g. amount of litter, cleaning frequency). This is presumably due to the insecure market demand and the lack of detailed knowledge regarding rather novel aspects of animal health and welfare such as lameness. Although in the plan of some farms, they obviously avoided to address more complex problems such as lameness presumably due to factors such as the short period elapsed since the implementation visit, time of the year or the costs for professional claw trimming.

6.3.2 (Short-term) effect of implementation

Two models (Model A and Model B) were used to describe the effect of the improvement strategy over the study period of four months. Model A included all groups (Control, Non-implementation, Implementation), while for Model (B) the Control group was excluded. This was considered useful as it was not clear whether farms in the Control group had been encouraged to implement changes by the mere discussion of different welfare aspects although respective measures were not part of their health and welfare plan. Taking this into account, model A did not allow to clearly examine the effects of implementing measures during the period of four months. However, the Non-implementation farms obviously had not implemented any improvement measure and were therefore considered to be the more appropriate 'control' group.

Improvements in AHW were achieved regarding animal cleanliness as well as severe integument alterations (lesions and swellings). Improvement in cleanliness over time was evident in all groups (Control, Non-implementation, Implementation) but it was more pronounced in the Implementation group. While in Model A regarding cleanliness of lower hindleg and udder only a statistical tendency for the group*time interaction was revealed ($p < 0.10$), significant reductions were found in Model B. The numerical decrease in prevalence of animals with dirty lower hindleg and dirty hindquarter was higher in the Control group than in farms which had measures for improvement of hygiene included in the plan but did not implement any (Non-implementation group). In terms of animal cleanliness, the baseline situation of the farms belonging to the Control group was comparatively better than the farms of the Non-implementation group. The farmers may therefore have been satisfied thus not explicitly addressing leg cleanliness. However, the seemingly paradoxical effect as regards the development of prevalences may be due to the fact, that the farmers may have benefitted from the discussion at the planning visit (V3) and without having it 'officially' addressed in the plans still implemented changes. According to (Whay et al., 2012), such a change of behaviour in the Control group is well recognised, this phenomenon being known as 'Hawthorne effect'. The awareness of participants is raised even when they are not directly involved in implementing changes in a given area. Similarly, a reduction of prevalence of dirty udders was found by (March et al., 2014), where in the course of 'Stable Schools' udder cleanliness had not been selected as a specific aim for improvement by the farmers but across all farms it improved significantly. A significant improvement of udder cleanliness as in the present study for the Implementation group (model B) has also been reported by (Tremetsberger et al., 2015). This improvement may have occurred due to changes of the daily management routines such as intensifying cleaning routines and improving bedding which is known to be beneficial for the cleanliness of the udder region (Plesch and Knierim, 2012).

Also seasonal effects as a further reason for a reduction in dirty animals cannot be excluded. Temperature and humidity might have an effect on cleanliness of the resting area and the animal, but since in the Non-implementation farms the reduction was smaller than in the Control and

Implementation groups, such a seasonal effect is less likely to explain the overall effect. However further studies additionally taking climatic parameters into account are recommended (Plesch and Knierim, 2012).

The prevalence of mild integument alterations (hairless) remained largely unchanged in Control and Non-implementation farms while it increased in Implementation farms (model B: $p_{\text{group*time}}=0.045$). Concurrently, the prevalence of severe integument alterations (lesions and swellings) increased in the Control and Non-implementation group but decreased in the Implementation group (models A and B: $p_{\text{group*time}}<0.05$). This pattern may indicate that due to implemented improvement measures in the Implementation farms severe alterations were positively affected and thus may have developed into mild alterations. However, our epidemiological knowledge about the ontogeny of skin alterations and how hairless patches, lesions and swellings change over time is limited (Norrington et al., 2008, Kester et al., 2014, Tremetsberger et al., 2015). However, the fact that four out of five Implementation farms improved the amount of bedding is in line with management factors identified by (Brenninkmeyer et al., 2013) influencing skin alterations such as dry, soft and clean lying areas.

Not in all areas implementation of measures took place, for example in the focus area regarding lameness; only one farm implemented one measure. During the study period no significant changes over time were observed, but the Control group differed significantly from the Non-implementation group at both visits (V3 and V4). The Control group consisted to some extent of farms, which showed a relatively low lameness prevalence compared to the other farms in the Non-implementation group. However, the low sample size in the Non-implementation group may also affect the results. Nevertheless, the situation regarding lameness prevalence should be an issue of concern for the majority of farms. Lameness is considered as most important welfare problem with multifactorial nature and of economic importance, where the management factor plays an important role (Whay et al., 2003, Richert et al., 2013, Bruijnis et al., 2013). The majority of the farms keep the dairy cows in tie-stalls with poor housing conditions and lack of opportunity of access to outdoor run. However lack of movement, poor dimension of resting area and hygiene have been reported in several studies as potential risk factors for lameness (Cook, 2002, Mattiello et al., 2005, Rushen et al., 2007b, Barker et al., 2010). Several studies confirm that even a longer implementation period than the four months in the present study does not ensure positive effects on the level of lameness prevalence. For example, one year after implementation of measures no significant change was found by (Bell et al., 2009, Gratzner, 2011, Whay et al., 2012, Barker et al., 2012, Tremetsberger et al., 2015).

No other areas were addressed by the farmers. Two measures however significantly changed during the four months observations period: the prevalence of lean cows decreased over time and the prevalence of animals with vulvar discharge increased (Table 21). Considering that no implementation was set up, the change may reflect several factors such as seasonal effect, introduction of new cows or feed quality. Gratzner (2011) reported a significant increase of thin cows across all investigated farms during study period of one year by attributing this effect to the quality of roughage feed. The increase in the percentage of cows with vulvar discharge may be explained by the timing of the final investigation, which was carried out in the early spring and thus a period with more calvings than in the rest of the year.

In conclusion, considering the relatively short duration of the implementation study, improvement measures were put into practice almost exclusively in the focus area of hygienic measures around

the resting area, but implementation exerted measurable effects in some of the health and welfare indicators. To our knowledge, there are no short-term on-farm studies the present study could be compared with. In beef bull farms, (Kirchner et al., 2014a) did not find changes in health and welfare indicators over a 6 months study period, but the areas addressed were mostly different and implementation rate was even lower. The duration of the observation period is however a crucial factor for implementation as well as for being able to measure change. Longer periods give the farmers more time to implement proposed measure such as changing the housing system or breeding improvement and more time for inducing effects in the respective outcome measures (Tremetsberger and Winckler, 2015).

6.4 Stakeholders' (farmers and veterinarians) attitude regarding animal welfare standards

The ultimate goal of this survey was to determine how stakeholders (farmers and veterinarians) view (selected) welfare criteria of the Welfare Quality assessment approach for dairy cattle and at which level they think problems need attention and require action. Furthermore, it was determined how the stakeholders rate implementation costs of changes necessary to improve dairy cattle welfare as well as the future of welfare standards in Kosovo. The thirty farmers participating in the survey were the same farmers involved in the previous activities of the project. The questionnaire to the farmers was delivered in a hard copy during the last farm visit. Additionally the questionnaire was spread online to more than 150 members of the Veterinary chamber and the Veterinary State Agency. However, only 15 veterinarians (members of the Veterinary Chamber) and one retailer of dairy products responded. Due to the lack of a sufficient number of other participants in the survey, the single retailer's opinion was excluded from analysis.

6.4.1 Importance of welfare criteria

In general the stakeholders involved in the survey agreed that the different welfare criteria are meaningful for the animals. The importance attributed to the welfare criteria did not differ between farmers and veterinarians but behavioural parameters were rated lower than health related measures.

This pattern confirms findings of earlier studies. In the study of (Scott, 2013), freedom from disease and pain was considered an important aspect of good welfare by veterinary professionals while they mostly gave less consideration to mental health. Also in a Spanish survey on perception of animal welfare, both farmers and veterinarians stated comparatively high levels of concern as regards animal welfare compared with other stakeholders included in the survey (María, 2006). Again, compared to other welfare criteria, both groups of stakeholders (farmers and veterinarians) gave less priority to the behaviour of dairy cows. Almost all respondents considered with high importance providing animals with appropriate food and sufficient quantity.

Farmers and veterinarians gave similar importance to water provision as well as water flow and cleanliness of the water bowls. Similar results have been reported by (Heleski et al., 2004) where out of 444 animal science faculties' members 98% and 92% agreed that agricultural animals should have freedom from hunger and thirst, respectively. However, for the access to water the majority of farmers considered one water bowl per two cows sufficient, while more veterinarians

were of the opinion that animals should be provided with more than one water bowl per cow, even if there is no neighbouring cow (see Table 23). Considering the fact that water restriction is likely to affect physiology and performance (Schroeder, 2008), the veterinarians' emphasis on providing animals with more than one water bowl may be attributed to health considerations. No significant difference was found regarding the opinion on comfort around resting; both groups considered providing animals with good comfort as highly important. Also Norwegian veterinarians and advisors regarded poor feed quality and hygiene as the most important welfare challenge (Ellingsen et al., 2012).

Our results show that both farmers and veterinarians gave more consideration to disease and injuries than to the behaviour of the animals. However, while good health is an essential part of animal welfare, being healthy does not guarantee good mental health (Webster et al., 2004). Providing animals with pasture was considered important by farmers and veterinarians. This may be due to the behavioural opportunities when out on pasture e.g. regarding the performance walking and grazing (Falk et al., 2012). Nevertheless, access to pasture might be beneficial also for animal health. According to (Washburn et al., 2002, Hernandez-Mendo et al., 2007), pasture can play a role in terms of a lower incidence of mastitis and lameness in cow. However despite giving importance to access to pasture our findings indicate that the majority of the dairy farmers find it difficult to provide animals with access to pasture. Only 6% of the investigated farms provided access to pasture while 40% of the farms provided access to outdoor runs.

The housing system as such was found to be of concern for both farmers and veterinarians. 96% and 87% of the farmers and veterinarians stated that a loose housing system would ensure high standards of animal welfare, respectively. However, the number of farms with loose housing in Kosovo is still very low and a rapid change to loose housing systems may not be expected due to the small herd sizes and economical constraints.

Farmers accepted disbudding of calves to a greater extent than the veterinarians who mostly considered disbudding as only partly acceptable. Disbudding is a widespread practice in cattle farming across EU countries (Cozzi et al., 2015). A study conducted with Italian farmers reports that the majority of respondents (80%) practises disbudding of calves (Gottardo et al., 2011). With regard to dehorning of cattle, e.g. removing an already existing horn in mostly adult animals, more or less equal percentages of the veterinarians stated that the procedure would be acceptable, partly acceptable and not acceptable, respectively, whilst farmers tended to agree that dehorning is an acceptable procedure (50%, **Table 25**). However, in the EU dehorning of older animals is much less common than disbudding and mostly performed in suckler and beef cattle farms (Cozzi et al., 2015). Tail-docking was considered not acceptable by both farmers and veterinarians, which is in line with the finding that tail docking was not routinely used in Kosovo farms. Similar results have been reported by Weary et al. (2011) where the majority of the respondents consisting of veterinarians, producers, industry professionals etc. were opposed to tail docking. Tail-docking is considered to not provide any benefit and may potentially play a role in reducing welfare by intensifying discomfort and chronic pain (Stull et al., 2002). Regarding the opinion on the use of medication during the management procedures (disbudding, dehorning and tail-docking), differences between farmers and veterinarians were found. Most veterinarians emphasised that both anesthetics and analgesics be used, while 43% of the farmers stated that the management

procedure may be performed without using analgesia and anesthesia. A similar opinion of veterinarians regarding pain relief was reported by (Heleski et al., 2004) and (Sabuncuoglu and Coban, 2008), where the majority of interviewed experts declared that using pain relief is necessary. Also the majority of Finnish farmers referred to disbudding procedure in terms of sensitivity to pain by rating as severe painful condition and stated that disbudding pain should be taken seriously (Hokkanen et al., 2011, Wikman et al., 2013). Our findings indicate that only 3% of the farmers use anesthetics and 30% use analgesics during disbudding or dehorning procedure. The discrepancy between opinion stated and actual practice reveals the importance of improved education and better communication between farmers and veterinarians.

6.4.2 Intervention levels

With regard to the median intervention level for the different welfare indicators (Table 26), both groups of respondents referred to the lower end of the scale 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 median intervention level of veterinarians was 0% (at the farm level), while farmers appeared to be more permissive by setting the threshold at the level of 10%. From the veterinarians' point of view, lameness and mastitis are probably considered effectively treatable and they may see this as a core task of their profession. Farmers may however view both disorders as to a certain extent unavoidable production diseases of farm animals (Mulligan and Doherty, 2008). The farmers nevertheless were stricter as regards the prevalence of very lean animals (farmers: 10%, veterinarians: 20%), maybe due to the fact that in none of the investigated farms the mean proportion of very lean cows was above 10%. Low feed quality and quantity, diseases and many other factors may lead to thin cows, for example lame cow are more likely to spend less time feeding than healthy cows (Gomez and Cook, 2010). Another example for differences between the groups is dystocia incidence where the acceptable level was set at 0% for the farmers and 10% for veterinarians. Apparently for veterinarians dystocia is one of the issues they are regularly confronted with. Despite the minimum threshold given by the farmers, the level of dystocia in the investigated farms was quite high thus often exceeding the alarm threshold set by the Welfare Quality® protocol (Welfare Quality®, 2009).

When comparing the intervention thresholds as set by the farmers and veterinarians with the actual on-farm situation, major discrepancies were detected such that average on-farm prevalences were substantially higher than the suggested thresholds, e.g. for animal cleanliness lameness and skin alterations. Lameness is considered to be of major welfare and economic concern in dairy farms all around the world (Whay et al., 2003, Hamilton et al., 2006, Oltenacu and Broom, 2010) and lameness prevalence in the investigated farms (37.8%) was markedly higher than the intervention threshold set by farmers (10%). According to (Whay et al., 2003, Oltenacu and Broom, 2010) the majority of experts agreed that action should be taken at a level between 9-20% of lameness prevalence. Likewise, based on the prevalence of dirty cows exceeding 90% in most of the farms, comfort around resting was considered one of the major welfare concerns. From the farmers' and veterinarians' point of view the acceptable level of dirtiness was at the level of 10% for udder and 20% for leg and hindquarter. Likewise, high prevalences were found for lesions and swellings (median prevalence: 29.8%, suggested

threshold: 10%). The huge difference between the suggested threshold and the on-farm situation may be explained by the fact that farmers and veterinarians were aware of the importance of cleanliness; in practice it still seemed to be difficult to safeguard.

Apart from the above mentioned prevalence of very lean animals, there were further parameters, for which both groups suggested higher median thresholds than found in the farms, e.g. regarding the prevalence of animals showing an avoidance distance larger than 50cm (median prevalence: 4.5%, suggested threshold: 20%).

6.4.3 Implementation costs and future perspective

In the last section of the questionnaire, our purpose was to evaluate opinions of farmers and veterinarians towards implementation costs of different animal welfare standards. Compared to farmers, the veterinarians in general estimated costs to be lower, but cost estimates for the different welfare standards followed the same overall pattern.

The perceived costs for the implementation of different welfare standards in dairy cows have been rarely taken into account in earlier studies. The majority of studies has focused on costs of specific disease such as mastitis (Seegers et al., 2003, Halasa et al., 2007) and lameness (Bruijnis et al., 2010) which makes a direct comparison difficult.

Providing animals with balanced and sufficient diets were considered to cause (relatively) high costs by both groups of respondents but more pronounced by the farmers. This finding may be related to factors such as lack of land for feed production as well as the need for feed imports. Most of the farmers rent land in order to produce feed for the animals, while the rest of the diet (e.g. concentrate) is imported from neighbouring countries. Changing the housing system was ranked as the most expensive investment from the farmers' point of view. Considering the fluctuations in economy, changing the structure of the farms seems to be difficult to achieve, especially since investments in buildings mean high implementation costs.

Health maintenance was considered expensive by both groups. The respondents were not asked to provide explanations for their scoring, but such costs may arise both from investments in preventive measures as well as costs related to the treatment of diseases. At the time of the study, farmers and veterinarians in Kosovo had only limited experience with health and welfare planning and its economical implications. At the same time, such assessment is complex and data are limited (Tremetsberger and Winckler, 2015). However, according to Huijps et al. (2010) maintenance of animal health e.g. by implementing management changes in farm may be cost efficient.

Significant differences were obtained regarding cost evaluation of access to an outdoor loafing area and to pasture. These costs were perceived higher by the farmers than by the veterinarians. This difference in perception may be explained by difficulties of the farmers to provide animals with access to outdoor-run/pasture due to inappropriate location and farm structure; additionally, any intervention to provide animals with access to outdoor-run/pasture may have been estimated to require investments.

Comfort around resting is considered essential for maintaining health and welfare (Cook and Nordlund, 2009). Nevertheless farmers considered it expensive to implement measures to ensure such comfort, probably due to higher labour input and changes in the management routine. The veterinarians may have regarded comfort around resting as a prerequisite for successful dairy farming, which from their point of view is feasible at low costs. From the farmers' point of view, implementing animal welfare standards in the different areas requires high monetary investments and a reliable market. Nevertheless, according to (Majewski and Harvey, 2012), particularly dairy farms benefit from an upgraded welfare standard due to a high potential to generate a milk yield increase and cost reduction.

To the author's knowledge, there is no detailed regulation for dairy cows that sets the standard regarding animal welfare of dairy cows in Kosovo. It is also considered unlikely, that the dairy industry creates an own welfare standard. This is due to limited capacity and willingness of the industry, since regulations to support products originating from farms with higher standard of animal welfare do not exist so far.

7 Conclusions

The present study offers a substantial amount of information on attitudes of Kosovo dairy farmers in the context of animal welfare and on the animal health and welfare situation of dairy cows kept in commercial farms in Kosovo. The conclusions hereafter refer to a) the attitude of the farmers regarding animal welfare, b) the current situation of animal welfare in dairy cows, c) the results as regards the welfare improvement study, and d) the attitudes with regard to intervention thresholds for a number of welfare parameters. This is followed by a brief outlook on future research needs.

a) Considering the given lack of information regarding animal welfare in Kosovo, farmers tend to portrait animal welfare in terms of either healthy animals or as the provision of favourable environments for the animals. The focus on health issues may be explained by the influence of advisors and veterinarians. Our findings indicate that a high proportion of farmers considers it important to take actions to improve animal welfare, but difficult to implement in practice. Despite the weak associations between attitudes and subjective norms, we assume that communication and collaboration between relevant stakeholders and farmers is missing and should be promoted. Further efforts in training of agricultural advisors and veterinarians to disseminate the knowledge with regard to animal welfare among the farmers is recommended.

b) The Welfare Quality assessment protocol appears to be an appropriate tool for obtaining information on health and welfare of dairy cows. Taking the small scale of 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. Based on the findings, the main areas of concern are cleanliness, lameness, integument alterations, and lack of access to outdoor runs and pasture. Although the sample may not be considered representative for dairy farming in Kosovo in general, it can be assumed that similar issues may be present in many farms in the country given the high prevalence of tie-stall housing and the economic situation. The risk factors for the welfare outcomes mentioned above are well known and mainly refer to housing and management. Investing in farm buildings (including amendments of existing barns) and incorporating changes of the daily management routine are considered necessary.

c) In the present study, cleanliness of the animals was the most accepted area for improvements and substantial changes became evident over the study period of only four months when implementation of measures – mostly changes in the daily routine - took place. Reporting of the results of the assessment including benchmarking seemed to be crucial for the motivation of farmers to take action in addressing certain welfare parameters. Since some parameters of animal welfare have to be considered as novel for Kosovo dairy farmers, further actions to disseminate the knowledge about indicators of animal health and welfare is needed. To assure improvement to a larger degree, further studies with longer observation periods and in cooperation with veterinary and/or agricultural advisory services are recommended.

It can be assumed that establishing legislation to reach minimum standards for livestock welfare will be beneficial for animal welfare standards. Incorporation of animal-based welfare assessment protocols in permanent monitoring of the farms by the state veterinary service is considered promising for future development.

d) Both farmers and veterinarians rated most welfare criteria important. Both groups gave more priority to appropriate feeding and health rather than behaviour of animals. Farmers and veterinarians suggested rather low intervention levels for welfare problems that need attention and require action. However while farmers and veterinarians considered it important to implement selected welfare standards in dairy farming, the costs of implementation were perceived higher by the farmers than by the veterinarians. To ensure the implementation of welfare standards, a close cooperation between stakeholders in terms of awareness and feasibility of implementing changes at low cost is needed.

Further research in the context of animal welfare science in Kosovo

The results obtained in the present study may serve as a starting point (baseline data) for veterinarians and advisory services and also for future research in this field. It should be highlighted that the participating farmers were willing to cooperate in dealing with the animal welfare issues. Suggestions for further research in the field of dairy cattle welfare are:

- Long term studies regarding the application of the Welfare Quality® protocol (or similar) and the implementation of improvement strategies focussing on a variety of welfare parameters for dairy cows in different housing systems
- Evaluation of strategies to motivate dairy farmers to implement changes in different housing systems
- Cost-benefit analyses of welfare improvement strategies
- Evaluation of the willingness of the society to contribute to animal welfare improvements (i.e. consumer studies)

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9 A1 Questionnaire regarding attitudes of farmers towards animal welfare

QUESTIONNAIRE INTRODUCING ANIMAL WELFARE ATTITUDES

General Information

1. What is the size of your farm (in hectares, rents included)?

_____ hectares.

2. How many dairy cows (dry and lactating) do you have at full occupancy on the farm?

_____ dairy cattle.

3. How many heifers do you have at full occupancy on the farm?

_____ (up to one year)

_____ (older than one year up to first calving)

4. What is the average daily milk production?

_____ L per day

5. For how many years do you run dairy cattle as an agricultural production branch on your farm?

_____ years.

6. What is the main motivation for dairy cattle on your farm?

a. ☐ Inherited/tradition

d. ☐ Switch from fattening cow production

b. ☐ Cattle are favourite farm animals

e. ☐ Business Enterprises

c. ☐ Response to market demands

f. ☐ Others

7. How many persons are working on the farm with the dairy cows?

_____ person/s.

Part time _____

Full time _____

8. How many of the persons working with the dairy cows are family members?

_____ person/s

9. What is your position in your farm?

10. Where do your professional skills come from?

- | | |
|---|--|
| a. <input type="checkbox"/> Agricultural School | d. <input type="checkbox"/> Additional courses |
| b. <input type="checkbox"/> Vocational Training | e. <input type="checkbox"/> Family |
| c. <input type="checkbox"/> University degree in agriculture/animal science | f. <input type="checkbox"/> Other |

11. How much of your income originates from dairy farming?

Up to 25% ☐ 25-50% ☐ 50-75% ☐ >75% ☐

12. To whom do you sell milk?

- a. ☐ Directly to consumers (off farm)
- b. ☐ To a local small-milk collection point
- c. ☐ To a milk dealer
- d. ☐ Other

13. Are you satisfied with the milk price?

Yes ☐ No ☐ *If no go to the question nr 14*

14. Why not?

15. If you sell milk to a contractual partner e.g. (milk factory): Are there some requirements regarding animal husbandry exceeding the legal requirements (if such exist)?

Yes ☐ No ☐

16. If there are some requirements regarding animal husbandry above the legal requirement: What are these?

Personal information & attitudes towards Animal Welfare

17. What does the term "Animal welfare" mean to you?

18. How do you recognize a good state of welfare in your animals?

19. How do you recognize a poor state of welfare in your animals?

20. What are from your point of view the current, most important welfare problems in your dairy herd?

21. What are the main cattle diseases that you face commonly?

22. How do you get information about the topic "Animal welfare"?

- a. ☐ From state agricultural organisations
- b. ☐ Through searching the web for useful information
- c. ☐ From the farm vet
- d. ☐ Through visiting information meetings/symposia
- e. ☐ Through reading magazines
- f. ☐ Other

23. Is nowadays Animal Welfare more important than 10 years ago? If yes, in which regard?

24. Who on the farm (position) is mostly caring for the welfare of the dairy cattle?

Who mostly caring for the feed rations_____

Who mostly caring for health_____

Who mostly caring for hygiene_____

25. What is the gender of this welfare-sensitive person?

a. ☐ Female

b. ☐ Male

26. With these steps, you can promote Animal Welfare. Evaluate how important they are and how easy it is to implement them in your own farm in practice. There are seven possible answers; the eighth option is "do not know":

How important/easy do you perceive...	Very important	Important	Quite important	neutral	Almost unimportant	Unimportant	Not important at all	Don't know	Very easy	Easy	Quite easy	neutral	Quite difficult	Difficult	Not easy at all	Don't know
Providing the animal with a favourable environment	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Giving the animals more space to move around	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Improving the quality of bedding	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Using more litter/rooting material	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Alleviating pain or euthanising the sick animal	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Keeping the animals and pens/barns clean	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Keeping an eye on the behavior of the animals	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Taking care of the animals health	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Talking and stroking the animals	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Treating the animals humanely	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Avoiding force in handling the animals	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Treating animals as individuals	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
The farmer having enough leisure and holidays	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
The farmer not having to hurry when at work	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
To invest in your own motivation and well being at work	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Farmer Enjoying this/her work	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

27. Here we ask if according to your intentions to improve your own animal welfare

In the near future, how likely are you to....

Build or restrucutre facilites that improve animal welfare on the farm	1	2	3	4	5	6	7
Take care of the animals health and treat diseases more intesively	1	2	3	4	5	6	7
Treat animals more humanely	1	2	3	4	5	6	7
Take time off for leisure time and holidays	1	2	3	4	5	6	7

28. Here we want to ask about your views on the various partners evaluate how much their opinions about animal welfare affect your own business, how much they emphasize the importance of animal welfare and what kind of knowledge they have in animal welfare. There are seven possible answers, the eighth option is "Do not know".

	Their opinions								They emphasize animal welfare								Their understanding of animal welfare							
	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know
Slaughterhouse/dairy	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Wholesale / retail trade	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Veterinarian	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Consumer	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Agricultural adviser	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Researchers ans specialists	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Other farmers	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

29. Here we ask you to comment appended claims

The general attitudes

	Strongly agree	Agree	Quite agree	neutral	Quite disagree	Disagree	Strongly Disag	Don't knr
Animal welfare is the most important issues in my work	1	2	3	4	5	6	7	8
I always do my best to improve the welfare of my animals	1	2	3	4	5	6	7	8
Improving animal welfare is economically profitable	1	2	3	4	5	6	7	8
It is mentally rewarding to improve animal welfare	1	2	3	4	5	6	7	8
Farmers is obligated to treat her/his animals well	1	2	3	4	5	6	7	8
A high yield is evidence of good animal welfare	1	2	3	4	5	6	7	8
Improving animal welfare is a valuable	1	2	3	4	5	6	7	8
Animal welfare should not cost too much money	1	2	3	4	5	6	7	8
A farmer must not become attached to her/his animals	1	2	3	4	5	6	7	8
Talking to animals is trivial	1	2	3	4	5	6	7	8

30. In your opinion, what would the most important things be to increase animal welfare in your farm?

31. Which are the factors that impair welfare improvement in your farm?

32. What type of support do you wish in order to improve animal welfare in your farm?

Feedback of results

33. How do you want to get feedback (report) on your data from the welfare assessment?

- a. ☐ In a meeting with group of farmers
- b. ☐ With individual meeting
- c. ☐ Via email
- d. ☐ Other....

If you want to carry out some parts of Welfare assessment by yourself

34. In which context would you like the advice activity regarding welfare improvement?

- e. ☐ In a meeting with group of farmers
- f. ☐ With individual meeting
- g. ☐ Via email or Magazine
- h. ☐ Other....

Interviewer information

35. Atmosphere during the conversation?

- i. ☐ Positive
- j. ☐ Negative
- k. ☐ Neutral

36. Was there enough time for the interview?

Yes ☐ No ☐

37. Was the interviewed person in your opinion in principle interested?

Yes ☐ No ☐

38. Further details that seem to be important to you to interpret the questionnaire later on:

39. May we ask your age?

_____ years.

40. Gender of the interviewed person?

☐ Male ☐ Female

Farm code_____

Date_____

A2: Questionnaire regarding animal welfare standards (farmers and veterinarians)

SURVEY OF THE ATTITUDES REGARDING ANIMAL WELFARE OF DAIRY CATTLE IN COMMERCIAL DAIRY FARMS

This survey is part of the Project “Animal Welfare research for cattle production in Kosovo and Macedonia” supported by the Center for Social Innovation from Vienna, Austria, as part of the scientific networking and project cooperation between research institutions in Austria, Kosovo and the Western Balkan region. The activities of this project are implemented by the project partners University of Natural Resources and Life Sciences (BOKU), Austria; Agriculture and Veterinary Faculty, University of Prishtina, Kosovo and Faculty of Veterinary Medicine – Skopje, Macedonia. To this date, the main activities of this project included on-farm welfare assessment in total of 45 dairy cattle farms in Kosovo and Macedonia and dissemination of the results, which present the actual welfare state of dairy cows in commercial dairy farms, to the different stakeholders.

The main objective of the follow – up activities of this project is assessing how different stakeholders evaluate the welfare situation on commercial dairy farms in Kosovo and Macedonia. Therefore the ultimate goal of this survey is through this questionnaire to determine in which case the stakeholders in the society think that certain welfare problem at dairy farms needs attention and requires an action. This survey will help to determine the attitudes of relevant stakeholders regarding welfare of dairy cattle, at what level the society is ready to accept certain welfare standards and what are the main welfare priorities for intervention in commercial dairy farms in Kosovo and Macedonia.

This questionnaire consists of four main sections, predominantly using multiple choice answers, ordinal questions and response scales. In most of the questions only one answer is needed, if is not indicated otherwise. The estimated time for completing the questionnaire is about 15 minutes, and it can be completed on a hard copy or electronic version.

The questionnaire is anonymous and individual responses will not be identified. Only aggregated data and data per stakeholder will be presented at the end of this survey and after processing the data.

We highly encourage and appreciate your participation of this survey, as well as, your support for this research by completing this questionnaire. The project partners are committed to privacy and protection of data with regard to processing personal data. Therefore, the responses that are provided on a voluntary basis for the only purpose of this survey will be treated in confidentiality. After the analysis, all personal data will be protectively stored and will be used only with prior agreement with the respondent which would be contacted specifically for this purpose before.

If you have any questions regarding this questionnaire, you may contact:

1. Egëzon Zhitia, for Kosovo, e-mail: egezon.zhitia@boku.ac.at
2. Miroslav Radeski, for Macedonia, e-mail: miro@fvm.ukim.edu.mk

Thank you in advance for your contribution.

I. Personal Data

1. Place of residence (city, village):

2. Municipality:

3. Age of the respondent:

☐ < 20 years ☐ 20 – 30 years ☐ 30 – 40 years ☐ 40 – 50 years ☐ > 50 years

4. Gender: ☐ male ☐ female

5. Considering your profession, occupation, business or area of interest, which of the following categories best describes your relation with the dairy industry (mark only one category):

☐ Certification, standard settings or control bodies related to animal production

☐ Consumer (no other connection with dairy industry)

☐ Dairy farmer

☐ Educator or scientist in the field of animal science

☐ Food processing industry and abattoirs

☐ Governmental bodies and Official veterinarian

☐ NGO with area of interest in animals

☐ Retailer of dairy products

☐ Veterinary practitioner

6. According to your opinion, what is the most important aspect with regard to the term “Good Animal Welfare”:

☐ Love for animals

☐ Animal’s rights

☐ Good feeding, housing, health and appropriate behaviour of animals

☐ Animal’s health care

☐ Maximized production with low costs

☐ Irrelevant in relation to animal husbandry

II. Welfare of dairy cattle

Absence of prolonged hunger

1. Grade the importance of providing good feed in sufficient amount for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

2. According to your opinion, in the dairy farm what is the acceptable* percentage of:

** The term “acceptable” means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

- a) Very Lean Cows

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

- b) Very Fat Cows

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

Absence of prolonged thirst

3. Grade the importance of providing sufficient amount of good clean water for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

4. According to your opinion, considering the water provision in tie-stall systems for dairy cows:

☐ Each cow should have its own water bowl
☐ It's ok if two cows are sharing one water bowl
☐ Each cow should have access to at least two water bowls, regardless of sharing

5. Considering good animal welfare, what is the relevance of:

- a) Water flow in the water bowls:

☐ Not relevant
☐ Moderately relevant
☐ Highly relevant

b) Cleanliness of water bowls and troughs:

- ☐ Not relevant
☐ Moderately relevant
☐ Highly relevant

Housing and comfort

6. Grade the importance of providing good comfort around resting for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

7. Give three descriptors (in one word each) for the lying area of dairy cows which mostly contribute to their health and welfare:

- 1.
- 2.
- 3.

8. Considering animal welfare, what is your opinion about animals colliding with the housing equipment during lying down?

- ☐ Colliding is not acceptable at all
☐ Colliding is acceptable if it is present in less than 30% of cows in the farm
☐ Colliding is not relevant to the welfare of the animal

9. According to your opinion, what is the acceptable* percentage of animals that lay partly (part of the body – pictures A and B) or completely (the whole body – picture B) outside the lying area in the dairy farm:

** The term “acceptable” means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*



Picture A



Picture B



Picture C

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

10. Considering good animal welfare, what is the relevance of cleanliness of the animal's body:

- ☐Not relevant
☐Moderately relevant
☐Highly relevant

11. According to your opinion, what is the acceptable* percentage of animals in the dairy farm with:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Dirty udder

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Dirty flank/upper legs

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

c) Dirty lower legs

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

12. According to your opinion, which housing system provided better standards of animal welfare for dairy cows:

- ☐Tie stall system ☐Loose housing system

13. Should animals have access to outdoor loafing area:

- ☐No ☐Yes

If Yes,

- The number of days per year that animals have access to outdoor loafing area should be:

- The number of hours per day that animals have access to outdoor loafing area should be:

14. Grade the importance of availability of pasture for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

- The number of days per year that animals are at pasture should be:
- The number of hours per day that animals are at pasture should be:

Good Health

15. Grade the importance of absence of injuries and disease for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

16. According to your opinion, what is the acceptable* percentage of animals in the dairy farm with:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Lameness

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Respiratory problems

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

c) Dystocia and reproductive disorders

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

d) Digestive disorders and diarrhea

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

e) Infectious diseases

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

17. According to your opinion, what is the acceptable* percentage of animals with at least one lesion or swelling on the body in the dairy farm:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

a) On individual level, how many lesions or swellings with a diameter of >2cm on the animal's body should be considered as critical?

- more than lesions or swellings on the animal's body

18. Do you think that testing for the milk somatic cell count on each animal in the farm is important for the animals and for the farm:

☐No

☐Yes

19. How often do you think the milk somatic cell count on individual level should be performed:

☐Monthly

☐Every 3 months

☐Every 6 months

☐Once per year

☐It should not be performed on individual level

20. According to your opinion, what is the acceptable* percentage of animals with clinical and subclinical mastitis in the dairy farm:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

21. According to your opinion, what is the acceptable* percentage of animals at farm per year regarding:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Downer cows – cows not able to stand up longer than one day

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Mortality (dead animals due to sickness, injuries, euthanasia or emergency slaughter; does NOT include planned culling of animals)

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

22. What is your attitude regarding disbudding (i.e. removing the horn bud in young calves) of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

23. What is your attitude regarding dehorning (removing of the horn when fully developed) of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

24. What is your attitude regarding tail docking of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

25. According to your opinion the management procedures like disbudding, dehorning and tail docking of the animals should be performed:

- ☐ Using anaesthetics
- ☐ Using analgesics
- ☐ Using anaesthetics and analgesics
- ☐ Without using anaesthetics and analgesics

Animal behaviour

26. Considering aggressive interactions between animals such as head butts, displacements or fights, grade the level of its impact for the welfare of the animals (mark on a scale from 1 to 8, where 1 is no impact at all and 8 is very high impact):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No impact							Very high impact

27. Considering human – animal interactions, what is the acceptable* percentage of animals that avoid humans at distance larger than 50cm:

** The term “acceptable” means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0%
 ☐10%
 ☐20%
 ☐30%
 ☐40%
 ☐50%
 ☐60%
 ☐70%
 ☐80%
 ☐90%
 ☐100%

Implementation costs

28. Should your previous answers of this questionnaire be set up as a welfare standard for dairy farms, what is your opinion regarding the on-farm implementation costs of these standards in regards to:

(mark on a scale from 1 to 8, where 1 is no costs and 8 is very high implementation costs)

a) Feed provision – balanced diet and sufficient amount of feed

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

b) Water provision, in terms of number of drinkers per cow

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

c) Improvement of comfort around resting (e.g. bedding, dimensions)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

d) Housing system (change to free-stall housing system)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

e) Access to outdoor loafing areas

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

f) Access to pasture

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

g) Safeguarding good health

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

h) Somatic cell count testing

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

i) Use of anesthesia and/or analgesia in the management procedures like disbudding, dehorning and tail docking

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
costs							costs

29. According to your opinion who should cover the costs for implementation of welfare standards in dairy farms (multiple answers are allowed):

☐ Farmer

- ☐ Farmer's associations
- ☐ Milk industry
- ☐ State's subsidies
- ☐ Other, please specify: _____

III. Perspectives

30. Do you think that the Animal Welfare topic requires special attention and further development in your country?
- ☐ No ☐ Yes
31. Besides the existing legislation on animal welfare in your country, what is your opinion for additional legislation regarding welfare of dairy cattle?
- ☐ The existing legislation is appropriate for implementation of welfare of dairy cattle
- ☐ There is no need for legislation considering dairy cows
- ☐ Additional legislation is needed specifically for welfare of dairy cows
32. At the market, should prices of dairy products from farms with higher standards for animal welfare be higher in comparison with those of the dairy products from other farms:
- ☐ No ☐ Yes
33. Are you willing to pay higher price at the market for dairy products originating from dairy farms with higher standards for animal welfare:
- ☐ No ☐ Yes
34. Do you think that the Farmer's Associations, Milk Industries, Markets or any other organization in your country should create their own higher welfare standards for dairy cattle, beside the welfare standards set by the state and legislation?
- ☐ No ☐ Yes
35. Do you think that the Farmer's Associations, Milk Industries, Markets or any other organization in your country have the capacity and willingness to create their own higher welfare standards for dairy cattle, beside the welfare standards set by the state and legislation?
- ☐ No ☐ Yes
36. Who should have the primary responsibility for safeguarding the implementation of existing welfare standards on dairy farms in your country?
- ☐ Farmer's Associations
- ☐ Milk industries
- ☐ State and Official veterinarians
- ☐ Veterinary or other Animal Science Faculties

- ☐ Veterinary practitioners
☐ Other, please specify: _____

37. Who should have the primary responsibility for improving the existing welfare standards on dairy farms in your country?

- ☐ Farmer's Associations
☐ Milk industries
☐ State and Official veterinarians
☐ Veterinary or other Animal Science Faculties
☐ Veterinary practitioners
☐ Other, please specify: _____

IV. Evaluation and feedback

38. Please evaluate this questionnaire in terms of its topic, structure and importance (mark on a scale from 1 to 6, where 1 is not satisfying and 6 is very satisfying):

- ☐ ☐ ☐ ☐ ☐ ☐
1 2 3 4 5 6

39. Regarding the results of this survey do you expect any further feedback to you (multiple answers are allowed)?

- ☐ I'm not interested in any feedback
☐ I expect to receive the final results from this survey
☐ I expect to receive the final report and findings from this survey
☐ I expect to participate at a workshop for presenting the results and further discussion
☐ I'm interested in the final findings of the whole project

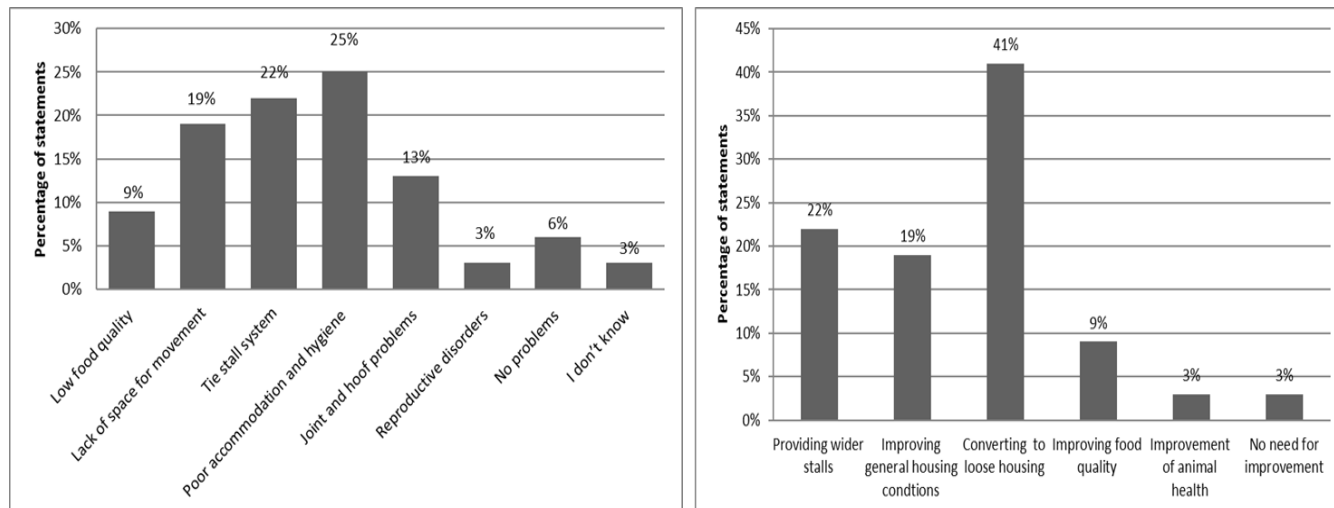
- Contact details (*optional*):

- e-mail:
- phone:

****THANK YOU FOR YOUR TIME AND COOPERATION****

providing wider stalls and improving the general housing conditions (e.g. renovating and farm extension, Figure 10).

Figure 9 and Figure 10 . Major obstacles of welfare (Fig.9 left) and important things to increase welfare (Fig.10, right) in dairy cows as stated by 30 farmers (fig 9 $n_{statements}=44$, fig 10 $n_{statements}=32$).



5.1.3 Perceptions of farmers in the context of improvement of animal welfare (Likert scales)

According to the farmers' reflections, taking care of the animals' health and providing animals with a favourable environment are considered the most important means of improving animal welfare, closely followed by the humane treatment of animals and investing in motivation and wellbeing at work (average scores 1.60 to 1.98; Table 11). However, despite the importance of these measures, these measures were estimated to be more difficult to implement (Table 11); the scores for easiness were always higher than those for importance.

The veterinarian, researchers and experts and other farmers were most influential as regards the subjective norms, whereas slaughterhouse/dairy and consumers were perceived as having the lowest influence (Table 11). Regarding the level of general attitudes, animal welfare seems to be one of the most important issues in the daily work followed by finding it mentally rewarding to improve animal welfare and an obligation to treat animals well. However, farmers agreed to some extent that animal welfare should not cost too much money. The farmers largely disagreed that farmer must not attach to his/her animals and that talking to animals is trivial, whereas they agreed that promoting animal welfare is important for the future.

9 A1 Questionnaire regarding attitudes of farmers towards animal welfare

QUESTIONNAIRE INTRODUCING ANIMAL WELFARE ATTITUDES

General Information

1. What is the size of your farm (in hectares, rents included)?

_____ hectares.

2. How many dairy cows (dry and lactating) do you have at full occupancy on the farm?

_____ dairy cattle.

3. How many heifers do you have at full occupancy on the farm?

_____ (up to one year)

_____ (older than one year up to first calving)

4. What is the average daily milk production?

_____ L per day

5. For how many years do you run dairy cattle as an agricultural production branch on your farm?

_____ years.

6. What is the main motivation for dairy cattle on your farm?

a. ☐ Inherited/tradition

d. ☐ Switch from fattening cow production

b. ☐ Cattle are favourite farm animals

e. ☐ Business Enterprises

c. ☐ Response to market demands

f. ☐ Others

7. How many persons are working on the farm with the dairy cows?

_____ person/s.

Part time _____

Full time _____

8. How many of the persons working with the dairy cows are family members?

_____ person/s

9. What is your position in your farm?

10. Where do your professional skills come from?

- | | |
|---|--|
| a. <input type="checkbox"/> Agricultural School | d. <input type="checkbox"/> Additional courses |
| b. <input type="checkbox"/> Vocational Training | e. <input type="checkbox"/> Family |
| c. <input type="checkbox"/> University degree in agriculture/animal science | f. <input type="checkbox"/> Other |

11. How much of your income originates from dairy farming?

Up to 25% ☐ 25-50% ☐ 50-75% ☐ >75% ☐

12. To whom do you sell milk?

- a. ☐ Directly to consumers (off farm)
- b. ☐ To a local small-milk collection point
- c. ☐ To a milk dealer
- d. ☐ Other

13. Are you satisfied with the milk price?

Yes ☐ No ☐ *If no go to the question nr 14*

14. Why not?

15. If you sell milk to a contractual partner e.g. (milk factory): Are there some requirements regarding animal husbandry exceeding the legal requirements (if such exist)?

Yes ☐ No ☐

16. If there are some requirements regarding animal husbandry above the legal requirement: What are these?

Personal information & attitudes towards Animal Welfare

In the near future, how likely are you to....

Build or restrucutre facilites that improve animal welfare on the farm
 Take care of the animals health and treat diseases more intesively
 Treat animals more humanely
 Take time off for leisure time and holidays

Very likely
Likely
Quite likely
Do not know
Quite unlikely
Unlikely
Very unlikely

1 2 3 4 5 6 7
 1 2 3 4 5 6 7
 1 2 3 4 5 6 7
 1 2 3 4 5 6 7

28. Here we want to ask about your views on the various partners evaluate how much their opinions about animal welfare affect your own business, how much they emphasize the importance of animal welfare and what kind of knowledge they have in animal welfare. There are seven possible answers, the eighth option is "Do not know".

	Their opinions								They emphasize animal welfare								Their understanding of animal welfare							
	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know	very much	pretty much	somewhat	neutral	quite	very little	not at all	do not know
Slaughterhouse/dairy	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Wholesale / retail trade	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Veterinarian	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Consumer	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Agricultural adviser	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Researchers ans specialists	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Other farmers	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

29. Here we ask you to comment appended claims

The general attitudes

Animal welfare is the most important issues in my work
 I always do my best to improve the welfare of my animals
 Improving animal welfare is economically profitable
 It is mentally rewarding to improve animal welfare
 Farmers is obligated to treat her/his animals well
 A high yield is evidence of good animal welfare
 Improving animal welfare is a valuable
 Animal welfare should not cost too much money
 A farmer must not become attached to her/his animals
 Talking to animals is trivial

Strongly agree
Agree
Quite agree
nuetral
Quite disagree
Disagree
Strongly Disag
Don't knr

1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8
 1 2 3 4 5 6 7 8

30. In your opinion, what would the most important things be to increase animal welfare in your farm?

31. Which are the factors that impair welfare improvement in your farm?

32. What type of support do you wish in order to improve animal welfare in your farm?

Feedback of results

33. How do you want to get feedback (report) on your data from the welfare assessment?

- a. ☐ In a meeting with group of farmers
- b. ☐ With individual meeting
- c. ☐ Via email
- d. ☐ Other....

If you want to carry out some parts of Welfare assessment by yourself

34. In which context would you like the advice activity regarding welfare improvement?

- e. ☐ In a meeting with group of farmers
- f. ☐ With individual meeting
- g. ☐ Via email or Magazine
- h. ☐ Other....

Interviewer information

35. Atmosphere during the conversation?

- i. ☐ Positive
- j. ☐ Negative
- k. ☐ Neutral

I. Personal Data

1. Place of residence (city, village):

2. Municipality:

3. Age of the respondent:

☐ < 20 years ☐ 20 – 30 years ☐ 30 – 40 years ☐ 40 – 50 years ☐ > 50 years

4. Gender: ☐ male ☐ female

5. Considering your profession, occupation, business or area of interest, which of the following categories best describes your relation with the dairy industry (mark only one category):

☐ Certification, standard settings or control bodies related to animal production

☐ Consumer (no other connection with dairy industry)

☐ Dairy farmer

☐ Educator or scientist in the field of animal science

☐ Food processing industry and abattoirs

☐ Governmental bodies and Official veterinarian

☐ NGO with area of interest in animals

☐ Retailer of dairy products

☐ Veterinary practitioner

6. According to your opinion, what is the most important aspect with regard to the term “Good Animal Welfare”:

☐ Love for animals

☐ Animal’s rights

☐ Good feeding, housing, health and appropriate behaviour of animals

☐ Animal’s health care

☐ Maximized production with low costs

☐ Irrelevant in relation to animal husbandry

II. Welfare of dairy cattle

Absence of prolonged hunger

1. Grade the importance of providing good feed in sufficient amount for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

2. According to your opinion, in the dairy farm what is the acceptable* percentage of:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

- a) Very Lean Cows

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

- b) Very Fat Cows

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

Absence of prolonged thirst

3. Grade the importance of providing sufficient amount of good clean water for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

4. According to your opinion, considering the water provision in tie-stall systems for dairy cows:

☐ Each cow should have its own water bowl
☐ It's ok if two cows are sharing one water bowl
☐ Each cow should have access to at least two water bowls, regardless of sharing

5. Considering good animal welfare, what is the relevance of:

- a) Water flow in the water bowls:

☐ Not relevant
☐ Moderately relevant
☐ Highly relevant

b) Cleanliness of water bowls and troughs:

- ☐ Not relevant
☐ Moderately relevant
☐ Highly relevant

Housing and comfort

6. Grade the importance of providing good comfort around resting for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

7. Give three descriptors (in one word each) for the lying area of dairy cows which mostly contribute to their health and welfare:

- 1.
- 2.
- 3.

8. Considering animal welfare, what is your opinion about animals colliding with the housing equipment during lying down?

- ☐ Colliding is not acceptable at all
☐ Colliding is acceptable if it is present in less than 30% of cows in the farm
☐ Colliding is not relevant to the welfare of the animal

9. According to your opinion, what is the acceptable* percentage of animals that lay partly (part of the body – pictures A and B) or completely (the whole body – picture B) outside the lying area in the dairy farm:

** The term “acceptable” means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*



Picture A



Picture B



Picture C

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

10. Considering good animal welfare, what is the relevance of cleanliness of the animal's body:

- ☐Not relevant
☐Moderately relevant
☐Highly relevant

11. According to your opinion, what is the acceptable* percentage of animals in the dairy farm with:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Dirty udder

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Dirty flank/upper legs

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

c) Dirty lower legs

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

12. According to your opinion, which housing system provided better standards of animal welfare for dairy cows:

- ☐Tie stall system ☐Loose housing system

13. Should animals have access to outdoor loafing area:

- ☐No ☐Yes

If Yes,

- The number of days per year that animals have access to outdoor loafing area should be:

- The number of hours per day that animals have access to outdoor loafing area should be:

14. Grade the importance of availability of pasture for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

- The number of days per year that animals are at pasture should be:
- The number of hours per day that animals are at pasture should be:

Good Health

15. Grade the importance of absence of injuries and disease for high welfare of dairy cows (mark on a scale from 1 to 8, where 1 is no importance and 8 is very high importance):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No							Very high
importance							importance

16. According to your opinion, what is the acceptable* percentage of animals in the dairy farm with:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Lameness

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Respiratory problems

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

c) Dystocia and reproductive disorders

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

d) Digestive disorders and diarrhea

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

e) Infectious diseases

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

17. According to your opinion, what is the acceptable* percentage of animals with at least one lesion or swelling on the body in the dairy farm:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

a) On individual level, how many lesions or swellings with a diameter of >2cm on the animal's body should be considered as critical?

- more than lesions or swellings on the animal's body

18. Do you think that testing for the milk somatic cell count on each animal in the farm is important for the animals and for the farm:

☐No

☐Yes

19. How often do you think the milk somatic cell count on individual level should be performed:

☐Monthly

☐Every 3 months

☐Every 6 months

☐Once per year

☐It should not be performed on individual level

20. According to your opinion, what is the acceptable* percentage of animals with clinical and subclinical mastitis in the dairy farm:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

21. According to your opinion, what is the acceptable* percentage of animals at farm per year regarding:

** The term "acceptable" means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

a) Downer cows – cows not able to stand up longer than one day

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

b) Mortality (dead animals due to sickness, injuries, euthanasia or emergency slaughter; does NOT include planned culling of animals)

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

22. What is your attitude regarding disbudding (i.e. removing the horn bud in young calves) of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

23. What is your attitude regarding dehorning (removing of the horn when fully developed) of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

24. What is your attitude regarding tail docking of the animals at the dairy farm, as management procedure:

- ☐ Acceptable
- ☐ Partly acceptable
- ☐ Not acceptable

25. According to your opinion the management procedures like disbudding, dehorning and tail docking of the animals should be performed:

- ☐ Using anaesthetics
- ☐ Using analgesics
- ☐ Using anaesthetics and analgesics
- ☐ Without using anaesthetics and analgesics

Animal behaviour

26. Considering aggressive interactions between animals such as head butts, displacements or fights, grade the level of its impact for the welfare of the animals (mark on a scale from 1 to 8, where 1 is no impact at all and 8 is very high impact):

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No impact							Very high impact

27. Considering human – animal interactions, what is the acceptable* percentage of animals that avoid humans at distance larger than 50cm:

** The term “acceptable” means the degree of presence of a given problem beyond which intervention should take place. Tick the percentage that you consider as acceptable and everything above that value is considered as a problem and is not acceptable.*

☐0% ☐10% ☐20% ☐30% ☐40% ☐50% ☐60% ☐70% ☐80% ☐90% ☐100%

Implementation costs

28. Should your previous answers of this questionnaire be set up as a welfare standard for dairy farms, what is your opinion regarding the on-farm implementation costs of these standards in regards to:

(mark on a scale from 1 to 8, where 1 is no costs and 8 is very high implementation costs)

a) Feed provision – balanced diet and sufficient amount of feed

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

b) Water provision, in terms of number of drinkers per cow

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

c) Improvement of comfort around resting (e.g. bedding, dimensions)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

d) Housing system (change to free-stall housing system)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

e) Access to outdoor loafing areas

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

f) Access to pasture

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

g) Safeguarding good health

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

h) Somatic cell count testing

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

i) Use of anesthesia and/or analgesia in the management procedures like disbudding, dehorning and tail docking

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8
No costs							Very high costs

29. According to your opinion who should cover the costs for implementation of welfare standards in dairy farms (multiple answers are allowed):

☐ Farmer

- ☐ Farmer's associations
- ☐ Milk industry
- ☐ State's subsidies
- ☐ Other, please specify: _____

III. Perspectives

30. Do you think that the Animal Welfare topic requires special attention and further development in your country?
- ☐ No ☐ Yes
31. Besides the existing legislation on animal welfare in your country, what is your opinion for additional legislation regarding welfare of dairy cattle?
- ☐ The existing legislation is appropriate for implementation of welfare of dairy cattle
- ☐ There is no need for legislation considering dairy cows
- ☐ Additional legislation is needed specifically for welfare of dairy cows
32. At the market, should prices of dairy products from farms with higher standards for animal welfare be higher in comparison with those of the dairy products from other farms:
- ☐ No ☐ Yes
33. Are you willing to pay higher price at the market for dairy products originating from dairy farms with higher standards for animal welfare:
- ☐ No ☐ Yes
34. Do you think that the Farmer's Associations, Milk Industries, Markets or any other organization in your country should create their own higher welfare standards for dairy cattle, beside the welfare standards set by the state and legislation?
- ☐ No ☐ Yes
35. Do you think that the Farmer's Associations, Milk Industries, Markets or any other organization in your country have the capacity and willingness to create their own higher welfare standards for dairy cattle, beside the welfare standards set by the state and legislation?
- ☐ No ☐ Yes
36. Who should have the primary responsibility for safeguarding the implementation of existing welfare standards on dairy farms in your country?
- ☐ Farmer's Associations
- ☐ Milk industries
- ☐ State and Official veterinarians
- ☐ Veterinary or other Animal Science Faculties

- ☐ Veterinary practitioners
☐ Other, please specify: _____

37. Who should have the primary responsibility for improving the existing welfare standards on dairy farms in your country?

- ☐ Farmer's Associations
☐ Milk industries
☐ State and Official veterinarians
☐ Veterinary or other Animal Science Faculties
☐ Veterinary practitioners
☐ Other, please specify: _____

IV. Evaluation and feedback

38. Please evaluate this questionnaire in terms of its topic, structure and importance (mark on a scale from 1 to 6, where 1 is not satisfying and 6 is very satisfying):

- ☐ ☐ ☐ ☐ ☐ ☐
1 2 3 4 5 6

39. Regarding the results of this survey do you expect any further feedback to you (multiple answers are allowed)?

- ☐ I'm not interested in any feedback
☐ I expect to receive the final results from this survey
☐ I expect to receive the final report and findings from this survey
☐ I expect to participate at a workshop for presenting the results and further discussion
☐ I'm interested in the final findings of the whole project

- Contact details (*optional*):

- e-mail:
- phone:

****THANK YOU FOR YOUR TIME AND COOPERATION****