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Master thesis

Development of a prototype on-farm welfare assessment protocol for dairy sheep

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Abstract

While the interest in dairy sheep products in Austria is growing and the number of dairy sheep *(Ovis orientalis aries)* is increasing, methods to monitor dairy sheep health and welfare are gaining importance. On-farm welfare assessment protocols for cattle, pigs, and poultry including animal-based parameters have recently been developed (e.g. in the course of the EU Welfare Quality ® project), but less attention has been paid to the development of assessment schemes for sheep, specifically dairy sheep, so far.

The present work aims at developing a prototype on-farm welfare assessment protocol for dairy sheep suitable for the Austrian production system including mainly animal-based parameters. The project was carried out in three steps: Firstly, a study in the form of a questionnaire was conducted among farmers asking them for indicators of good and poor sheep welfare. Secondly, a literature research was carried out, and a draft version of an on-farm welfare assessment protocol for dairy sheep - based on scientific literature as well as the outcomes of the questionnaires - was developed. Thirdly, the draft protocol was tested at three Austrian dairy sheep farms and revised during this process to ensure its feasibility.

The overall outcome of this project is a prototype on-farm welfare assessment protocol for dairy sheep structured into distinct modules including a collection of general data about the farm, behavioural observations, an evaluation of the water provision, and an assessment of individuals. It is accompanied by additional explanations and it can be applied within one day by a single person. The protocol should represent a tool for farmers, veterinarians, and independent farm inspectors to monitor dairy sheep welfare, and it facilitates comparisons across farms and time. It allows to recognise good animal welfare and highlight acute welfare problems using a combination of measures for the welfare of individual animals and for the overall flock welfare.

Key words: animal welfare, dairy sheep, on-farm welfare assessment, animal-based parameters, farmers' opinion

Zusammenfassung

Da sich in Österreich Schafmilchprodukte zunehmender Beliebtheit erfreuen und die Anzahl von Milchschafen *(Ovis orientalis aries)* stetig steigt, gewinnen Methoden zur Beurteilung von Gesundheit und Wohlergehen von Milchschafen an Bedeutung. Während für Rinder, Schweine und Geflügel bereits Checklisten mit tierbezogenen Parametern zur Erhebung des Tierwohlergehens auf landwirtschaftlichen Betrieben entwickelt wurden (vgl. EU Welfare Quality ® Projekt), wurden Schafe, besonders Milchschafe, in dieser Hinsicht bisher kaum berücksichtigt.

Das Ziel der vorliegenden Arbeit ist die Entwicklung eines Prototyps einer solchen Checkliste, der auf österreichische Produktionsbedingungen abgestimmt ist und hauptsächlich tierbezogene Parameter enthält. Das Projekt wurde in drei Schritten durchgeführt: Erstens wurden Landwirte/Landwirtinnen mittels Fragebogen nach Indikatoren für gutes und schlechtes Wohlergehen bei Schafen gefragt. Zweitens wurde Literaturrecherche betrieben und darauf aufbauend - unter Einbeziehung der Fragebogenergebnisse - ein Entwurf der Checkliste erstellt. Drittens wurde dieser auf drei Milchschafbetrieben in Österreich auf Durchführbarkeit geprüft und überarbeitet.

Das Ergebnis ist ein in Module gegliederter Prototyp einer Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben, der die Einholung allgemeiner Betriebsdaten, Verhaltensbeobachtungen, eine Evaluierung der Wasserversorgung und eine Einzeltierbeurteilung beinhaltet. Der Checkliste sind Erläuterungen beigefügt und sie kann innerhalb eines Tages von einer Einzelperson angewendet werden. Sie soll ein Instrument für Landwirte/Landwirtinnen, Tierärzte/Tierärztinnen und betriebsfremde Kontrollorgane darstellen, um eine konstante Beobachtung des Wohlergehens der Tiere sowie inner- und überbetriebliche Vergleiche zu ermöglichen. Mithilfe von Einzeltierparametern und herdenbezogenen Parametern können Bereiche guten Wohlergehens und Problembereiche aufgezeigt werden.

Schlagwörter: Wohlergehen, Milchschaf, Wohlergehensbeurteilung, tierbezogene Parameter, Bauernbefragung

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Contents

List of figures viii

List of tables ix

1 Introduction 1

1.1 Dairy sheep husbandry in Austria . . . 1
1.2 Common perception of sheep as production animals . . . 2
1.3 What is animal welfare? . . . 3
1.4 Scientific basis for sheep welfare assessment . . . 5
1.5 Peculiarities of sheep and their implications for welfare assessment . . . 6
1.6 Aim of the project . . . 7

2 Farmers' view on sheep welfare 9

2.1 Material and methods . . . 9
2.2 Results . . . 10
2.2.1 Part I of the farmer questionnaire: General farm management and husbandry system . . . 11
2.2.2 Part II of the farmer questionnaire: Sheep health and welfare . . . 12
2.2.3 Part III of the farmer questionnaire: Sources of information on sheep health and welfare and their availability . . . 19
2.3 Discussion . . . 20
2.3.1 Material and methods . . . 20
2.3.2 Part I of the farmer questionnaire . . . 21
2.3.3 Part II of the farmer questionnaire . . . 23
2.3.4 Part III of the farmer questionnaire . . . 24

3 Development of a prototype protocol 27

3.1 Animals, material, and methods . . . 27
3.1.1 Literature review . . . 27

3.1.2 Designing a draft protocol by combining farmers' opinion and literature findings . . . 28
3.1.3 On-farm testing and revision of the draft protocol . . . 29
3.2 Results and discussion . . . 32
3.2.1 Adequate housing . . . 35
3.2.2 Appropriate nutrition . . . 50
3.2.3 Good management . . . 57
3.2.4 Proper healthcare . . . 69
3.2.5 Summary: Parameter revision at a glance . . . 92

4 Final version of the prototype protocol 95

5 General discussion and outlook 99
5.1 General discussion . . . 99
5.1.1 Selection of the parameters . . . 100
5.1.2 Validity and reliability of the parameters . . . 101
5.1.3 On-farm testing of the draft protocol . . . 101
5.2 Outlook . . . 103

6 Conclusion 105

References 107

Appendix 119
Farmer questionnaire (German)
On-farm welfare assessment protocol for dairy sheep - a prototype (English)
On-farm welfare assessment protocol for dairy sheep - a prototype (German)
Additional explanations (German)

List of Figures

2.1 Data set A - sheep breeds on all farms 11
2.2 Data set B - sheep breeds on dairy sheep farms 11
2.3 Data set A and data set B - husbandry systems 12
2.4 Data set A - three categories of indicators of good sheep welfare 13
2.5 Data set B - three categories of indicators of good dairy sheep welfare . . 13
2.6 Data set A and data set B - sub-categories of behavioural indicators of good (dairy) sheep welfare 13
2.7 Data set A and data set B - sub-categories of indicators of overall appearance of good (dairy) sheep welfare 14
2.8 Data set A and data set B - sub-categories of performance indicators of good (dairy) sheep welfare 15
2.9 Data set A - proportions of three categories of indicators of poor sheep welfare in general 15
2.10 Data set B - proportions of three categories of indicators of poor dairy sheep welfare 15
2.11 Data set A and data set B - sub-categories of behavioural indicators of poor (dairy) sheep welfare 16
2.12 Data set A and data set B - sub-categories of indicators of overall appearance of poor (dairy) sheep welfare 17
2.13 Data set A and data set B - sub-categories of performance indicators of poor (dairy) sheep welfare 17
2.14 Data set A - problems at sheep farms 18
2.15 Data set B - problems at dairy sheep farms 18
2.16 Data set A and data set B - diseases occurring at (dairy) sheep farms . . 18
2.17 Data set A - preconditions for good sheep welfare 19
2.18 Data set B - preconditions for good dairy sheep welfare 19

3.1 Parameters used in the draft protocol 34

List of Tables

3.1 Characteristics of the three visited Austrian dairy sheep farms 31
3.2 Assessment of *cleanliness* in the final protocol 37
3.3 Assessment of *appearance of the wool* in the final protocol 39
3.4 Assessment of *respiration* in the final protocol 41
3.5 Assessment of *synchronicity of behaviour* in the final protocol 43
3.6 Assessment of *abnormal behaviour* in the final protocol 46
3.7 Assessment of *qualitative behaviour assessment* in the final protocol . . . 49
3.8 Assessment of *body condition* in the final protocol 53
3.9 Assessment of *water provision* in the final protocol 56
3.10 Assessment of *behaviour during milking* in the final protocol 61
3.11 Assessment of *ear temperature* in the final protocol 62
3.12 Assessment of *length of the tail* in the final protocol 66
3.13 Assessment of *reaction to an unfamiliar human* in the final protocol . . . 68
3.14 Assessment of *lameness* in the final protocol 74
3.15 Assessment of *condition of the claws* in the final protocol 76
3.16 Assessment of *rubbing, scratching, and nibbling at own body parts* in the final protocol 78
3.17 Assessment of *intense head tossing* in the final protocol 79
3.18 Assessment of *excessive lip licking* in the final protocol 80
3.19 Assessment of *integument alterations* in the final protocol 83
3.20 Assessment of *coughing* in the final protocol 85
3.21 Assessment of *condition of the teeth* in the final protocol 89
3.22 Assessment of *nasal discharge* in the final protocol 90
3.23 Assessment of *ocular discharge* in the final protocol 91
3.24 Overview of the on-farm revision process of all parameters 92

4.1 Structure of the final protocol 97

"Trying to take the sheep's viewpoint
is the challenge for animal welfare science to address"
(Goddard, 2008)

Chapter 1

Introduction

The keeping of sheep by man has a long tradition and is still practised all over the world for many different reasons (Kilgour et al., 2008). Sheep can be found in various forms of management systems (Kilgour et al., 2008), and sheep production is of major economic importance in many countries (Stubsjøen et al., 2011). Besides providing people with meat, wool, leather or even fuel, sheep produce milk. Even though there is little information available on the number of dairy sheep worldwide, the world's sheep milk production of the year 2012 was estimated at 10 million tonnes (FAO, 2014). The motivation for the following work roots in a deep personal interest for sheep as a sometimes neglected, but amicable small ruminant, and for dairy sheep production, in particular.

1.1 Dairy sheep husbandry in Austria

As a relatively small country with a large amount of mountainous regions, Austria can look back on a long tradition of sheep husbandry. The focus so far was mainly put on meat production (Ringdorfer, 2010), and dairy sheep products have not had as much economic importance as in some other European countries, like Greece, Turkey or Italy (Mayer & Fiechter, 2012). With 526,993 cows being kept for dairy production in the year 2012 producing 3,382,076 tonnes of milk, dairy cows still represent the vast majority of milk producing livestock in Austria (StatistikAustria, 2013a). However, the number of dairy sheep in Austria has risen over the last years: While in 2007 only 20,031 dairy sheep were kept in Austria, 25,001 dairy sheep were counted in 2012 (an increase by 24.8%), producing 8,289 tonnes of milk and 10,636 tonnes of milk, respectively (StatistikAustria, 2013b). The reason for that can be found when looking at the consumption of dairy sheep products, which increased by 20.4% within 5 years

(from 6,132 tonnes in the year 2007 to 7,383 tonnes in the year 2012; StatistikAustria, 2013b). Dairy breeds mainly used in Austria are the East Friesian Dairy Sheep with its origin in East Friesland and the Lacaune Sheep from France (Hörth et al., 2009). The average milk yield in Austria was 466kg of milk/sheep in the year 2012 (ÖBSZ, 2012). It seems that the former niche of sheep milk production is now continuously developing into a notable, economically relevant branch of dairy production (Ringdorfer, n.d.) with more and more (young) innovative farmers (Krenn et al., 2011) becoming engaged in the scene (Deix et al., 2009).

1.2 Common perception of sheep as production animals

The image of sheep milk being healthy and natural as well as its specific taste might be a possible reason for the growing interest in this product as an alternative to cow milk (Mayer & Fiechter, 2012). The fact that consumers often associate dairy sheep products with local production systems and sustainable agriculture makes them even more attractive (Deix et al., 2009). Yet, this common perception might not necessarily reflect the actual situation. The positive image of sheep husbandry might have been created by the fact that sheep have not been subject to the agricultural intensification process over the last decades, as opposed to other livestock (Kilgour et al., 2008; Stubsjøen et al., 2011). Sheep are often managed quite extensively mostly outdoors. The idea of a white 'cuddly' flock of sheep grazing on green pastures having the freedom to behave naturally, seems to dominate the image of this species. They are thought to live in fairly 'natural' management systems and consequently to have a high level of welfare (Goddard, 2011). But even though extensively managed animals might have a greater amount of freedom, that does not automatically mean that they do not experience welfare challenges (Dwyer, 2009): Food or water scarcity, lack of shelter, or the presence of predators can present serious threats to their survival (Goddard, 2011). However, dairy sheep in particular are exposed to the challenges of a more intensive form of management than sheep kept for meat production usually are. They experience closer contact with humans and are milked (twice) daily during the lactation period (Kilgour et al., 2008). Additionally, the high demand for performance involves management practices like the early weaning of lambs. Despite this, dairy sheep husbandry in Austria is still found to be practised in a more or less small-scale manner.

As fattening sheep are oftentimes seen grazing in areas other livestock cannot access, like the steep slopes of the Austrian Alps, sheep are perceived as very robust ruminants (Goddard, 2011). They can live on relatively scarce food sources, are relatively resistant to thermal extremes (Dwyer & Lawrence, 2008), and have a high adaptability to their environment (Caroprese et al., 2010); even though the mere fact that they can survive these conditions does not automatically mean that they experience good welfare (Dwyer & Lawrence, 2008). The fact that this image of robust fattening sheep might be transferred to dairy sheep represents a special threat to their welfare: these animals have to produce high amounts of milk, and if their nutritional demands are not met, the consequences can become critical to their overall welfare.

Some people tend to view sheep as animals with low cognitive capabilities (Kendrick, 2008) and therefore are not concerned about their welfare. Nowadays, several studies give evidence that sheep have sophisticated social and emotional recognition skills as well as a good capacity for memory. This means that husbandry conditions (e.g social environment, composition of the group) as well as handling and management procedures have a large impact on their welfare (Kendrick, 2008).

As public opinion is usually a driver of change (Goddard, 2011), it might have been the consumers' perception of sheep which had animal welfare scientists focusing more on other livestock, leaving sheep aside. Whereas the EU-funded project WelfareQuality® (2009a) recently developed on-farm assessment schemes for cattle, pigs, and poultry, only little research has been carried out on the welfare of sheep in general and on the welfare of dairy sheep in particular. However, keeping sheep under our custody and presenting them with a more or less artificial environment for the purpose of production automatically implicates a moral demand - the demand that these animals can experience a "life worth living" (FAWC, 2011), represented by good welfare.

1.3 What is animal welfare?

The concept of welfare is a multi-dimensional one comprising physical and mental health and including various aspects of life such as physical comfort, possibilities to perform highly motivated behaviour, absence of hunger and disease, etc. (WelfareQuality®, 2009a). Depending on several factors, such as different management procedures or environmental conditions, welfare is in a constant flux (Roger, 2008). Welfare is nothing that is either good or poor; its changes over time rather take place along a continuum

ranging from very good to very poor welfare (Broom, 2007). Welfare is the characteristic of an individual (Silanikove, 2000). Within its environment, an animal has to balance external influences by its reaction at behavioural, physiological, and biochemical levels (Roger, 2008).

There are three main approaches towards welfare, focusing on either the naturalness of the housing conditions (natural-living based definitions), the feelings experienced by an animal (feelings-based definitions), or the biological functioning of an animal (biological-functioning based definitions; D. Fraser, 2003). All of these different approaches contribute to the assessment of welfare insofar as they all propose to use a combination of different indicators for assessment to get a complete picture of an animal's welfare. There is agreement on the fact that no single parameter can assess the welfare of an animal, and therefore a combination of integrated and composite measures is necessary (Dwyer & Lawrence, 2008).

Independently of the approach that is taken to assess welfare, measures can be divided into two different categories: resource-based measures and animal-based measures. Resource-based measures focus on the environment the animal lives in and hence the resources it is provided with (e.g. bedding). They also include management strategies carried out by the stock person (e.g. feeding strategies; WelfareQuality®, 2009a). Animal-based measures in contrast, are measures that are taken when directly looking at an animal (e.g. observing its behaviour; WelfareQuality®, 2009a) and therefore "show the 'outcome' of the interaction between the animal and its environment" (WelfareQuality®, 2009a). The latter are currently emphasised increasingly in scientific research (Goddard, 2011), but there is a consensus that a proper combination of measures of both categories best serves welfare assessment (WelfareQuality®, 2009a).

According to WelfareQuality® (2009a), it is important that measures used for welfare assessment are valid (=truly reflecting an aspect of an animal's actual welfare), reliable (=giving consistent results over time when assessment is repeated by one and the same assessor as well as when carried out by different assessors), and feasible (=are realistic in their application concerning factors like time, safety, etc.). It is also important to use parameters that are indicative of good animal welfare and not only to use such that reflect poor animal welfare. Merely concluding that the welfare of an animal is automatically good when signs of poor welfare are absent is not necessarily sufficient (Goddard, 2011).

Parameters used for the assessment of animal welfare can either refer to physiology, behaviour, production, or health of an animal (Dwyer & Lawrence, 2008; WelfareQuality®, 2009a). On-farm welfare assessments which are done directly at the production site where an animal spends a great amount of its life bring along some peculiarities that have to be taken into account (Phythian et al., 2011), such as the large amount of animals, limited time for assessment (Sevi, 2009), and variations in housing and management. Despite the different approaches to animal welfare and the variety of parameters that can be used, there is one remaining challenge: to "come to a conclusion from the animal's perspective" (Goddard, 2011).

1.4 Scientific basis for sheep welfare assessment

As interest in dairy sheep as production animals is rising in Austria, methods to monitor the welfare of these animals are required. This becomes especially important if the dairy sheep industry wants to keep the image of providing healthy and natural food, as the quality of the products is tightly connected to the welfare of the animals producing them (e.g. a high amount of somatic cells in the milk lowers its quality and might be an indicator of a mastitis-infection). However, looking at scientific literature there is little information available on the assessment and improvement of sheep welfare (Fitzpatrick et al., 2006). There are papers dealing with the most important welfare issues in sheep, like lameness (e.g. Winter, 2008), parasites (e.g. Plant, 2006), mastitis (e.g. Bergonier et al., 2003) or distress (e.g. Cockram, 2004), but only few address the current need for welfare assessment schemes for sheep (Napolitano et al., 2009; Sevi, 2009; Goddard, 2011; Phythian, 2011; Stubsjøen et al., 2011). Yet, "the need for a comprehensive and uniform method for inspectors to assess welfare is no less for this species than for other farm animals" as Stubsjøen et al. (2011) point out correctly. Several other authors also stress the need for scientifically valid parameters and assessment schemes for sheep (Cockram, 2004; Roger, 2008; Gougoulis et al., 2010; Goddard, 2011; Phythian et al., 2011).

Animal-based measures in particular are only poorly developed for these animals (Goddard, 2011). In Austria, one checklist with the goal to evaluate whether the conditions at a sheep farm fulfil the requirements specified by the Austrian law on animal welfare exists, but it mainly focuses on resource-based measures (conf. BMGF, 2006). Even in countries with a large number of sheep, only "few valid, reliable or feasible

measures have been developed and tested to assess the on-farm welfare of sheep" as Phythian (2011) writes about the situation in the UK. Those few authors who deal with the topic of welfare assessment in sheep mainly focus on sheep in general, but there is still a lack of on-farm welfare assessment schemes for dairy sheep in particular. On-farm welfare assessment protocols - which are defined as "a description of the procedure and requirements for the overall assessment of welfare" by WelfareQuality® (2009a) - would be of great value for farmers, veterinary surgeons, and farm inspectors (Phythian et al., 2011). Such protocols would enable these people not only to assess the actual welfare of the dairy ewes and take appropriate action towards the improvement of their welfare, but also to use gathered data for certification processes or farm assurance programs (Phythian et al., 2011).

1.5 Peculiarities of sheep and their implications for welfare assessment

In addition to the lack of public concern, there are some peculiarities of sheep which make a welfare assessment of this species more difficult and might have slowed down scientific research on sheep welfare.

Firstly, sheep are relatively stoic living beings which do not to show obvious signs of pain or distress (Fitzpatrick et al., 2006) to avoid becoming the target of predators (Dwyer & Bornett, 2004). This makes it difficult to interpret their behaviour in terms of their state of welfare. It might as well be that we as humans simply fail to identify and interpret their subtle behavioural expressions that could tell us about their (emotional) status (Fitzpatrick et al., 2006). The fact that "sheep are smaller and more defenceless than other farmed species" (Dwyer & Lawrence, 2008) could have also "meant that sheep have had to tolerate poorer standards of husbandry" (Goddard, 2008).

Secondly, establishing universally applicable welfare measures with comparable outcomes is no easy task as the husbandry systems sheep are kept in differ widely (Goddard, 2011).

Thirdly, sheep have a pronounced herd instinct which does not only make the assessment of individuals difficult (Fitzpatrick et al., 2006) and stressful for the animals, but also presents the risk that overall flock welfare is overrated, thereby neglecting the welfare of the individual. Extrapolating from the impression of the welfare of a flock to

the state of an individual does not seem right in terms of welfare, because welfare is a concept that applies to individuals (Goddard, 2008).

Despite these challenges, some scientists only recently started to tackle the problem of sheep welfare assessment; Caroprese et al. (2010) for example discussed potential indicators of sheep and goat welfare and Napolitano et al. (2009) conducted a study in which the welfare of sheep was monitored using a method derived from the Animal Needs Index (ANI 35 L). Stubsjøen et al. (2011) carried out a pilot study in which they assessed sheep welfare by using on-farm registrations and performance data, and in her PhD thesis Phythian (2011) developed indicators for the on-farm welfare assessment of sheep welfare and tested their validity, reliability, and feasibility. Also the new FP7-project Animal Welfare Indicators focuses on sheep alongside other "commercially relevant, but often forgotten animals in welfare assessment" such as goats, donkeys, or turkeys (AWIN, n.d.). However, all the efforts focusing on sheep primarily deal with sheep kept for meat production in more extensively managed environments or sheep welfare in general, but none of them specifically studies dairy sheep and their welfare.

1.6 Aim of the project

The aim of this project was therefore to develop a prototype on-farm welfare assessment protocol for dairy sheep with special regard to the Austrian production system. It should include valid, reliable, feasible, and non-invasive animal-based measures. The protocol should be based on scientific knowledge, at the same time taking farmers' opinion on sheep welfare into account. It should, in the end, represent a management tool to make comparisons across farms and time possible. The idea of this protocol is that it should highlight acute welfare problems as well as enable constant monitoring, but it is not to be used as a tool to diagnose diseases (conf. WelfareQuality®, 2009a). It should combine measures for overall flock assessments and for the assessment of individual ewes.

Carrying out this project was encouraged by the Veterinary Health Service ('Tiergesundheitsdienst') in Austria, an organisation where farmers and veterinarians work closely together to improve animal health, ensure compliance with legislative standards, and promote product quality. The Veterinary Health Service showed interest in a standardised scheme to assess the health and welfare of sheep on-farm.

Chapter 2

Farmers' view on sheep welfare

Since the aim of this project was to develop a prototype protocol to assess dairy sheep welfare for application on-farm, it was regarded important not only to integrate scientific, but also farmers' knowledge. The following chapter should therefore describe the farmers' view on sheep welfare identified by means of a questionnaire study.

2.1 Material and methods

A farmer questionnaire was created to gain insight which indicators of sheep welfare are used by practitioners to judge whether the welfare of their sheep is good or poor (see Appendix).

The questionnaire was divided into three parts. In the first part, farmers had to answer general questions about the farm, its management and the husbandry system. In the second part, they had to name the three most important animal-based indicators of good and the three most important animal-based indicators of poor sheep welfare, as well as specifying three problems they already faced with regard to their flock and three requirements to ensure good sheep welfare. As all questions from part two of the questionnaire were open questions, farmers had the chance to describe their experiences in their own words. The third part of the questionnaire contained questions about the availability of information on sheep health and welfare and sources of knowledge farmers use. Additionally, farmers were asked which topics would be of interest to them if further education were to be offered.

The questionnaires were distributed at two conferences on sheep in Austria in November 2012. The first one ('14. Internationale Milchschaftagung') focused on dairy

sheep and was organised by 'Landesverband für Schafe, Oberösterreich', a provincial association for sheep. The second one ('7. Fachtagung für Schafhaltung') was a symposium on sheep husbandry and was organised by 'LFZ Raumberg-Gumpenstein', a research and educational center for agriculture. All participants in both conferences who kept sheep - 221 in total - were asked to fill in the questionnaire anonymously during the conference and return it to the organisers. The return rate was 33.8% at the first conference (142 participants; 48 questionnaires filled in) and 34.2% at the second conference (79 participants; 27 questionnaires filled in). In total, 75 questionnaires (return rate: 33.9%) could be analysed.

As both conferences were attended by sheep farmers from all German-speaking countries, the results reflect opinions of farmers across Austria, Germany, and Switzerland. Regardless of the purpose for which they kept sheep (e.g. milk production, meat production, landscape conservation, etc.), every farmer was asked to fill in the questionnaire. Accordingly, data were divided into two different samples, one including all 75 questionnaires (data set A, n=75), the other including only these 47 questionnaires (63.0% of all answered questionnaires) that were filled in by dairy sheep farmers (data set B, n=47).

Analysis of parts one and three of the questionnaires was conducted by calculation of percentages, and results are presented descriptively. Answers of part two of the questionnaires (sheep health and welfare) - which were most important for the project - were first grouped in categories with regard to similarity (*behavioural indicators*, *indicators of overall appearance*, and *performance indicators*), and percentages for all categories were calculated. In a second step, these categories were divided into sub-categories (e.g. *feeding behaviour/ruminating*, *condition/fitness*, *milk yield*), and percentages of them were calculated. The sub-category *other* combines single answers that could not be assigned to any other sub-category. Analysis of data set A and data set B was done in the same way.

2.2 Results

In this section results of data set A and data set B will be presented according to the three parts of the questionnaire. $n_{ansA} = ...$ and $n_{ansB} = ...$ indicate the number of answers per question for each data set.

2.2.1 Part I of the farmer questionnaire: General farm management and husbandry system

With regard to the production purpose, most frequently farmers answered to keep dairy sheep at their farm (39.2%), followed by breeding ewes which produce offspring for meat production (32.5%), fattening lambs (26.7%), and sheep for other purposes (1.6%). Multiple answers were possible.

On average, farmers kept 125 sheep per farm (min: 3 - max: 765). 104 dairy ewes (min: 2 - max: 350), 63 fattening lambs (min: 3 - max: 300), 41 breeding ewes which produce offspring for meat production (min: 1 - max: 140), 25 replacement ewes (min: 3 - max: 100), and 3 rams (min: 1 - max: 10) were kept on a farm on average.

As depicted in Figure 2.1 (data set A), the most common sheep breeds were the East Friesian Dairy Sheep and the Lacaune Sheep. Also different kinds of the 'Bergschaf Breed' (a mountain breed) and of the Merino Breed seemed to play a role. Breeds that were named less than five times were grouped together (sub-category *other*). Dairy sheep farmers (data set B) exclusively kept the East Friesian Dairy Sheep and the Lacaune Sheep (see Figure 2.2). Multiple answers were possible.

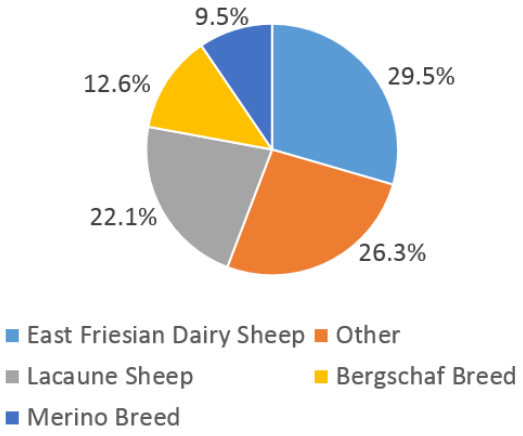

Figure 2.1: Data set A - sheep breeds on all farms (n_{ansA}=95)

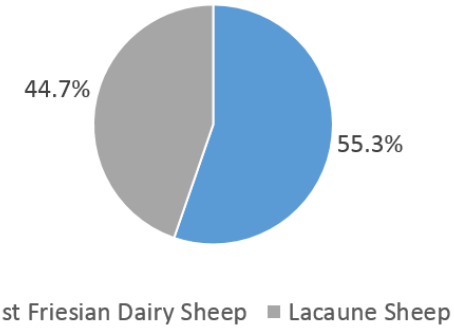

Figure 2.2: Data set B - sheep breeds on dairy sheep farms (n_{ansB}=47)

52.0% of all farmers (data set A) ran a conventional farm, and 42.7% ran an organic farm (5.3% did not answer the question). A higher proportion of dairy sheep farms (data set B) were organic (51.1%), and 40.4% were conventional (8.5% did not answer the question).

Concerning the husbandry system (see Figure 2.3), farmers in general (data set A) as well as dairy sheep farmers (data set B) mainly kept sheep indoors with access to pasture during summertime (50.0%). The remaining 50.0% of both data sets, however, show a different distribution: dairy sheep farmers (data set B) more frequently mentioned to keep sheep in indoor-systems with only limited time spent outdoors than sheep farmers in general (data set A). Especially systems which include access to alpine pasture were only named very seldom in the case of dairy sheep (data set B).

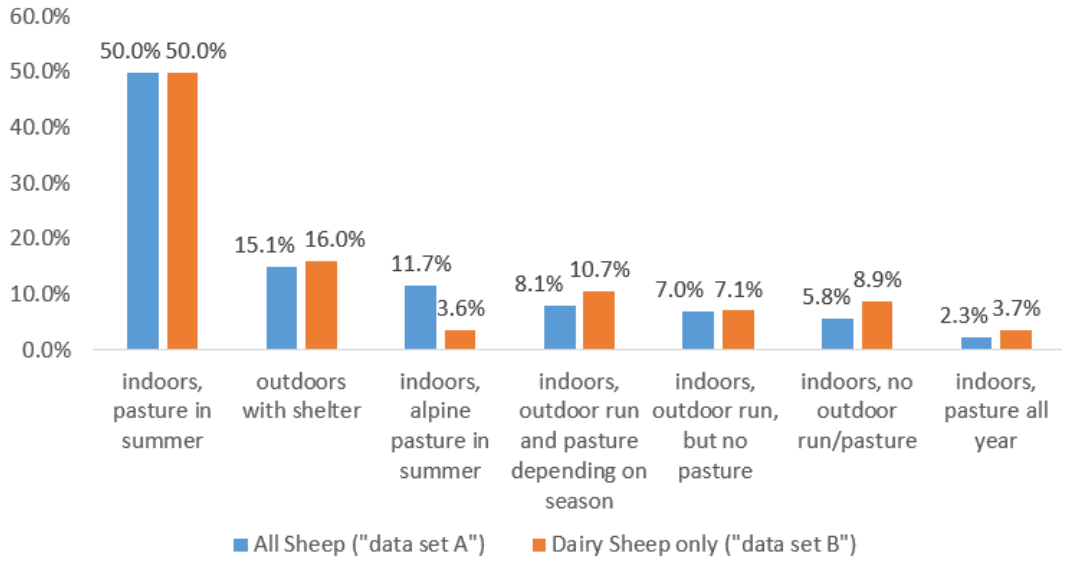

Figure 2.3: Data set A and data set B - husbandry systems (n_{ansA}=86, n_{ansB}=56)

2.2.2 Part II of the farmer questionnaire: Sheep health and welfare

Part two of the questionnaire focused on sheep health and welfare. Indicators of good and poor sheep welfare, problems at sheep farms, and preconditions for good sheep welfare listed by the farmers will be described below.

Indicators of good sheep welfare

All answers could be grouped in three categories *behavioural indicators*, *indicators of overall appearance*, and *performance indicators*. *Behavioural indicators* were the most frequently listed indicators of good sheep welfare, followed by *indicators of overall appearance*, whereas *performance indicators* seemed to be less relevant for farmers to assess animal welfare (see Figure 2.4 and Figure 2.5).

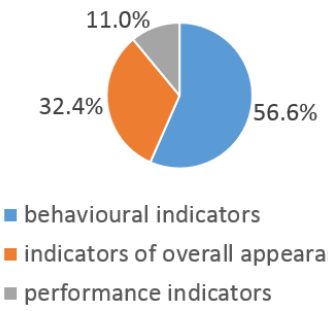

Figure 2.4: Data set A - three categories of indicators of good sheep welfare (n_{ansA}=210)

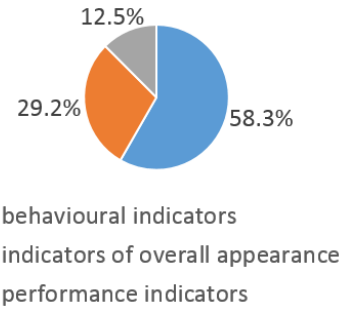

Figure 2.5: Data set B - three categories of indicators of good dairy sheep welfare (n_{ansB}=120)

Behavioural indicators

The answers relating to *behavioural indicators* of good welfare were grouped according to their focus, so that six sub-categories could be established. These sub-categories were suitable for the analysis of both data sets. Answers of dairy sheep farmers (data set B) only differed a little from the answers of all sheep farmers (data set A) with regard to exact percentages, but it is noticeable that dairy sheep farmers emphasised *reaction to humans* less as can be seen in Figure 2.6.

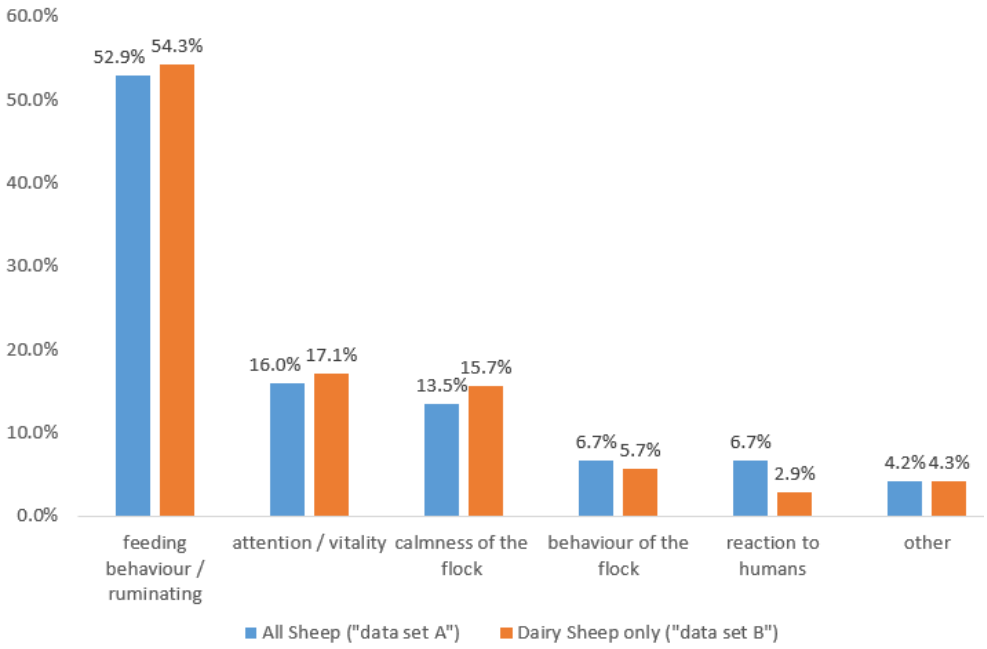

Figure 2.6: Data set A and data set B - sub-categories of behavioural indicators of good (dairy) sheep welfare (n_{ansA}=119, n_{ansB}=70)

Indicators of overall appearance

Concerning the category *indicators of overall appearance* of good welfare, answers could be summarised under five sub-categories. The sub-category *condition/fitness* was the most commonly mentioned topic by all sheep farmers (data set A), followed by the sub-category *claws/movement*. Dairy sheep farmers (data set B) focused more on *claws/movement* as depicted in Figure 2.7. The order of the remaining sub-categories is the same for data set A and data set B, even if exact percentages vary.

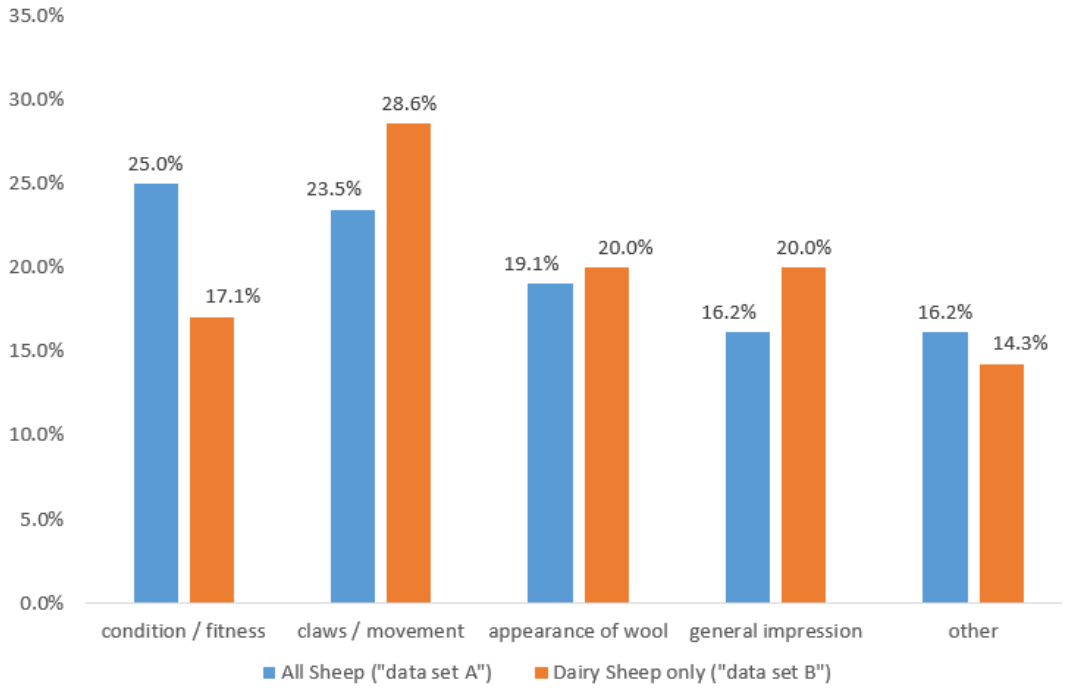

Figure 2.7: Data set A and data set B - sub-categories of indicators of overall appearance of good (dairy) sheep welfare (n_{ansA}=68, n_{ansB}=35)

Performance indicators

When looking at *performance indicators* of good welfare (see Figure 2.8), results from all questionnaires (data set A) suggested that besides *milk yield* and *number of vital lambs*, *fertility* could also be used as an indicator of sheep welfare. Dairy sheep farmers (data set B), however, did not mention *fertility* at all and put great emphasis on *milk yield*.

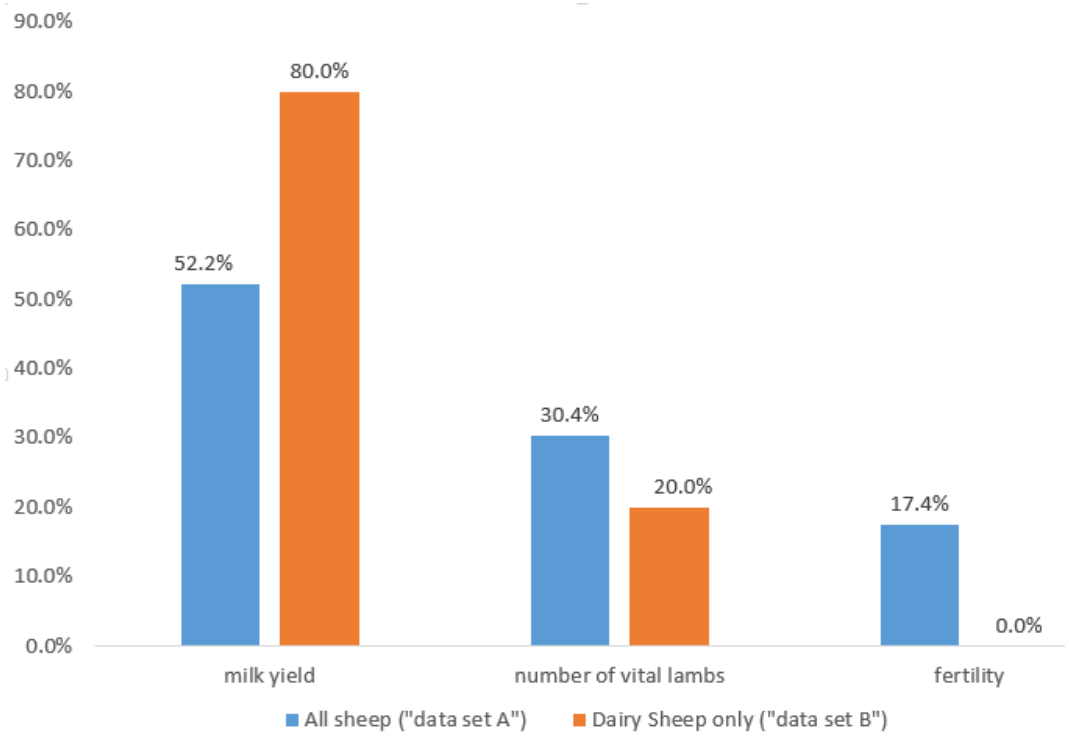

Figure 2.8: Data set A and data set B - sub-categories of performance indicators of good (dairy) sheep welfare (n_{ansA}=23, n_{ansB}=15)

Indicators of poor sheep welfare

Just like with the answers regarding indicators of good sheep welfare, all answers could be grouped in the three categories of *behavioural indicators*, *indicators of overall appearance*, and *performance indicators*. Once more, the results of data set A and data set B are very similar, with dairy sheep farmers (data set B) placing a slightly lower value on *behavioural indicators* (see Figure 2.9 and Figure 2.10).

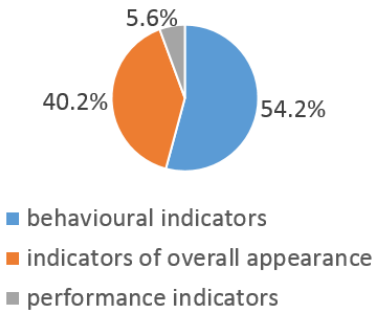

Figure 2.9: Data set A - proportions of three categories of indicators of poor sheep welfare in general (n_{ansA}=214)

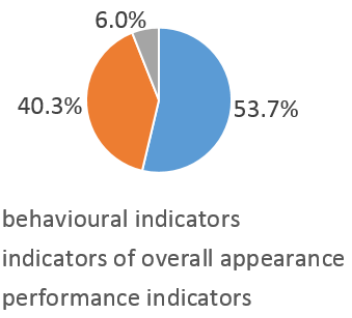

Figure 2.10: Data set B - proportions of three categories of indicators of poor dairy sheep welfare (n_{ansB}=134)

Behavioural indicators

Six distinct sub-categories could be formed when looking at *behavioural indicators* of poor welfare mentioned by farmers. According to the percentages, both data sets (data set A and data set B) showed the same order of importance of those sub-categories (see Figure 2.11).

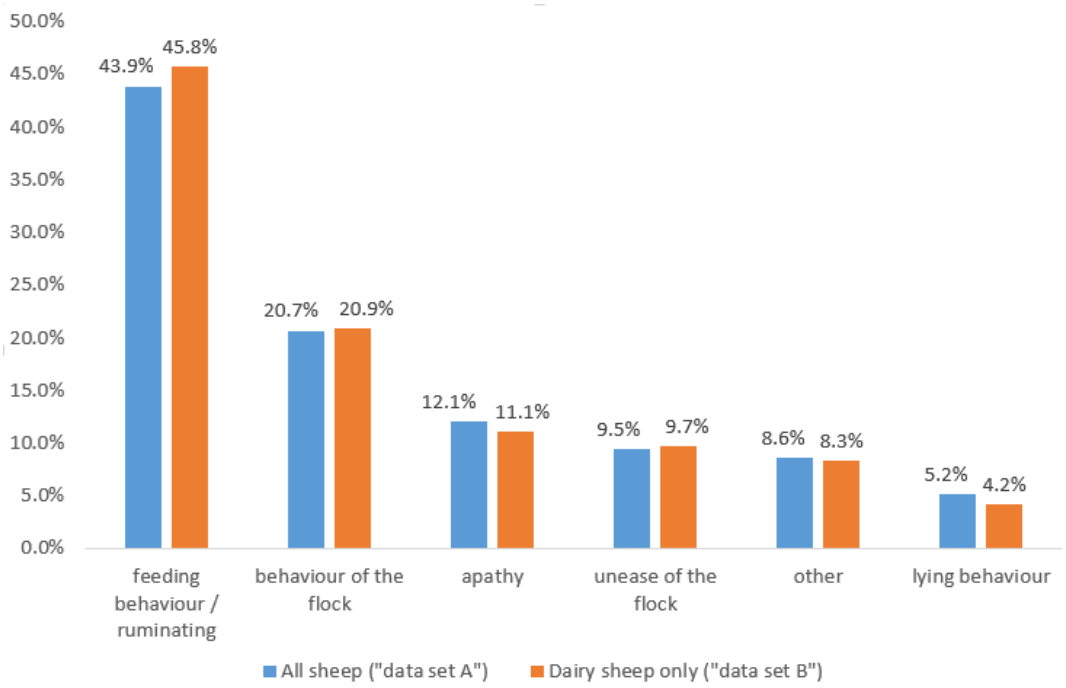

Figure 2.11: Data set A and data set B - sub-categories of behavioural indicators of poor (dairy) sheep welfare (n_{ansA}=116, n_{ansB}=72)

Indicators of overall appearance

Indicators of overall appearance of poor welfare (see Figure 2.12) could be grouped in the same nine sub-categories for both data sets. Although the two with the highest percentages (*claws/movement* and *signs of disease*) were mentioned the most by farmers (data set A and data set B), the order of the remaining sub-categories differed between the two data sets.

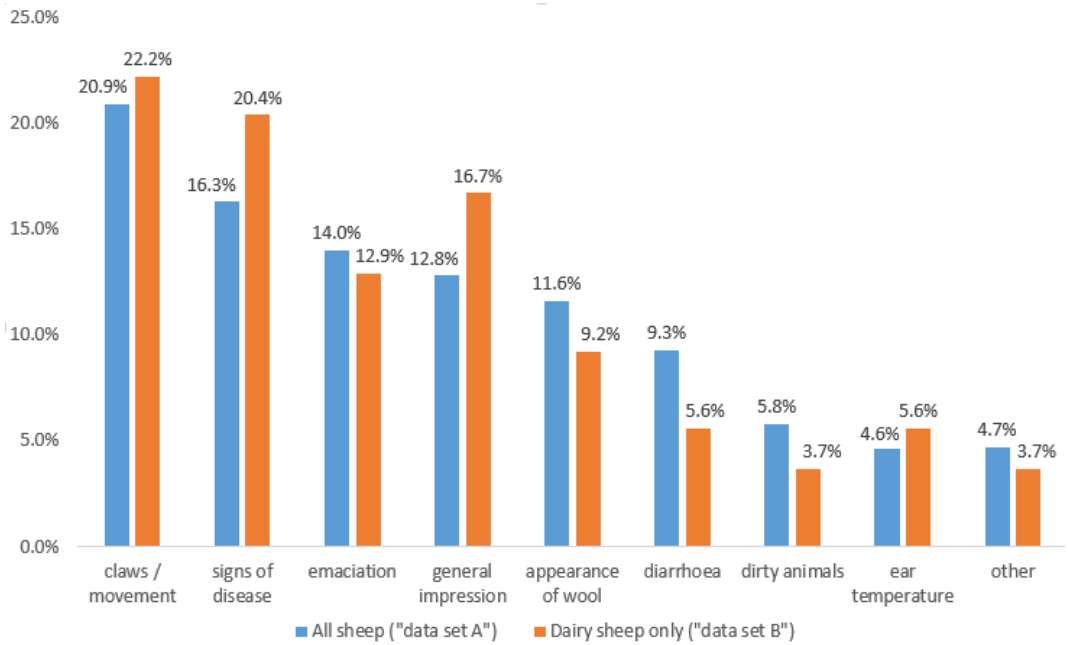

Figure 2.12: Data set A and data set B - sub-categories of indicators of overall appearance of poor (dairy) sheep welfare (n_{ansA}=86, n_{ansB}=54)

Performance indicators

All three sub-categories *milk yield*, *fertility*, and *number of vital lambs* could be established for the indicators of poor welfare as was done for the *performance indicators* of good welfare, when looking at data set A. Looking at data set B only *milk yield* was mentioned (see Figure 2.13).

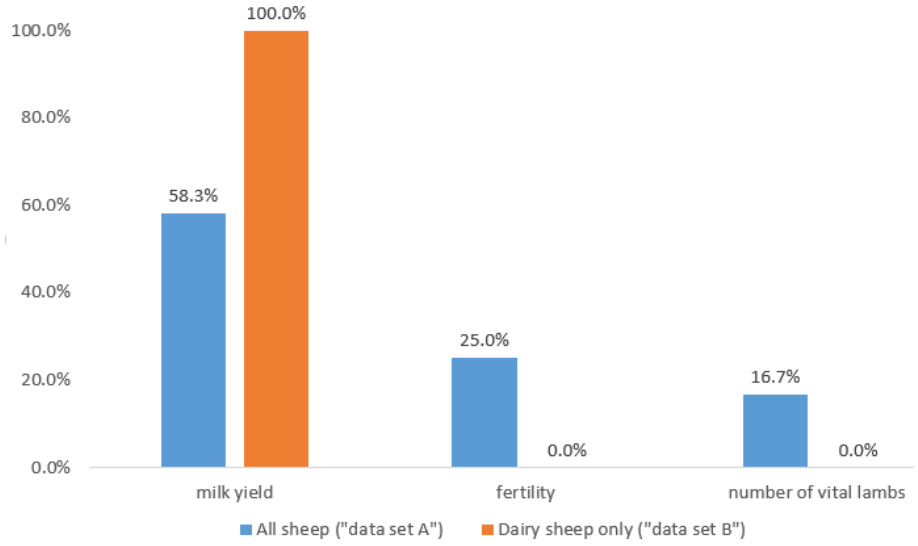

Figure 2.13: Data set A and data set B - sub-categories of performance indicators of poor (dairy) sheep welfare (n_{ansA}=12, n_{ansB}=8)

Health and welfare problems at sheep farms

Problems which farmers had already experienced at their farm could be grouped in four categories (see Figure 2.14 and Figure 2.15): *diseases* (e.g. footrot), *problems related to feeding* (e.g. poor quality of feed), *problems concerning the environment* (e.g. draught), and *other* (e.g. negative consequence of lack of contact between ewe and lamb). There were no topics that seemed to be of special concern for the dairy sheep farmers (data set B). As diseases were most commonly listed, Figure 2.16 provides a more detailed insight: most of the answers in both data sets referred to *parasites* and *problems with the claws*. Dairy sheep farmers (data set B) also emphasised *diseases of the udder*.

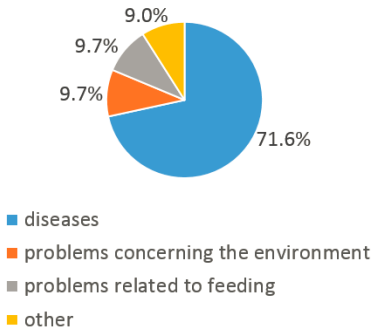

Figure 2.14: Data set A - problems at sheep farms (n_{ansA}=115)

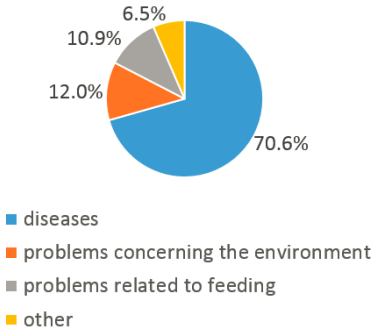

Figure 2.15: Data set B - problems at dairy sheep farms (n_{ansB}=92)

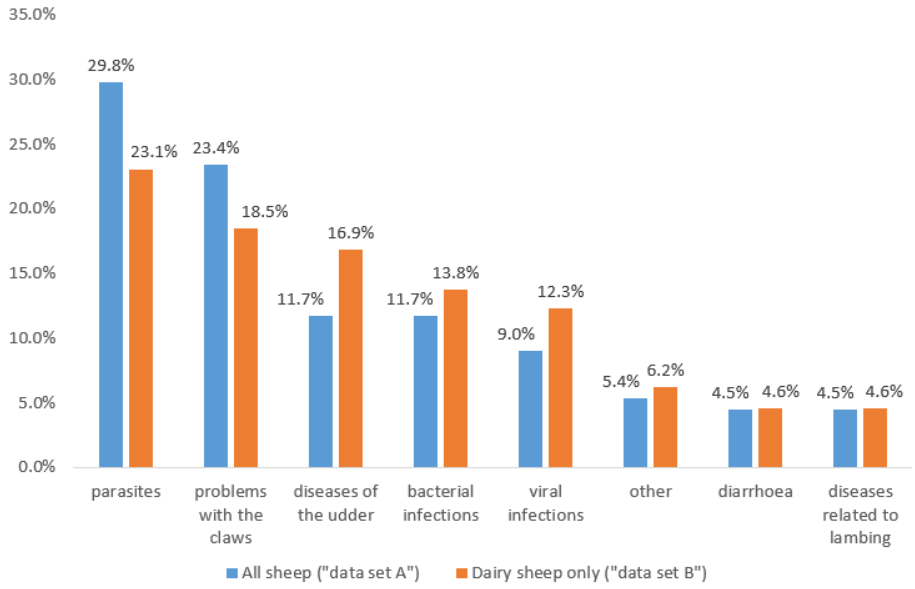

Figure 2.16: Data set A and data set B - diseases occurring at (dairy) sheep farms (n_{ansA}=111, n_{ansB}=65)

Preconditions for good sheep welfare

As preconditions for good sheep welfare, *good housing* (e.g. clean, bright pens with adequate bedding), *appropriate feeding* (e.g. sufficient feed and water of good quality), *careful management* (e.g. daily inspection and observation of animals), *good healthcare* (e.g. deworming), and *other* (e.g. good weather conditions) were listed. This was similar for both data sets as can be seen in Figure 2.17 and Figure 2.18.

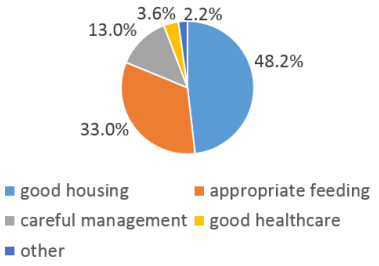

Figure 2.17: Data set A - preconditions for good sheep welfare (n_{ansA}=224)

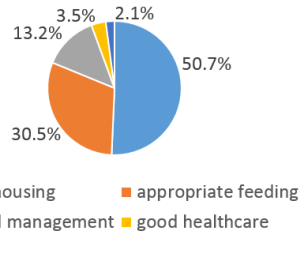

Figure 2.18: Data set B - preconditions for good dairy sheep welfare (n_{ansB}=114)

2.2.3 Part III of the farmer questionnaire: Sources of information on sheep health and welfare and their availability

When analysing the answers from part three of the questionnaire, it became obvious that the first person sheep farmers turned to if they had questions about their sheep, was the veterinarian (48.1% for data set A, 45.0% for data set B). The second most important group of people to be contacted were colleagues (29.8% for data set A, 31.3% for data set B). Sources like books or the internet were also consulted (12.2% for data set A, 12.5% for data set B). Agricultural advisers seemed to be contacted quite rarely (9.1% for data set A, 11.2% for data set B). Only one farmer admitted to having nobody to get in touch with if problems or questions arise.

60.0% of all farmers (data set A), and 60.0% of all dairy sheep farmers (data set B) felt that sufficient education was offered in the field of sheep husbandry, whereas 30.7% of all farmers (data set A; the remaining 9.3% did not answer the question), and 40.0% of all dairy sheep farmers in particular (data set B), felt a lack of proper information.

A lot of information seemed to be offered by several sheep organisations, associations, and working groups through meetings, seminars or training courses. They covered topics

like organic farming, breeding, shearing or dairy production. Topics farmers (data set A) would be interested in regarding additional education and training were: feeding, sheep health and management, and the economics of sheep husbandry. Dairy sheep farmers (data set B) did not specifically express the need for particular information on additional topics.

2.3 Discussion

In the following chapter the first part of the project will be discussed with regard to the material and methods used and the findings from the farmer questionnaire. A discussion of the results of the development of the draft protocol and a more general discussion of the project can be found in Chapter 3.2 and Chapter 5.

2.3.1 Material and methods

As scientific literature on the welfare of dairy ewes is relatively sparse, and only few animal-based measures for on-farm welfare assessment of sheep are available at the time, it seemed to be necessary to conduct a farmer questionnaire study to gain insight into the farmers' understanding of sheep welfare. Kauppinen et al. (2010) claim that farmers' opinion on animal welfare is hardly ever heard. Therefore, the idea of actively involving farmers when developing a tool for the assessment of animal welfare seemed even more justified. In the present project, the indicators of good and poor sheep welfare named by the farmers within the questionnaires in particular helped to develop a list of relevant parameters.

The fact that the questionnaires were only distributed at subject-specific conferences might have produced a bias. It can be expected that such meetings are mainly attended by highly engaged and educated stock persons, possibly leaving out quite a great share of producers and their view on animal welfare. However, since the aim was to get an insight into indicators of sheep welfare with practical relevance rather than to 'test' the farmers' knowledge about sheep welfare, it seemed logical to interview motivated farmers who are interested in continuing education. It has to be mentioned that several participants of the questionnaire as well as the organisers of the conferences showed interest in the project and were keen on being informed about the results of the study afterwards.

As the purpose of the questionnaire study was not to make a complete analysis of sheep farming in Austria, but to identify important welfare issues, a sample size of 75 questionnaires (of which 47 were answered by dairy sheep farmers) seemed sufficient for a first approach to the topic.

As the participants in the conferences at which the questionnaires were distributed also came from Germany and Switzerland, the questionnaires do not only represent Austrian farm practice. However, the view of indicators of good and poor sheep welfare should not differ too much in German-speaking countries due to similar traditions of sheep keeping and similar cultural understanding of livestock; this, however, may not be true for some peculiarities in practice (e.g. flock size, breeds used, conventional/organic farming) which complicated the interpretation of the first part of the questionnaire a little.

2.3.2 Part I of the farmer questionnaire

Answers from the first part of the farmer questionnaire are quite hard to compare with literature findings, as only little statistical data are available on sheep husbandry, especially on dairy sheep husbandry, as pointed out by Ringdorfer (2008); this is not only true for Austrian dairy sheep production, but also for the situation in Europe (Deix et al., 2009).

Concerning the size of sheep farms, results of the questionnaire showed that 125 sheep are kept at a farm on average; the largest number of animals can be found on farms specialised in dairy sheep (104 ewes/farm on average). Data from the year 2012 given by the 'Österreichischer Bundesverband für Schafe und Ziegen' (the Austrian association for sheep and goats; ÖBSZ, 2013) indicate that in Austria sheep husbandry is still practised in a small-scale manner with 41% of all Austrian sheep farmers keeping only 1 to 9 sheep, and only 12% keeping more than 50 sheep; regarding dairy sheep farms in Austria data from the year 2007 suggest that 23 dairy sheep are kept at a farm on average, which still indicates relatively small farm sizes (Deix et al., 2009). Looking at data available on purebred herd book ewes in Austria from the year 2006, it can be seen that about 40 ewes are kept per breeder; the number of registered purebred herd book ewes, however, is relatively counting only about 1500 animals (Fuerst-Waltl & Baumung, 2009). The reason for the deviation of the results obtained by the farmer questionnaire and these data from Austria might be found in the fact that in Germany

usually larger flocks are kept; in the year 2010 16% of all sheep farms in Germany kept more than 100 animals (DBV, 2012). Also the average flock size on dairy sheep farms is higher in Germany than in Austria, as Klumpp et al. (2003) found when interviewing 269 organic dairy sheep farmers in Germany: Their findings show that 40% of all interviewed farmers kept 50 to 99 dairy sheep at their farm, and 20% as much as 200 to 399 (Klumpp et al., 2003). Also data from Switzerland suggest that the average flock size per farm is higher than in Austria with 46 sheep on average kept at a farm in the year 2012 (StatistikSchweiz, 2013); information on Swiss dairy sheep farms in particular could not be found.

Within the questionnaire study the East Friesian Dairy Sheep and the Lacaune Sheep were found to be the most commonly used breeds in dairy sheep production in the German-speaking countries, with the East Friesian Dairy Sheep being named slightly more often. These findings can be supported by literature when looking at the dairy ewes subject to regular production controls in Austria in the year 2012: 58% of these animals were East Friesian Dairy Sheep, and 42% belonged to the Lacaune Breed (ÖBSZ, 2012); it has, however, to be kept in mind that only about 1500 dairy sheep in Austria are subject to such controls. Also the contribution on "Economic values for performance and functional traits in dairy sheep" by Fuerst-Waltl and Baumung (2009) gives evidence that those two breeds are of major importance in Austrian production systems: about 1000 of all registered purebred herd book ewes are East Friesian Dairy Sheep, and about 450 of all ewes Lacaune Sheep (Fuerst-Waltl & Baumung, 2009). In Germany, the East Friesian Dairy Sheep is also of major importance as pointed out by Klumpp et al. (2003) and Ringdorfer (2008).

Comparison of questionnaire results and literature findings on the distribution of conventionally and organically run farms is confusing, since the only statistical data available are from a study conducted by the 'Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft' (the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management) in Austria in the year 2009 showing that only 19% of all dairy sheep farms are run organically (Deix et al., 2009), but no information from Germany or Switzerland could be found. The information available regarding the husbandry systems commonly used in (dairy) sheep husbandry in the German-speaking countries is equally poor, and no surveys about this topic could be found.

Since data on the general aspects and common (dairy) sheep practice in the EU are scarce, comparisons of the questionnaire outcomes with other studies are hard to make; a comprehensive collection of data would be of great value.

2.3.3 Part II of the farmer questionnaire

Part two of the questionnaire was the most important one with regard to this project.

The farmers' answers helped to identify three groups of indicators which are important for on-farm sheep welfare assessment: *behavioural indicators*, *indicators of overall appearance*, and *performance indicators*. These groups of indicators were also found in literature (e.g. Goddard, 2011).

It became obvious that *behavioural indicators* (e.g. "sheep are feeding and ruminating", "sheep behaves like the rest of the flock") are of special importance for farmers. This might be indicative of a deep knowledge stock persons have concerning the species-specific behavioural characteristics of sheep. *Indicators of overall appearance* (e.g. "healthy claws", "bright wool") seem to matter to farmers, too; also signs of illness and disease were referred to as *indicators of overall appearance* in the analysis. These two kinds of indicators do not only seem to be of relevance for farmers, but also literature findings confirm that they provide good insight into welfare, as stated by Sevi (2009): "Behavio[u]ral indicators play a main role in this case, and so do indicators visually collected and for which a close relationship was demonstrated with objective indicators of animal welfare, taken under experimental conditions".

The third group of indicators, which deals with the performance of the animals (e.g. "high milk yield", "fertile sheep") turned out to be of relatively little importance to the farmers. The connection between productivity and animal welfare, however, is reported to be of relevance for farmers as shown by a study carried out by Vaarst (2003): in this study, dairy, pig, and mink farmers presented with an animal welfare assessment system demanded a more direct connection of its outcomes with production results. These farmers primarily focused on productivity of the animals and viewed animal welfare more as kind of an 'additional area of interest' (Vaarst, 2003). In how far these findings can be applied to sheep farmers has to be left open, but since the subcategory *feeding behaviour/ruminating* of the questionnaires was the most dominant one concerning *behavioural indicators*, and feeding behaviour in dairy sheep is tightly connected to (at least) their milking performance, they might also put quite some value on performance; hence, the weight put on *behavioural indicators* in the analysis has to be mitigated. Nevertheless, farmers seem to take behavioural specificities of the sheep

species into account, stating answers correlated to *attention/vitality* or *calmness of the flock* as indicators of good sheep welfare.

Most of the welfare issues - grouped together in sub-categories in the analysis (e.g. *reaction to humans*, *condition/fitness*, *claws/movement*, *attention/vitality*) - could be found in literature, either because they are important for sheep in general or because of their relevance for other ruminant species (e.g Dwyer, 2009; Hodgkinson, 2010; Goddard, 2011; Phythian et al., 2012). Although they are described in literature (e.g. Goddard, 2011), physiological parameters (e.g. cortisol measures) were not listed by farmers, very likely because they are not feasible for farmers to use in their daily routine as they require elaborate equipment and assessment strategies, such as blood sampling.

Regarding problems at the sheep farm, diseases were named most often. *Parasites*, *problems with the claws*, and *diseases of the udder* seemed to be of great concern. This is in concordance with scientific literature, where these three clinical conditions are reported to be associated with severe pain and discomfort and are hence of special importance when talking about sheep welfare (Fitzpatrick et al., 2006). In a study conducted by Müller and Hörnig (2011) problems with the claws and endoparasites were also named by farmers as problems frequently occurring at dairy sheep farms.

The answers of the questionnaires further showed that from the farmers' perspective *good housing*, *appropriate feeding*, *careful management*, and *good healthcare* are crucial to ensure good sheep welfare. This is in concordance with literature findings, as e.g. agonistic interactions (Bøe et al., 2006), nutritional state (Phythian, 2011), human-animal interaction (Goddard, 2008), and lameness (Roger, 2008) are named as important welfare issues. In the study conducted by Kauppinen et al. (2010) a favourable living environment and healthcare were also pointed out by dairy cow and pig farmers as being important in terms of animal welfare.

2.3.4 Part III of the farmer questionnaire

Results from part three of the questionnaires showed that only slightly more than half of all interviewed farmers felt that there was enough information offered concerning sheep health and welfare. This might be indicative of the fact that research in the field of sheep welfare seems to be relatively new and that not as much attention has been paid to the species of sheep as to other livestock yet.

When farmers have questions regarding sheep health and welfare they primarily turn to the veterinarian or ask colleagues for help. A similar, but not identical situation was found in a study conducted by Kirchner et al. (2014); it showed that the Veterinary Health Service plays a major role for beef farmers. For sheep farmers the Veterinary Health Service does not seem to be that important; they contact single veterinarians rather than make use of this service. Data from the Veterinary Health Service show that only 30% of all sheep in Austria, but 61% of all cattle are kept by farmers who cooperate with this organisation (Litzllachner et al., 2010).

The 'Österreichischer Bundesverband für Schafe und Ziegen' (the Austrian association for sheep and goats), however, states that there is a lack of veterinarians in Austria who are specialised in the treatment of small ruminants (ÖBSZ, 2013). In the UK, Kaler and Green (2013) report sheep farmers to have a quite bearish attitude towards veterinarians who are mostly contacted only in case of emergency, but not regularly consulted, for example, because of inconsistent service or lack of expertise.

Kirchner et al. (2014) found that for beef farmers meetings played a role in information availability which is also true for sheep farmers who frequently named several organisations, associations, and working groups as source of information within the present questionnaire study.

Chapter 3

Development of a prototype protocol

Conducting a farmer questionnaire study to gain insight into farmers' view on sheep welfare and its indicators, as described earlier (see Chapter 2), represented an important basis for the process of developing a welfare assessment protocol. The second main part of the project was the development of a prototype on-farm welfare assessment protocol for dairy sheep, which will be described in the following chapter. To simplify matters, throughout the whole thesis the terms 'draft protocol' and 'final protocol' will be used to distinguish between the different versions of the protocol that have been designed in the course of the developmental process of the prototype protocol.

3.1 Animals, material, and methods

The development of the prototype protocol included a literature research, followed by a systematic combination of the findings from scientific literature and the outcomes of the farmer questionnaire in form of a draft protocol, and a feasibility-testing of the draft protocol at three Austrian dairy sheep farms.

3.1.1 Literature review

During literature research the focus was put on peer-reviewed scientific literature. Several different data bases (e.g. Sciverse ScienceDirect, ingentaconnect) were used, and key words that were searched for included 'dairy sheep', 'dairy sheep welfare', 'dairy sheep welfare indicators', 'dairy sheep welfare assessment', 'animal welfare', 'sheep welfare', 'sheep welfare indicators', 'sheep welfare assessment', and 'on-farm welfare assessment'.

Besides that, the university libraries of the University of Natural Resources and Life Sciences, Vienna as well as of the University of Veterinary Medicine, Vienna were visited. Additionally, grey literature was considered to get an idea of the information more readily available for farmers. Special attention was paid to parameters that are reported to be valid and reliable.

Although only few of the publications deal with sheep welfare directly, some of them could be taken as a guideline for the development of the draft protocol. Those were for example the PhD thesis on the "Development of indicators for the on-farm assessment of sheep welfare" written by Phythian (2011) and the contributions on the "Assessment of sheep welfare using on-farm registrations and performance data" by Stubsjøen et al. (2011) and on "Welfare assessment in sheep" by Goddard (2011). Within the latter, suggestions are made for possible measures used in sheep welfare assessment modelled after WelfareQuality® (2009a). Therefore, the original protocol of WelfareQuality® (2009a) with special focus on dairy cattle was also studied carefully. In addition to that, technical information about how to perform an on-farm welfare assessment could be taken from this protocol. It is important to note that this work will not go beyond the productive period of a dairy ewe on-farm and therefore will not deal with topics like transport or killing (e.g. Goddard, 2011).

3.1.2 Designing a draft protocol by combining farmers' opinion and literature findings

In a next step, the findings from literature research were compared and - where possible - supported by the questionnaire results to design a draft protocol for the on-farm welfare assessment in dairy sheep.

Since assessing an animal's welfare means to get an idea of its life - as complete as possible - including all different facets and their interplay, it requires using a combination of several different measures. As the measures included in this work should "reflect what is meaningful to the animals" (WelfareQuality®, 2009a), the aim was to use mainly animal-based measures which focus on the animal directly. The parameters which were chosen were selected according to their relevance for dairy sheep welfare, information available on their validity and reliability, and their meaning for the Austrian production system (i.e. parameters referring to husbandry practices that are forbidden

by Austrian law, like mulesing, were not included). The attempt was made to balance the use of measures that mainly assess the individual welfare and those that focus on the welfare of the flock.

The development of the draft protocol was oriented towards already existing parameters. Some welfare issues were mentioned in literature without suggesting measures to assess the impact on the animals. In these cases, measures were newly developed and included in the draft protocol. However, testing them for their validity and reliability would have gone far beyond the scope of this work. Therefore, the draft protocol does only include very few of such new parameters.

Subsequently, all measures were listed in a logical order according to the assessment procedure. Furthermore, a guideline was developed including a detailed description of the assessment method for each measure and important notes to ensure correct assessment (see Appendix).

3.1.3 On-farm testing and revision of the draft protocol

In order to test the feasibility of the developed draft protocol and optimise the final outcome, it was applied at three Austrian dairy sheep farms and constantly revised during this process.

Farms were selected according to the interest of the farmers to participate and the location, so that each visit could be conducted within one day, including travelling. Contact with the farmers was easily established as two of the three farms (A and B) were already visited for research purposes, and the third one (C) was visited during an excursion of one of the sheep conferences mentioned above ('14. Internationale Milchschaftagung'). The only inclusion criteria was that the dairy ewes at the farm were milked at the time of the visit.

A few weeks before the visits, farmers were contacted by telephone and informed about the project and the planned procedures at the farm. It was pointed out that the application of the draft protocol at their farm was not to actually assess the welfare of their animals, but to test the feasibility of the draft protocol. Shortly before the actual visits, farmers were called again to confirm the date of the visit.

All visits took place in October 2013. Farms A and B were located in Lower Austria, farm C in Upper Austria, which are typical geographical regions for dairy sheep farms. Each farm was visited by the author and a second person to take photos (with the permission of the farmer) for detailed explanations to go with the prototype protocol (see Appendix).

The equipment used for assessment (e.g. stopwatch, measuring cup) was brought from the university and was disinfected before and after each visit. The observers wore disinfected clothing inside the animal area at every farm.

All test farms differed regarding flock size and management as presented in Table 3.1. This provided the possibility to test if the draft protocol was flexible enough to be applied under different circumstances, but at the same time standardised enough to make comparisons between farms. When testing the feasibility of the draft protocol, the focus was put on time requirements (e.g. duration of single assessment steps), peculiarities concerning the character of sheep (e.g. pronounced flocking behaviour), characteristics of the parameters (e.g. assessment procedure), and variabilities of on-farm conditions (e.g. type of milking system). The assessment during milking did not take place at the same time of the day at every farm. On farms A and C, animals were assessed during the morning milking, whereas on farm B this procedure was performed during the evening milking. This was done to find out the best possible point in time for carrying out the assessment during milking. During the visits as many lactating ewes as possible were assessed.

Table 3.1: Characteristics of the three visited Austrian dairy sheep farms

	Farm A	**Farm B**	**Farm C**
sheep breed	East Friesian Dairy Sheep (some animals crossed with Texel Sheep)	East Friesian Dairy Sheep, Lacaune Sheep	East Friesian Dairy Sheep
husbandry system	deep litter system (occasionally access to outdoor run)	deep litter system with permanent access to pasture during the whole year	deep litter system with daily access to pasture (8h) for about 8 months a year and permanent access to an outdoor run for 4 months a year
farming type	organic	organic	conventional
time of visit (incl. milking time)	0700am-0200pm, milking observation at 0700am	0200pm-0700pm, milking observation at 0500pm	0730am-0100pm, milking observation at 0730am
type of milking system	hand milking	machine milking	hand milking
total number of ewes	100	200	56
number of lactating ewes	70	150	56
number of groups of lactating ewes	1	5	1
number of groups assessed	1	2	1
number of individual ewes assessed during milking	38	86	32

3.2 Results and discussion

From the literature, it became obvious that four main aims towards good sheep welfare can be formulated: adequate housing, appropriate nutrition, good management, and proper healthcare. An on-farm welfare assessment scheme should therefore respect these basic columns of good welfare; the animal-based parameters used should integrate information about the sheep's welfare related to all these areas to gain a complete picture. The following chapter is structured according to these four aims, and the parameters used for the present prototype protocol are assigned to them. Clearly, the four formulated aims are tightly connected. Each of the parameters reflects a single aspect of a dairy sheep's life, while the sum and interplay of these aspects is what actual makes up the overall welfare of an animal.

Structuring the work into these four aims was done because of the input from scientific literature and should also reflect the outcomes of the farmer questionnaires. The concept is quite similar to the approach taken by WelfareQuality® (2009a), which uses a set of four principles comprising twelve criteria and measures which assess these criteria. The Bristol Welfare Assurance Programme (Main et al., 2004) builds on the Five Freedom concept which defines ideal welfare states (FAWC, 2011). Figure 3.1 gives an overview of the four main aims towards good dairy sheep welfare and the parameters of the draft protocol assigned to these aims. Further the input of the farmer questionnaire outcomes on the single parameters, and the most important key words from literature are depicted.

The parameters presented below refer to animal behaviour or to the overall appearance of an animal; the only exception are the parameters used for the assessment of the water provision, as there are only resource-based measures available (e.g. WelfareQuality®, 2009a). Within the prototype protocol parameters, which refer to the performance of an individual are assessed within a short interview with the farmer. They are hence not described in the following chapter as they are not assessed when directly looking at an animal and did not undergo changes during the on-farm testing. Further, this interview should help to collect general data about the farm and to get an insight into farming practice, as suggested by Lovatt (2010).

For each parameter a description of the outcomes of the farmer questionnaire and literature research as well as of its draft version is given. Further, the procedure of the on-farm testing is described for each parameter. For those parameters which are

incorporated into the final protocol also its final version is presented and accompanied by a short table showing its main characteristics. Detailed descriptions of the assessment procedure of these parameters can be found in the additional explanations accompanying the final protocol (see Appendix). When parameters turned out not to be feasible they were eliminated from the draft protocol. Also an overview of all parameters is given, showing which of them were accepted without modification, eliminated or modified in the course of the on-farm testing.

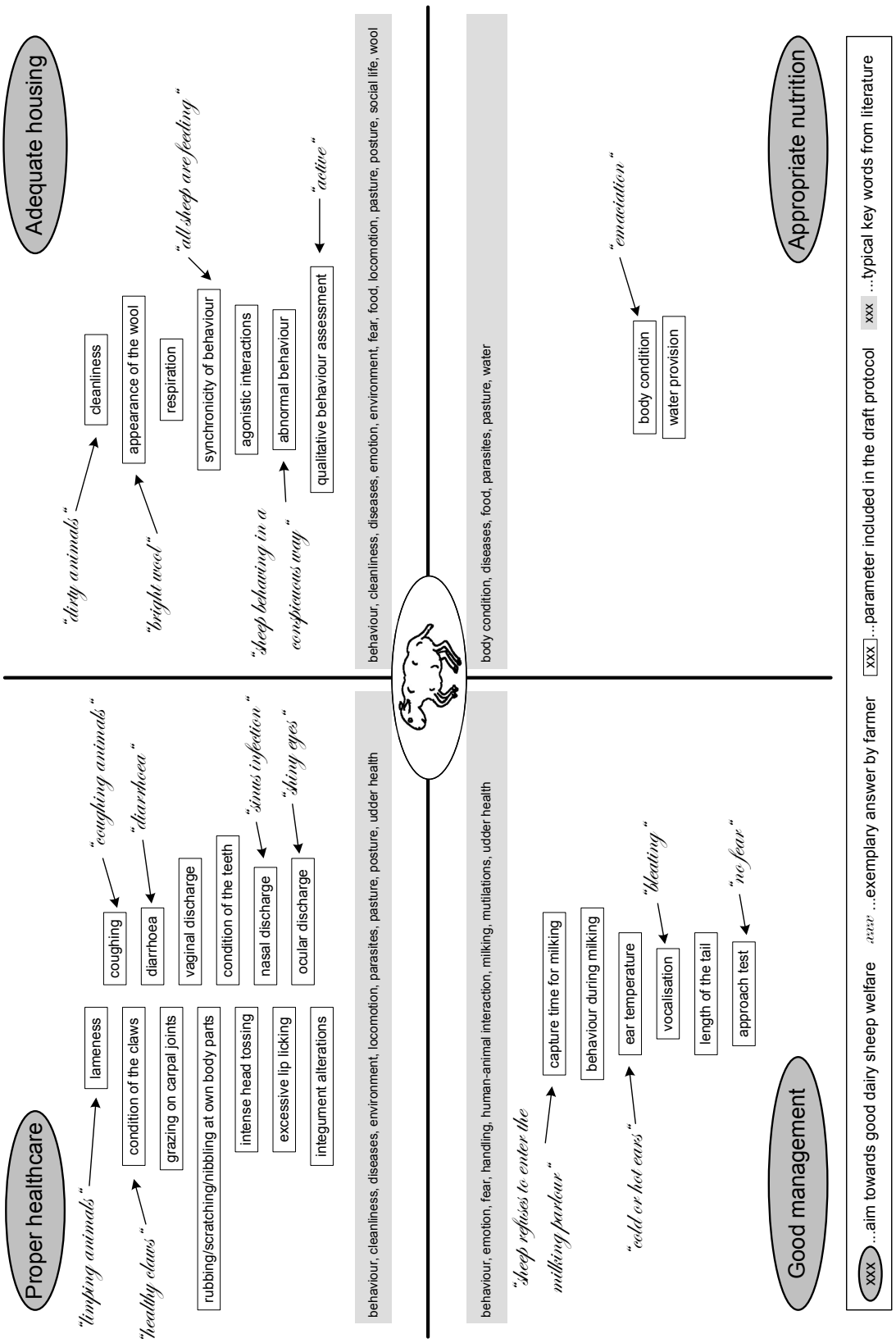

Figure 3.1: Parameters used in the draft protocol combining the outcomes of literature research and farmer questionnaires, assigned to the four aims towards good dairy sheep welfare

3.2.1 Adequate housing

Although it is stated by the Royal Society for the Prevention of Cruelty to Animals that "the environment in which livestock are housed needs to be conductive to good health" (RSPCA, 2013), it is evident that the way sheep are kept not only influences their health, but also substantially influences their welfare (Caroprese, 2008). Therefore, adequate housing should be considered a major aim when addressing good dairy sheep welfare and cannot only be assessed by using resource-based parameters, but especially with the help of animal-based parameters. Seven animal-based parameters pointing into the direction of adequate housing are described in the following part.

Cleanliness

Cleanliness of the surrounding environment is an important precondition for good sheep welfare and involves hygiene of the bedding, all surfaces, and the air (Caroprese, 2008). If the environment is not clean, sheep are very likely to get dirty.

Dirty animals are usually stained with a mixture of soil and dung which does not only irritate the skin (Stubsjøen et al., 2011), but also increases the risk of infection with different kinds of bacteria (FSA, 2007) as well as ectoparasites (Stubsjøen et al., 2011).

Farmers mentioned that "dirty animals" are a sign of poor welfare (see Chapter 2.2.2).

Several authors (e.g. Sevi, 2009; Caroprese et al., 2010; Goddard, 2011) suggest that looking at the degree of dirtiness/cleanliness of a sheep, and the proportion of stained sheep in a flock can give a good insight into the housing conditions sheep are exposed to.

Stubsjøen et al. (2011) looked at the presence of dirt stains larger than 5x5cm or diffuse overall soiling at the side, limbs, and udder of sheep and scored the overall dirtiness of a sheep along a 4-point scoring scale.

Napolitano et al. (2009) assessed animals from a distance of 2m and classified them as dirty when major splashings or distinct plaques of dirt at the hind quarters and the udder were present. They found a significant correlation between different observers, thus showing good inter-observer reliability for this measure.

Phythian (2011) applied the parameter dirtiness in the course of an individual examination of sheep restrained in an upended position. She scored the cleanliness of the

rear (perineum, parts of the gluteal region, top of the hind limbs), the belly, and the legs along a 4-point scale with dirt applying to fresh as well as dried stains of mud or faeces. The results of her study suggest that the observation of dirt at the belly and the rear are useful for welfare assessment, even if a 3-point scale would be better than the 4-point scale in terms of inter-observer reliability, which appeared to be relatively low.

For the draft protocol it was decided to observe the parameter cleanliness in the course of an individual examination during milking. When standing behind the animals one flank, the rear (including the hind legs, the region around the tail, and the tail), the udder, and the ventral abdomen were assessed using a 2-point scoring scale with clean animals showing no or only some minor splashings of dirt and clean teats (score 0), and dirty animals showing major splashings of dirt and/or separate or continuous plaques of dirt (score 1). This scoring scale was created following WelfareQuality® (2009a). In contrast to the method Phythian (2011) used, sheep did not have to be restrained in an upended position because of feasibility. Even though the results of the thesis by Phythian (2011) did not suggest incorporating cleanliness of the legs into further welfare assessment schemes, it was included as it was thought to be important to complete the overall picture of cleanliness of an animal when viewed from behind.

When testing the parameter cleanliness on-farm, it became clear that the areas that had to be looked at had to be defined again. It was decided to leave out the assessment of the ventral abdomen, since it was not possible to look at it when ewes were standing in the milking parlour. The assessment of the flank was rejected as well because it was already included in the assessment of the appearance of the wool. It was also decided not to assess the cleanliness of the tail and the region around the tail because this was (at that time) covered by the parameter diarrhoea. Therefore, the legs and the udder have to be inspected when applying the parameter cleanliness. This is in concordance with Phythian (2011) who states that judgement of the cleanliness of the legs alone, did not seem to be a reliable test for welfare assessment in sheep.

Although cleanliness of the hind legs and cleanliness of the udder seem to be tightly connected, ewes with completely clean legs, but dirty udders were found on the test farms. Since dirtiness of the udder can have an impact on the quality of the milk and can represent a health risk for the animal, the parameter cleanliness was split up into two distinct measures.

Table 3.2: Assessment of *cleanliness* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
cleanliness of hind legs	individual assessment in milking parlour; both hind legs (including back view, inner and outer side) are assessed; the back view of the udder is assessed	0 = clean (no or only a few splashings of dirt*) 1 = dirty (several splashings of dirt* and/or plaques of dirt*) *splashings longer than 5cm; plaques larger than palm of the hand	percentage of animals with dirty hind legs (score 1)
cleanliness of udder			percentage of animals with a dirty udder (score 1)

The final protocol (see Appendix) now includes the parameters cleanliness of the hind legs and cleanliness of the udder (see Table 3.2).

Additionally, in the course of the farm visits it turned out that a definition of the minimum size of dirt splashings as well as of plaques of dirt had to be made in order to ensure standardised assessment. Also the definition of the scores was slightly refined.

Appearance of the wool

The condition of the wool can provide information about the welfare of a sheep. It is very important with regard to the presence of ectoparasites (e.g. psoroptes ovis, lucilia cuprina, bovicola ovis), as they are counted as one of the most significant health issues in sheep (Goddard et al., 2006).

The assessment of the appearance of the wool is very specific to the species of sheep, as nearly no other livestock kept for production purposes in Austria has as pronounced a wool cover as sheep have. Therefore, no proven welfare measures applied to other species can be adapted for sheep concerning their wool.

Within the farmer questionnaires answers like ”bright wool” or ”shaggy fur” were given when asked for indicators of good and poor welfare, respectively (see Chapter 2.2.2).

Some practical information for stock people include assessment of the wool, e.g. the guideline for producing clean sheep for slaughter published by the Food Standards Agency, which uses signs such as cleanliness, dryness, adherence of bedding, and contamination with dirt/dung of the fleece to make any judgements about the condition of

the wool (FSA, 2007). Even though the primary reason for assessing wool condition in this case is to ensure product quality rather than animal welfare, it can also be used in the context of welfare, as suggested by several authors (e.g. DEFRA, 2003; Sevi, 2009; Caroprese et al., 2010; Lovatt, 2010; Goddard, 2011; Phythian, 2011).

Napolitano et al. (2009) looked for integument alterations in sheep as an indicator of poor welfare, including the occurrence of wool-less patches. When assessing this parameter with yes or no answers, they found significant correlations between different observers and classified this parameter as a reliable measure in sheep welfare assessment.

Also Phythian (2011) looked at the fleece of sheep when validating possible parameters for on-farm welfare assessment in sheep. Within an individual assessment of shorn and unshorn sheep, the presence of any area of wool loss regardless of its size was recorded. The results of this study suggest very good reliability of this measure when assessed by different observers.

In the draft protocol, the parameter appearance of the wool was included as a parameter to be applied within an individual observation during milking. Assessing the appearance of the wool of individual sheep when looking at a whole herd did not seem to be possible because of the pronounced flocking behaviour of sheep (Phythian et al., 2012).

The condition of the wool had to be scored along a 3-point scale, ranging from good (score 0) to slightly affected (score 1), and poor (score 2). It is important to note that this parameter does not only focus on the cleanliness of the wool; it includes such aspects as wool-less patches or length of the wool and therefore looks more at the overall condition of the wool-covered parts of a ewe.

Because of feasibility, the observation was only done visually, without additionally parting the hair to examine the skin beneath the wool (even though suggested otherwise by Phythian, 2011).

Testing the parameter on-farm, it turned out not to be feasible to look at all wool-covered parts of a sheep while it was standing in the milking parlour. However, independently of the design of the milking parlour (side-by-side, rotary system), it was possible to look at the wool of the hind parts (around the tail), one side of the body, and the back. As these parts cover a great amount of the woolly areas of a sheep, it was estimated that they are representative enough.

The scoring system for this measure seemed adequate and was not changed after the farm visits before including it in the final protocol (see Appendix); the only minor

Table 3.3: Assessment of *appearance of the wool* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
appearance of the wool	individual assessment in milking parlour; the wool of the hind parts around the tail, one side of the body, and the back are assessed	0 = good (no/only few plaques of dirt*, no/ little bedding adherent, authentic colour of wool) 1 = slightly affected (several plaques of dirt*, bedding adherent, some areas of wet/felted wool, colour of wool not easily identifiable) 2 = poor (many plaques of dirt*, great amount of bedding adherent, great amount of wet/felted wool, overgrown wool and/or wool-less patches, no authentic colour of wool) *plaques larger than palm of the hand	percentage of animals with a slightly affected wool condition (score 1) percentage of animals with a poor wool condition (score 2)

modifications that were made, was to define the size of the plaques of dirt as being at least of the size of the palm of a hand and to decide to assign the scores according to the relative number of plaques of dirt and the overall appearance. Table 3.3 shows the main characteristics of the parameter.

Respiration

Ambient temperature and climate also have an impact on the welfare of sheep (Cockram, 2004). Sheep have a better ability to cope with dry and cold weather than with hot temperatures. Hot temperatures can eventually lead to severe heat stress in the animals, especially if there is no access to shade (Silanikove, 2000; Roger, 2012).

Air pollution by noxious gases (e.g. ammonia, carbon dioxide), microorganisms, and dust further contributes to heat stress as it has a negative impact on the thermal exchange between the body surface of a sheep and the environment (Caroprese, 2008). Additionally, it can lead to problems with the respiratory system (BMGF, 2006).

Also the presence of certain disease (e.g. sinusitis; Pugh & Baird, 2012) can have an impact on the respiratory system of sheep. Respiratory diseases (e.g. pneumonia; Pugh

& Baird, 2012) in particular are an important welfare issue in dairy ewes (Kilgour et al., 2008).

Since heat stress and irritations of the respiratory tract are often reflected by alterations in respiration, this can be used as a cue in welfare assessment.

In the questionnaire study (see Chapter 2) farmers did not mention the respiration of a sheep to be important in the evaluation of their welfare, but literature findings give evidence that respiration has to be considered in terms of welfare.

Silanikove (2000) describes that thermal stress can negatively influence the welfare of sheep and can be indicated by an increased respiration rate and panting. Observations of such signs are reported to be feasible even under extensive housing conditions (Silanikove, 2000).

Respiration rate is described with 20 breaths per minute in healthy, adult, clinically normal sheep (Lovatt, 2010). According to Gougoulis et al. (2010), the combination of a respiration rate higher than 40 breaths per minute and open-mouthed breathing can be defined as panting. The reason for panting is to lose heat and cool the body through evaporation (Gougoulis et al., 2010). However, panting can not only be a sign of coping with heat, but also of extreme exertion or stress and therefore Phythian (2011) emphasises that a clear definition is needed to distinguish between the different causes of panting. The way of breathing as well as the respiration rate can give an insight into a sheep's welfare. Phythian (2011) concludes that a respiration rate with about 200 breaths per minute together with open-mouthed breathing can be an indicator of heat stress and evaluated the presence of excessive panting within a group observation method. Unfortunately, her study provides no information on the reliability of this measure, since it was not observed at any of the farms (Phythian, 2011).

In the draft protocol respiration was assessed within a group observation. It had to be recorded whether more than five animals per group showed an increased respiration rate of 20-40 breaths per minute. It was further assessed whether more than five additional animals per group showed a drastically increased respiration rate (greater than 40 breaths per minute) possibly breathing with an opened mouth. The threshold levels regarding the number of breaths per minute were not set as high as by Phythian (2011), as lower levels already seemed to be indicative of at least impaired welfare.

In the course of the on-farm testing, the conclusion was reached that the assessment of respiration described within the draft protocol was insufficient. Although the

Table 3.4: Assessment of *respiration* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
respiration	15min group observation from outside; instantaneous scan sampling at four points in time: the number of affected animals is counted	increased respiration rate: 20-40 (or more) breaths/min abnormal respiration: panting, breath pumping or any abnormalities in breathing mode or rhythm	percentage of animals showing an increased respiration rate and/or abnormal respiration

approach of assessing the respiration of the ewes as part of the group observation was feasible, making an exact distinction between animals that showed an increased respiration rate and those that showed a drastically increased respiration rate was difficult. Since the welfare of an animal might be impaired as soon as any sign of increased respiration occurs, no matter how severe, it was decided to combine these two classes of increased respiration rate. Therefore, all sheep that showed any increased respiration rate (20-40 breaths per min or higher) were recorded.

Additionally, it was decided to record if any signs of abnormal respiration (panting, breath pumping or any abnormalities in breathing mode or rhythm) were observed at all, as this could also be an indicator of reduced welfare (Lovatt, 2010).

The second problem of the original version of this measure was that merely assessing whether more than five animals per group showed an increased respiration rate did not give any information on how severe the problem was within the flock. Counting the total number of affected ewes was not feasible either, since keeping an overview of the whole group without counting ewes twice - especially when the ewes were moving - was not possible. Therefore, the assessment method was changed from continuous scan sampling (where all affected animals were counted throughout the whole observation period) to instantaneous scan sampling (where the number of affected animals was recorded only at four distinct points in time, following 5 minute intervals). This was thought to give a good insight into the average number of animals with irregular respiration.

This modified version of the measure was integrated into the final protocol (see Appendix). The main characteristics of the parameters are depicted in Table 3.4.

Synchronicity of behaviour

Sheep are animals with a marked sociality who always try to stay with their group (Nowak et al., 2008). Ewes and their offspring build stable social groups which stay in one home range for a longer period of time. Rams build their own groups (frequently changing their home ranges) which break up during the mating season (Fisher & Matthews, 2001). Providing sheep with enough resources (e.g. lying space or space at the feeding trough; BMGF, 2006; Lenz et al., 2012) is of special importance as they are gregarious animals who have a strong need for carrying out certain basic activities together with their group (e.g. feeding and lying; A. Fraser & Broom, 1997). Otherwise, sheep would not only have to compete for access - a problem especially for lower ranking animals - but they would be then also limited in their possibilities to perform certain behaviours synchronically (Bøe et al., 2006).

The need for synchronicity of behaviour is underlined by answers like "all sheep are feeding" or "lots of animals are lying" given by the farmers in course of the questionnaire study when asked for indicators of good sheep welfare (see Chapter 2.2.2).

Synchronicity of feeding or lying behaviour is suggested as a possible indicator of animal welfare by Bøe et al. (2006).

Assessing the synchronicity of behaviour using the draft protocol required to do an instantaneous scan sampling within a group observation, recording the number of animals feeding (not including ruminating, drinking or salt licking) and the number of animals lying at four distinct points in time (following 5min intervals).

After proving to be feasible, the parameter (see Table 3.5) was integrated into the final protocol (see Appendix).

Table 3.5: Assessment of *synchronicity of behaviour* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
synchronicity of feeding	15min group observation from outside; instantaneous scan sampling at four points in time; the number of animals feeding/lying is counted	feeding: repeated uptake of feed from trough/feeding alley/ground, followed by swallowing (excluding rumination, drinking, and salt licking)	percentage of animals feeding
synchronicity of lying		lying: animal in resting position, not standing; usually belly touching the ground	percentage of animals lying

Agonistic interactions

Sheep are known to have a great flocking instinct and to find isolation from their flock mates highly aversive (Nowak et al., 2008). Their social recognition ability mainly relies on visual and olfactory cues (Roger, 2012). Sheep maintain preferred distances from their companions and establish a social hierarchy, which is of special importance when resources are limited (Nowak et al., 2008). Agonistic interactions can be indicative of an environment of limited resources, like space at the feeding trough, or preferred lying areas (Arnold & Maller, 1974) and hence of impaired welfare.

Within the questionnaire study (see Chapter 2) none of the farmers mentioned any kind of agonistic interaction as an indicator of poor welfare. This might be explained by the fact that - in contrast to other species - sheep usually do not display overt signs of aggression, even if competition is high (Dwyer & Bornett, 2004). However, the absence of aggressive behaviour does not mean that subordinate sheep do not experience stress (Dwyer & Bornett, 2004). Competitive situations can have a durable, negative influence on the social behaviour of a herd (BMGF, 2006), and chronic stress can have severe consequences, like reduced immunity (Kilgour et al., 2008).

To maintain hierarchy, sheep often make use of such subtle behaviours as head movements or eye contact (Dwyer & Bornett, 2004). Displacing other ewes is also done by

resting their chins on the backs of subordinates, by pushing them away (Gougoulis et al., 2010) or by pawing (McGlone, 1986). Chasing can also be found in sheep (McGlone, 1986). These more aggressive behaviours might appear when sheep have to deal with limited resources (Bøe et al., 2006), large group size (Kiley-Worthington, 1977) or sudden environmental and social change (Sevi et al., 2001).

Even though agonistic activity is described as relatively low in females (except when they protect their young; Roger, 2012) - especially when compared to other female ungulates (Gougoulis et al., 2010) - it seemed plausible to look at it in dairy sheep herds, as aggressive behaviour is more often found in single age and single sex groups (Stolba et al., 1990). Therefore, in order to get an insight into the social interactions within a flock, it was decided to observe the flock for signs of (aggressive) agonistic interactions when using the draft protocol.

During a group observation, every event of pushing (one individual butting another with its forehead or horn basis), chasing (one sheep quickly following or running after another one) or pawing (threatening stamping in short intervals shown by one individual against another; not to be confused with stamping against insects or scratching the ground before lying down) was registered.

On the test farms, no evidence of the mentioned agonistic behaviours was found. Since the draft protocol was still too long and needed a reduction and agonistic interactions were neither mentioned by the farmers within the questionnaire study nor suggested in scientific literature as an established parameter for on-farm welfare assessment, it was decided to drop this parameter. However, within the final protocol the possibility remains to take notes, if any signs of agonistic interactions arise.

Abnormal behaviour

Animals kept in intensive farming systems are known to show stereotypies or abnormal behaviour which are supposed to be a strategy to cope with the unnatural living conditions they are confronted with (Wechsler, 1995). Therefore, such behaviours are commonly viewed as indicators of impaired welfare (Goddard, 2011).

The results of the farmer questionnaires give evidence that "sheep behaving in a conspicuous way" can be a sign of poor welfare, and that farmers rely on signs of "normal behaviour" to assume their ewes experience good welfare (see Chapter 2.2.2).

Some scientific studies suggest that there are certain stereotypies that can be found in sheep (e.g. wool-biting or wool-pulling; Dwyer & Bornett, 2004), for example evoked by frequent disruption of group stability (Nowak et al., 2008). It is important to note that certain diseases, like rabies, can also lead to abnormal behaviour (Goddard, 2011). However, Goddard (2011) describes sheep as animals which appear to only very rarely display such behaviours, and Nowak et al. (2008) state that "sheep appear to have the lowest rate of stereotyped behaviour of the various species of farm animal". Possible explanations for this fact might be that sheep are only rarely kept in intensive management systems (Dwyer & Lawrence, 2008) or that rumination acts as a buffer to better cope with aversive conditions (A. Fraser & Broom, 1997).

It is suggested by several authors to observe the flock for the presence of abnormal behaviour, because it reflects stress, poor welfare, or impaired health (Sevi, 2009; Caroprese et al., 2010; Phythian et al., 2011, 2012).

Based on these findings, it was decided to record any sign of abnormal behaviour (any behavioural sequence not belonging to the normal behavioural repertoire such as stereotypies, usually only shown by single animals) within a flock observation and briefly describe its appearance within the draft protocol.

Even though abnormal behaviour was not observed at any of the three test farms - most likely because of the relatively little study population - this parameter remained in the protocol, because it seemed to be an important parameter for welfare. Additionally, it was thought to be easily applicable in the course of a group observation. No modifications were made and the parameter (see Table 3.6) was included in the final protocol (see Appendix).

Table 3.6: Assessment of *abnormal behaviour* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
abnormal behaviour	15min continuous group observation from outside; any signs of abnormal behaviour are briefly described	abnormal behaviour: any behavioural sequences not belonging to the normal behavioural repertoire such as stereotypies (usually only shown by single animals)	presence of abnormal behaviour

Qualitative behaviour assessment

Apart from looking at the behaviour of a single sheep or a whole flock in a quantitative way, it is also possible to observe the quality of behaviour as described within the method of qualitative behaviour assessment. This approach focuses on the whole animal with the aim of getting an insight into its emotional life (Wemelsfelder, 2007), which is of importance, as the emotional dimension of welfare makes it impossible to determine welfare merely physiologically (Duncan, 2005). It considers the animal as an entity, and it enables the observer to get an insight into both the physical and the mental experience of an individual sheep thereby underlining present welfare issues and/or revealing new ones (Phythian, 2011). Putting more effort than has been done so far into investigating a sheep's behavioural expressions could contribute to a better recognition of a sheep's emotions and welfare (Wemelsfelder & Farish, 2004).

For farmers, indicators tightly connected to the emotions of the animals or the way they carry out certain behaviours seem to be of great importance when judging their sheep's welfare; within the questionnaires they mentioned terms such as "general impression", "attentive", "active", "curious" to describe good sheep welfare and terms like "apathetic", "restlessness", "low carriage of head", "gaze" to describe poor sheep welfare (see Chapter 2.2.2).

Qualitative behaviour assessment describes the behaviour with terms that have positive or negative emotional components (Phythian, Michalopoulou, et al., 2013) in order to understand an animal's active role in regulating its interactions with the environment (Wemelsfelder, 1997a). This way of assessment works against the approach of

directly judging the emotional state of an animal just by recognising that it behaves in a certain way (Rushen, 1990), as this neglects the fact that behaviours do not reflect one single emotional state with certainty.

The terms that are used for a qualitative behaviour assessment can either be generated by the observer himself/herself when looking at the animals (free-choice profiling; Wemelsfelder et al., 2001) or a pool of fixed terms established in advance can be used (Wemelsfelder & Millard, 2009). Each term is represented by a so-called visual analogue scale, a line of 125mm in length reaching from minimum to maximum (Phythian, Michalopoulou, et al., 2013). Along this line, it can be scored to which extent the term describes the observed behaviour. An important characteristic of qualitative behaviour assessment is that it includes positive terms (e.g. 'relaxed') as well as negative terms (e.g. 'apathetic'; Wemelsfelder et al., 2000) and therefore does not only focus on the absence of negative experiences of an animal (e.g. pain or distress), but also evaluates whether positive emotions (e.g. joy) are present.

This method has to face the criticism of being anthropocentric (Kennedy, 1992) and subjective (Scott, 2005) and hence unscientific (Wemelsfelder & Farish, 2004). These arguments, however, ignore the fact that this intuitive approach has been used since the beginning of stockmanship; people involved in the keeping and caring of animals (e.g. pet owners or veterinary surgeons) usually make use of such an approach when trying to identify the feelings and expressions of the species under their custody (Wemelsfelder, 1997b). Furthermore, although not mandatory, several scientists even use qualitative descriptions of quantitative measures, giving further evidence for the tendency of humans to make use of qualitatively meaningful descriptions (Wemelsfelder & Farish, 2004). To completely leave out this 'psychologically connoted' component of assessment would mean to restrict our abilities to assess animal welfare.

Applying qualitative behaviour assessment to sheep is a relatively new field (Wemelsfelder & Farish, 2004), but according to Roger (2008) such "qualitative interpretation may help clarify any ambiguity of quantitative measurements" and may contribute to a more sheep-centred view of welfare. Several authors suggest that within sheep welfare assessment the whole appearance of sheep should be taken into account - ranging from posture (Lovatt, 2010) and general demeanour (Stubsjøen et al., 2011) over the carriage of head and ears (Phythian et al., 2012) to restlessness (Lovatt, 2010) and apathy (Lovatt, 2010). Also in the the protocols of WelfareQuality® (2009a) qualitative behaviour assessment is used.

After finding out that a panel of experts suggested this approach for sheep on-farm welfare assessment, Phythian (2011) proved this method to be valid, reliable, and fea-

sible when assessed by a diverse group of observers (students, veterinarians, and farm certification assessors) using a list of 12 fixed terms (e.g. 'relaxed', 'tense'). Since applying this parameter was done both with video-clip assessments and during on-farm visits, but reliability was only evaluated for the video-clip results, further reliability-testing on-farm is recommended by Phythian (2011).

As qualitative behaviour assessment is reported to be a method that can easily be applied on-farm without heavily disturbing the flock (Phythian, Michalopoulou, et al., 2013), it was integrated into the draft protocol.

A list of fixed terms was established, following the results of two sheep projects done by Phythian, Michalopoulou, et al. (2013) and Wemelsfelder and Farish (2004) as well as WelfareQuality® (2009a) and the outcomes of the farmer questionnaires. The findings were refined according to the purposes of the draft protocol. It was decided not to use the method of free-choice profiling because it is reported that a fixed list contributes to a more standardised approach for on-farm purposes (Wemelsfelder & Millard, 2009).

Two different schemes for qualitative behaviour assessment were developed to be applied in two different situations, both lasting 15min. The first qualitative behaviour assessment had to be carried out at the beginning of the on-farm visit when the observer was standing outside of the group and the second one a little later when standing inside the group. The second assessment was combined with an approach test. This was done to get an overall impression of the animals during an undisturbed situation as well as when confronted with humans.

For these two assessments different terms were established; the first qualitative behaviour assessment used the terms 'fearful', 'active', 'apathetic', 'attentive', 'relaxed', 'exhausted', 'sociable', 'curious', 'uneasy', 'content', the second one was extended for the adjectives 'pushy', 'outgoing', 'suspicious', 'skittish', 'uninterested', 'avoiding'. However, to ensure standardised use of qualitative behaviour assessment, observers involved have to clarify the meaning especially of ambiguous terms and come to a consensus with regard to their exact definition (Phythian, Michalopoulou, et al., 2013).

When testing both of the two versions of qualitative behaviour assessment on-farm, only the first one appeared to be feasible, and only some minor changes were made: reducing the observation time to 10min because of time constraints and deleting the term 'sociable', because of potentially ambiguous interpretation.

The second qualitative behaviour assessment including the approach test was not feasible as it was very hard for the observer to concentrate on both tasks at the same

Table 3.7: Assessment of *qualitative behaviour assessment* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
qualitative behaviour assessment	10min continuous group observation from outside; afterwards nine terms (qualitatively describing behaviour) are scored along a visual analogue scale (min. to max.)	terms used: fearful active apathetic attentive relaxed exhausted curious uneasy content	qualitative description of behaviour

time. Separating these two tests did not seem to be a possibility as this would exceed the time resources for one farm visit. The underlying idea of a qualitative behaviour assessment is to get an insight into the flock; carrying out a second one therefore might not be necessary as the observer has already got an impression of the animals through the first qualitative behaviour assessment. Furthermore, regarding the terms used, the first and the second qualitative behaviour assessment only differed a little, with the second one including terms connected to the presence of the human which are at least indirectly covered by the approach test.

Hence, only the slightly adapted version of the first qualitative behaviour assessment as depicted in Table 3.7 was integrated into the final protocol (see Appendix).

3.2.2 Appropriate nutrition

A second basic column for good sheep welfare is the one of nutrition. If a sheep does not have the possibility to feed on fodder in right quality and quantity which meets its physiological needs according to its state of production, its nutrition will be imbalanced (Hörth et al., 2009; Caroprese et al., 2010), and several complications will arise.

Undernutrition is of major importance when looking at the welfare of sheep, whereas overnutrition usually only appears in very rare cases (e.g. when dominant animals can take up too much of the feed; Hogan et al., 2008). Dairy ewes that experience undernutrition are not able to reach performance targets as lactation is an energetically demanding process (Kilgour et al., 2008), and body reserves are not able to cover food shortage over a longer period of time. Additionally, their milk might show higher milk somatic cells counts, which can be indicative of metabolic stress (Sevi et al., 2010). The reproductive cycle of ewes can be impaired by undernutrition, producing less lambs than ewes in good condition, and they might experience problems during pregnancy (e.g. pregnancy toxaemia) or lambing (e.g. long labour; DEFRA, 1997). Underfed ewes are more prone to diseases than sheep in a good body condition and could even starve to death (Hogan et al., 2008). Overnutrition is especially relevant in pregnant ewes, as it can lead to pregnancy toxaemia (Clarkson, 2000).

For a balanced nutrition minerals and trace elements are of importance, too (Ganter, 2008). Special attention has to be paid to copper intake, since sheep are at greater risk of copper poisoning than other species (DEFRA, 2003). Abrupt changes of feed can also elicit problems concerning digestion of feed and utilisation of nutrients and can lead to reduced milk yield (Hörth et al., 2009).

Apart from solid feed, water plays an important role in the nutrition of sheep, especially of dairy ewes which produce large amounts of milk a day. If sheep are provided with insufficient amounts of water, their welfare is at risk. Additionally, their feed intake is reduced which has an adverse effect on their milk yield (Hörth et al., 2009).

Lack of feed and water therefore clearly have an adverse effect on welfare, even though only little is known on how sheep exactly experience hunger (Sevi et al., 2010; Goddard, 2011) as the rumen might act as a buffer protecting sheep from extreme sensations of hunger and thirst (Dwyer, 2009).

In scientific literature (e.g. Stubsjøen et al., 2011) as well as in some practical booklets (e.g. BMGF, 2006) it is commonly suggested to look at some resource-based indicators, like through space per animal or access to water to assess the provision of nutrition. Within the draft protocol the parameters body condition and water provision were chosen for assessment, because they seem to make the most direct statement concerning nutrition.

Body condition

The most direct animal-based measure to assess the nutritional state of a dairy ewe is to score its body condition. This is generally more useful than measuring its weight (Goddard, 2011), as weighing a large amount of animals several times a year is not feasible. Furthermore, weight has to be corrected for wool growth, influence of wet wool, weight of the foetus or milk, etc. (LTW, 2006) and can vary to a large extent between healthy animals (e.g. because of breed differences) making the interpretation of the data difficult (ARD, 2005).

The practical relevance of body condition scoring seems to be recognised by farmers who mentioned "body condition" as well as terms like "nutritional status" or "emaciation" several times as an indicator of sheep welfare (see Chapter 2.2.2).

Body condition scoring in sheep has a tradition of over 40 years (Lovatt, 2010). In several guidances for good sheep husbandry the ability of the stock person to recognise changes in body condition through proper assessment is emphasised (DEFRA, 1997); it helps to identify animals that need special care and prevents the development of certain welfare problems (DEFRA, 2003).

As body condition varies according to the production stage (Goddard, 2011; RSPCA, 2013), dairy ewes that are in the right condition at any time of the production cycle are likely to be healthy and productive (DEFRA, 1997), which positively influences their overall welfare. Regular use of this parameter also helps to further plan management actions (DEFRA, 1997). Thus, to ensure a high welfare standard and to guide sheep through a whole production cycle in a healthy and productive manner, this scoring should be done several times a year in several stages of production (LTW, 2006).

When assessing the body condition of a sheep the vertical bone protrusions and the short horizontal protrusions of the loin vertebrae are felt by manual palpation of the back (DEFRA, 2003; ARD, 2005), and the condition is scored along a scale. While it is usually possible to palpate the bony structures through the wool and the skin, it is sometimes more difficult in fat ewes (ISU, 1986). It is important that the animal is in a

relaxed position because when an animal is tense, scoring is difficult or impossible (LTW, 2006). In contrast to visual observation, manual palpation is much more accurate (ARD, 2005), especially because of the wool-cover of sheep. This is different to the common practice in cattle, where visual assessment seems to be sufficient (WelfareQuality®, 2009a). Body condition scoring is a convenient management tool (ARD, 2005) that is easy to learn and quick to apply (LTW, 2006) and therefore easy to incorporate into the farm routine.

To test the feasibility of the parameter body condition, Phythian (2011) applied two different scoring systems. Both of them - the 6-point scoring scale developed by Russel (1984, quoted in Phythian, 2011) and a simplified version of it (classifying a sheep either to be thin, fit, or fat) - turned out to be reliable when assessed by different observers. However, the use of the 3-point scoring scale had even better reliability results (Phythian, 2011).

Stubsjøen et al. (2011) also used a 6-point scoring scale and in a more practical guideline for stock people by the Department for Environment Food and Rural Affairs a 5-point scale is suggested (DEFRA, 1997). In the study conducted by Napolitano et al. (2011) also a 5-point scoring scale was applied. Different scoring systems use either whole numbers or half or even quarter scores as intermediate points along the scale.

Even though using the parameter body condition seems to be a reliable and feasible method to assess the nutritional state of an animal, critical voices point out that it does not necessarily indicate if a sheep experiences the mental state of hunger (Lawrence & Conington, 2008). Lawrence and Conington (2008) write that "it is common sense that very low condition scores are indicative of poor physical welfare and also very likely mental suffering as well. However, there is very little information available to judge at what point low condition scores begin to impact significantly on welfare...".

As long as no other parameters are developed to measure the feeling of hunger in sheep, body condition scoring seemed to be a suitable approach to this issue and was hence included in the draft protocol as a parameter to be applied in the course of an individual observation during milking. The fact that animals were restrained and lined up next to each other facilitated assessment and saved time. A 5-point scoring scale was applied with score 1 referring to cachectic, score 2 to emaciated, score 3 to fit, score 4 to fat and score 5 to obese animals. This scale was modified after Braunreiter (2012).

The assessment of the parameter body condition was carried out at all test farms and proved to be feasible. No changes had to be undertaken before including the parameter

Table 3.8: Assessment of *body condition* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
body condition	individual assessment in milking parlour; the spinous processes (s.p.), transverse processes (t.p.), loin muscle, and fat cover behind the last ribs are palpated	1 = cachectic (single s.p. and t.p. can be felt easily, little loin muscle, no fat cover) 2 = emaciated (single s.p. can be felt, single t.p. can not be easily distinguished, loin muscle thin, very little fat cover) 3 = fit (s.p. can be felt but single ones can not be distinguished, t.p. can be felt only with pressure, loin muscle and fat cover well developed) 4 = fat (s.p. can be felt only with pressure, t.p. cannot be felt, loin muscle well developed, thick fat cover) 5 = obese (neither s.p. nor t.p. can be felt, loin muscle very well developed, very thick fat cover)	percentage of cachectic animals (score 1) percentage of emaciated animals (score 2) percentage of fit animals (score 3) percentage of fat animals (score 4) percentage of obese animals (score 5)

(see Table 3.8) in the final protocol (see Appendix), neither in the way the assessment was carried out nor within the scoring scale.

Water provision

Provision of a sufficient amount of fresh water is crucial to ensure animal welfare (Lenz et al., 2012) as drinking is one of the most basic needs of any living being. This is especially true for lactating animals like dairy ewes, who require at least the double amount of water (up to 15l per day; BMGF, 2006) than non-lactating ewes (Roger, 2008). The actual amount of water a sheep takes up per day depends on several different factors like water content of the feed, size of the animal, etc. Particularly when ambient temperatures are very high or when animals are sick, sufficient water provision is essential (BMGF, 2006). If water provision is deficient, this does not only lead to a decrease in milk yield, but also represents a threat to health and welfare of the dairy

ewe and can in the most severe cases, even lead to the death of the animal (BMGF, 2006).

Farmers did not mention animal-based indicators of the sheep's nutritional status with regard to water, but they named "fresh water", "sufficient and clean water", etc. as important requirements for good sheep welfare (see Chapter 2.2.2).

As written by Phythian (2011) it is not possible to use clinical signs of dehydration (e.g. sunken eyes, dry mucous membranes) as parameters for an on-farm welfare assessment, even though insufficient water provision can manifest in such a way. This is because clinical signs of dehydration only appear in very severe cases of water deprivation, failing to detect animals that suffer from a less extreme lack of water that nevertheless decreases their welfare. Additionally, there are no validated animal-based parameters available to detect dehydration or only such which would not be feasible for on-farm assessments (Phythian, 2011). The results of the farmer questionnaires give further evidence for this problem as farmers in general did not mention any animal-based indicators related to water supply, but nonetheless pointed out the importance of water provision as explained earlier. The only way to assess the water provision on a farm is to make use of resource-based measures as suggested by the scientists who worked on the project WelfareQuality® (2009a).

As described in sheep husbandry guidelines (e.g. BMGF, 2006) sheep are very sensitive to the quality of water, and clean and fresh water has to be available at all times. Contamination of the water with dung, urine, food leftovers, algae, etc. has to be prevented as it does not only affect the taste of the water, but also gives way to bacterial growth which can lead to diseases of the dairy ewe (BMGF, 2006).

Water should be provided ad libitum in cup drinkers or water troughs (Krenn et al., 2011), which facilitate a water intake that is appropriate to the species (BMGF, 2006). Sufficient drinkers or troughs in the animal area should ensure that all sheep - also the lower ranking ones - have access to water at any time (EuropeanConvention, 1992; BMGF, 2006). Water points should be easy to access for all sheep regarding height and position (BMGF, 2006; Krenn et al., 2011). The number of water points required depends on the number of ewes kept within one compartment (about one drinker per 20 animals), but should never be less than two (e.g. because one might cease to function; BMGF, 2006). Regular supervision and cleaning of all water points is required (EuropeanConvention, 1992). Concerning the water flow no data are available for the minimum requirements; commercially available drinkers for sheep in Austria, however, have a water flow of 7-8l/min.

In the protocol of WelfareQuality® (2009a) for dairy cattle evaluation of the water provision includes the assessment of the number of water points, their cleanliness, water flow/water reservoir, and functionality.

Stubsjøen et al. (2011) assessed the hygiene of and the access to water along a 3-point scale (ranging from good to poor) within their on-farm welfare assessment protocol for sheep.

The presence of a water supply, its accessibility, and cleanliness were also part of the parameter-testing done by Phythian (2011).

In order to get an insight into the water provision on-farm, the draft protocol included the assessment of the number of water points as well as their water flow (at least 7l/min) and cleanliness (no stainings of faeces, algae, etc.).

Although the feasibility of assessing the number of water points and their water flow, and cleanliness was given, two further criteria had to be added: the mechanical functioning of the water point and the accessibility for all animals. Additionally, the definitions were extended so that they could also be applied to troughs.

The final protocol (see Appendix) now includes the following four different measures which have to be applied to every single water point as depicted in Table 3.9: water flow or water volume (depending on whether drinkers or troughs are provided), cleanliness, mechanical functioning, and access. Each of these measures has to be scored along a 2-point scoring scale, and only if one water point fulfils all criteria (score 0), it can be counted as a water point that is actually available for the ewes. Summing up the number of these water points in the end and relating that to the number of sheep shows whether the water supply is sufficient.

Table 3.9: Assessment of *water provision* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
water flow/volume	the water flow of each water point is assessed by taking the time needed to fill a measuring cup and calculating the water flow in l/min (in case of troughs: calculation of volume)	0 = adequate (water flow 7l/min or water volume 5-15l/sheep and day or higher) 1 = inadequate (water flow/volume too little)	number of water points fulfilling all four criteria in proportion to the number of animals (1:20, but at least 2 water points per group)
cleanliness	each water point is inspected	0 = clean (no stainings in water/drinker) 1 = dirty (stainings with faeces, algae etc. and/or unnatural odour)	
mechanical functioning		0 = good (proper functioning) 1 = poor (mechanical defect)	
access		0 = easy to access (access possible for all sheep) 1 = hard to access (access impaired because of height, position, etc.)	

3.2.3 Good management

Sheep used for production purposes usually have to undergo several management procedures, either once in their life (e.g. tail docking), from time to time (e.g. claw trimming) or regularly (e.g. milking). The aim of good management towards good dairy sheep welfare, leaving animals as undisturbed as possible by management procedures, becomes fully evident when considering that dairy sheep in particular are confronted with a relatively artificial environment and are demanded to produce a high amount of milk under certain technological conditions (Kilgour et al., 2008). Not all of the common management processes are only undertaken to facilitate or increase production (e.g. weaning), but also to ensure good animal welfare (e.g. claw trimming). However, it is known that sheep can be highly fearful of these performances and experience severe levels of acute stress. This might eventually lead to chronic stress (Rushen, 1990) which in turn has a negative impact on their health and welfare (Goddard, 2008).

Goddard (2008) states that "the skilled stockperson has the ability to reduce the impact of some of the negative experiences that potentially aversive procedures - individual handling or transportation for example - may engender". Therefore, it is important not only to consider which procedures are carried out, but also who is carrying them out. Usually the stock person is the one that interacts with his/her sheep the most and thus is tightly connected to several management practices. Beausoleil et al. (2002, quoted in Goddard, 2008) suggest that sheep might view humans as potential predators which might be the reason why sheep often appear to be quite fearful of human beings (Caroprese et al., 2010). A close approach by the handler during milking, for example, can be fear-eliciting and stress-provoking (Hemsworth, 2003).

The quality of the relationship between the animals and their handler is a key factor affecting animal welfare (Napolitano et al., 2011). In a study conducted with dairy cows a negative influence on the productivity of poorly handled animals was found (Breuer et al., 2000). Once an animal experienced the interaction with the stock person negatively (e.g. because of rough handling), it will become fearful of the stock person or certain handling procedures or at least experience them as being aversive (Phythian, 2011). Consequently, the next time it might behave in a way which makes handling even more difficult for the stock person, evoking stress and negative feelings also in the stock person, which then results in even rougher handling, like slapping the animal or shouting at it. If such a vicious circle has begun, there is an increasing risk of injuries

for the animal as well as the handler (Rushen et al., 1999) and the welfare of both is endangered.

In contrast, positive handling experiences might improve animal welfare as shown in cows (Waiblinger et al., 2004) as well as in sheep. Gentling in sheep has been found to reduce fear of humans (Dwyer & Bornett, 2004) and to establish a positive social bond between the animal and the human (Boivin et al., 2000), especially when done from an early age (Dwyer & Bornett, 2004). So, as Kilgour et al. (2008) express "...attention to the development of a relationship with the stockperson in the early life of the dairy lamb, and positive handling during the productive life of the ewe, will help to reduce welfare issues with milking of dairy ewes". Positive human-animal interactions can therefore mitigate the potentially negative experiences that might accompany certain management procedures (Dwyer & Lawrence, 2008). Since this might once again alter the way the stock person experiences the situation, such human-animal interactions have a reciprocal effect on both partners (Hemsworth, 2003).

Several guidelines and booklets for caretakers deal with proper handling and good stockmanship (EuropeanConvention, 1992; DEFRA, 2003; BMGF, 2006; RSPCA, 2013). However, to evaluate the impact of certain management procedures and the stock person himself/herself on the welfare of sheep, scientifically valid measures are needed (Phythian, 2011). Also Waiblinger et al. (2003) report the lack of "generally accepted and used methods" for the assessment of human-animal relationship on dairy farms and started to conduct some studies in this field.

Although some resource-based measures are described in literature (e.g. the maintenance of handling equipment; Phythian et al., 2011), a few animal-based measures will be suggested below. Issues like castration (e.g. Goddard, 2011; Phythian et al., 2011) will not be described as this does not relate to the female dairy sheep. The fact that the draft protocol should be the basis for short on-farm welfare assessments gives no possibility to properly assess management procedures like shearing, isolation of sick animals, appropriate intervention at lambing or the obligatory procedure of ear tagging (Phythian et al., 2011).

Capture time for milking

The procedure of milking clearly is one of the major management processes in dairy sheep husbandry. Usually carried out twice a day, it highly influences the health and welfare of dairy ewes which might also manifest in their behaviour.

Sheep are known to have a very good memory for place (Hutson, 2007) and hence, might connect the procedure of milking with unpleasant former experiences (e.g. poor handling). If this is the case, they will very likely try to avoid entering the milking parlour. Additionally, sick animals might also refuse to come into the milking parlour (e.g. because of lameness). In contrast, animals that do not fear to be milked or even have positive associations with entering the milking parlour (e.g. being fed concentrates during milking) are more likely to voluntarily walk into the milking parlour when requested to do so.

Answers like "sheep refuses to enter the milking parlour" given by the farmers within the questionnaire study as an indicator of negative welfare (see Chapter 2.2.2), indicate that such cues are relevant for farmers in their daily work with the sheep.

Caroprese et al. (2010) suggest to use the capture time for milking as a possible parameter in dairy sheep welfare assessment.

The parameter was hence included in the draft protocol and defined as the average time needed to capture the ewes; it was measured from the moment the stock person/milker encouraged the sheep to enter the parlour until all ewes of one milking batch got in.

This parameter was applied at all three farms, but turned out to be problematic. The main difficulty was that it was nearly impossible to tell when exactly the milker encouraged the ewes to enter the milking parlour. At all three farms, sheep were highly motivated to get in and did not really have to be encouraged to do so. Therefore, this process only lasted for seconds, and it was not feasible to measure the starting and the end points.

Another problem became obvious at the second test farm, where the design of the milking parlour (rotary system) and the waiting area (not to be seen when standing at the milker's place) did not allow to observe the time it took to capture the ewes.

The evaluation of this parameter seemed to be too complicated for on-farm assessment purposes, as calculations including the number of sheep and their walking distance to the milking parlour would have to be made in order to receive comparable results. In addition to that, the interpretation of the parameter might not be easy, since quickly entering the milking parlour might also be a fear reaction of the sheep to an aversive driving stimulus, like an aggressive stock person or a sheep dog. Furthermore, it is not very likely that all ewes will refuse to enter the milking parlour. It might be that single

animals show an aversion against coming into the milking parlour, but the reasons for that can be diverse (e.g. fear of the milker, disease) and will make the outcome hard to interpret.

Deleting this parameter was therefore necessary. However, the parameter behaviour during milking, which is described later on can give an insight into a dairy ewe's welfare connected to milking, too.

Behaviour during milking

As described earlier the management procedure of milking can be experienced negatively by dairy ewes which might become obvious in their behaviour. If the milking procedure evokes stress, and the animals get nervous, this has a negative effect not only on their welfare, but also on their productivity. Besides stress, animals may also experience pain during milking, e.g. because of diseases like mastitis. Since emotional as well as physical stress contribute to poor welfare, measures should be established to identify signs that indicate stress during milking.

Interestingly, within the questionnaires (see Chapter 2), none of the farmers mentioned *behavioural indicators* of poor welfare which become apparent during milking.

However, in scientific literature Caroprese et al. (2010) propose to record kicking behaviour as an indicator of the ewes' welfare. Together with records of the incidences of defecation and urination, which can represent signs of fear or stress (Archer, 1973) this might make it possible to evaluate welfare (Caroprese et al., 2010).

These three behavioural signs were included in the draft protocol as parameters assessed during milking. Every event of kicking (lifting a hind leg higher than 10cm and suddenly stretching/ relocating it without the purpose of walking), defecation (releasing faeces), and urination (excreting urine) had to be recorded.

In the course of the on-farm testing no difficulties were experienced with the proposed version of the parameter. Without making any adaptations, the parameter behaviour during milking (see Table 3.10) could be implemented into the final protocol (see Appendix).

Table 3.10: Assessment of *behaviour during milking* in the final protocol

Indicator	Procedure	Definition	Parameter
kicking	continuous observation of milking batch from behind; every single event of kicking/ defecation/ urination is counted	kicking: lifting a hind leg higher than 10cm and suddenly stretching/ relocating it without the purpose of walking	average number of events of kicking per animal
defecation		defecation: releasing faeces	average number of events of defecation per animal
urination		urination: excreting urine	average number of events of urination per animal

Ear temperature

An indicator of sheep welfare that was suggested by sheep farmers within the questionnaires (see Chapter 2.2.2), but not found in literature is ear temperature. Several farmers mentioned that sheep that have "cold or hot ears" are experiencing poor welfare. Regularly touching the ears of the animals seems to be a feasible measure for practitioners to become aware of any health or welfare problems.

Looking for the meaning of sheep ear temperature in literature revealed that a connection between ear temperature and stress exists (Lowe et al., 2005). Lowe et al. (2005) suggest that at least part of the stress responses mediated by the sympathetic nervous system (responsible for stress responses) can be made visible by measuring ear-pinna temperature; they found that decreases in ear-pinna temperature indicate periods of physical activity in sheep, and that there is an association between prolonged periods of decreased ear-pinna temperature and elevated cortisol and catecholamine levels. The sympathetic nervous system is activated in situations that are threatening to the sheep and is tightly connected to sensations of stress (Lowe et al., 2005). This is in concordance with other literature findings. They show that during exercise (e.g. flight reaction) the ear-pinna temperature in sheep rapidly decreases while the core temperature rises (Ingram et al., 2002). This is due to the fact that in

Table 3.11: Assessment of *ear temperature* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
ear temperature	individual assessment in milking parlour; both ears are touched	0 = inconspicuous (normal ear temperature) 1 = conspicuous (ears appearing to be 'cold' or 'hot')	percentage of animals with conspicuous ear temperature (score 1)

such situations, blood is sent to the core of the body to ensure the onset of exercise, and the associated vasoconstriction in the ears causes them to display lower ear pinna temperatures (Bell et al., 1983).

It might be the case that animals experiencing severe stress show lower ear temperatures which can be detected by the stock person. However, it is questionable whether it is also possible to detect long-term stress in sheep with this method. There was no explanation found for the occurrence of extremely high ear temperature, but variations in ear temperature might also be due to fever accompanying severe disease or due to inflammations of the ear (e.g. ear tag lesions).

The reason that ear temperature as a parameter for animal welfare is not described in scientific literature might be that it is hard to standardise it in terms of subjective temperature as experienced by different assessors. The alternative - using measuring instruments - seems to be too elaborate and expensive for on-farm assessment.

Since it seemed to be of practical importance for sheep farmers as shown by the questionnaire outcomes, the measure was integrated into the draft protocol to test its feasibility. While the ewes were standing in the milking parlour the ears of every individual had to be touched, and it had to be recorded whether their temperature seemed to be inconspicuous (score 0) or conspicuous (score 1).

At all three farms it was easily possible to touch both ears of a ewe when they were restrained in the milking parlour. No marked differences in temperature could be detected, maybe because of the relatively little study population. Since the parameter was easily applicable and was suggested by farmers as a welfare indicator, it remained in the protocol.

It was refined by establishing a scoring system in order to keep the recording of data simple (see Table 3.11). Even though the parameter is now part of the final protocol (see Appendix), further research is needed.

Vocalisation

Within the questionnaires several farmers mentioned "bleating" to be an important indicator of sheep welfare (see Chapter 2.2.2). However, these results were not easy to interpret, as bleating animals were viewed as both a sign of good as well as a sign of poor welfare. These confusing findings could not be clarified by literature research which showed that the topic of vocal signals in adult sheep (especially in terms of recognition) has only been poorly investigated so far (Nowak et al., 2008).

It seems that vocalisations in sheep are restricted to interactions between ewes and their lambs and the behaviour of rutting rams (Nowak et al., 2008), making the interpretation of vocal signals in a flock of dairy ewes even more difficult. Some sources claim that bleating is a characteristic of a healthy flock (EuropeanConvention, 1992), while other authors suggest that vocalisation could be an indicator of fear (Stubsjøen et al., 2010) or (isolation) distress in sheep (usually connected to weaning; Nowak et al., 2008). However, Dwyer and Lawrence (2008) point out that sheep drastically reduce their vocalisation behaviour in the presence of a potential predator - a fearful response that overrides the increased vocalisation which is shown in other aversive situations.

Even though the use of vocalisation as a parameter for on-farm welfare assessment has not been investigated so far, it seemed to be interesting to look at in terms of stress and welfare of a flock. Therefore, the recording of any vocalisation event during a group observation was included in the draft protocol.

At the test farms, it became obvious that the parameter was too complex to integrate it into an on-farm welfare assessment scheme.

Firstly, recording every single event of vocalisation was very laborious or nearly impossible (especially when the majority of animals was bleating), as other measures had to be recorded at the same time within the group observation as well.

Secondly, interpreting the data was not possible. Initially, there was hope that interpreting the meaning of the vocalisations would be made easier by the fact that the observer will get an insight into the behaviour of the herd during the group observation, but this turned out not to be true.

As opinions about the role of vocalisation behaviour as a welfare indicator were already divided in scientific literature and the outcomes of the farmer questionnaires, it was decided to exclude this parameter from the protocol.

Length of the tail

A management procedure that is commonly undertaken in sheep husbandry is the removal of a proportion of the tail in lambs (Dwyer & Lawrence, 2008; Phythian, 2011). Usually, this is done to keep the breach area of sheep clean from faecal soiling in order to prevent a myiasis infection (Wood & Molony, 1992; French et al., 1994), which can represent a major welfare problem (Dwyer & Lawrence, 2008). Often, exactly this argument is taken as a justification to routinely perform this surgical intervention (Dwyer & Lawrence, 2008), but a simple cost-benefit assessment - taking into account the aversive effects of the procedure and a realistic risk analysis concerning myiasis - would be more efficient in terms of welfare (Goddard, 2011). Even though myiasis is not reported to be a major problem in Austria, and tail docking is not routinely carried out in dairy sheep in Austria, some farmers tail dock their ewes to avoid problems during the lambing season or for greater comfort for the milker.

Within the outcomes of the farmer questionnaires (see Chapter 2) no answer was found that was related to the topic of tail docking. This might be because it is not seen as an indicator that gives an insight into the temporary welfare status of a sheep. However, the procedure of tail docking itself and its consequences have a negative impact on the welfare of the animals.

The Austrian law permits the removal of a third of the tail or of its half in breeding females (THVO, 2004). Lambs must not be older than three days when tail docking takes place, except, if the procedure is done by a veterinarian under anaesthetic (THVO, 2004). In any case it has to be done by using a sharp knife (THVO, 2004). However, no matter what the circumstances are, this procedure causes pain and discomfort (Wood & Molony, 1992; Phythian, 2011). Even if tail docking is carried out in a careful manner, and anaesthetics and analgesics are used, it remains to be an intervention interfering with an animal's integrity. There is no evidence that sheep use their tail for communication purposes or to remove flies, and not much is known about phantom limb pain in this species (Dwyer & Lawrence, 2008); nevertheless, the procedure per se is clearly aversive to the sheep, eventually resulting in chronic pain, inflammation or the development of a neuroma (Goddard, 2008). It can further predispose ewes to prolapse of the vagina or cervix (Roger, 2008) and leaves behind a mutilated animal.

Proving whether the tail docking policy of a farm is in concordance with the law in force is required when using the checklist published by the 'Bundesministerium für Gesundheit und Frauen' (the Austrian Ministery for Health and Women's Affairs) and the 'Bundesministerium für Land- und Forstwirtschaft, Umwelt- und Wasserwirtschaft'

(the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management; BMGF, 2006).

In the dairy cattle protocol of WelfareQuality® (2009a) a few questions asking the stock person about the policy of tail docking at his/her farm are included, too.

Also Napolitano et al. (2009) recorded the absence or presence of routine mutilations like tail docking, and Phythian (2011) came to the conclusion that assessing the length of the tail of individual standing sheep according to the legal compliances (for England) was a reliable and feasible measure. She recommends it for implementation into on-farm welfare assessment schemes.

In the draft protocol the parameter was included in a way that the length of the tail of a sheep should be scored along a 4-point scale when the ewes were standing in the milking parlour. The scores ranged from 'undocked' (score 0) over 'docked, half of the tail remaining' (score 1) to 'docked, a third of the tail remaining' (score 2) and finally to 'docked, only lesser than a third of the tail remaining' (score 3). It is important to note that in some cases short tails are the result of accidents and not necessarily of tail docking.

Within the farm visits it became clear that the 4-point scoring system for the length of the tail was too sophisticated to be applied in the course of an on-farm welfare assessment. The differentiation between scores 1 and 2 in particular was hard to make in some cases, as there are natural variations in tail length between individuals and breeds. Therefore, the scale was changed to a 3-point scoring system in accordance with the Austrian law.

The final scoring system distinguishes between undocked tails (score 0), docked tails in compliance with the Austrian law (remaining tail at least half as long as the original tail; score 1), and docked tails with less than half of the original length of the tail remaining (score 3). From an animal point of view, it might not make much of a difference whether two thirds or half of the tail is remaining, as tail docking represents a severe operation anyway; whereas if the tail is docked so that only a minimum remains, this represents not only a threat to welfare, but also brings along serious health problems and is forbidden within Austrian legislation. The new version of the measure (see Table 3.12) can be found in the final protocol (see Appendix).

Table 3.12: Assessment of *length of the tail* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
length of the tail	individual assessment in milking parlour; the length of the tail is assessed	0 = tail undocked 1 = tail at least half of original tail 2 = tail shorter than half of original tail	percentage of animals with tail at least half of original tail (score 1) percentage of animals with tail shorter than half of original tail (score 2)

Approach test/Reaction to an unfamiliar human

As already outlined above, the interaction of a stock person with his/her dairy ewes can considerably influence the welfare of the animals and should therefore be evaluated within an on-farm welfare assessment.

The importance of assessing the human-animal relationship becomes obvious when looking at the farmer questionnaires (see Chapter 2.2.2). There, animals being "trusting" and showing "no fear" were mentioned as signs of good sheep welfare.

However, directly assessing the quality of the relationship a farmer has with his/her dairy ewes is no easy task, as this would involve observing their interactions in a daily situation. As this would most likely include informing the stock person about the observation in advance, the results might get distorted because of the stock person altering his/her behaviour, consciously or unconsciously (Waiblinger et al., 2003). Self-assessment of the caretaker is possible (Phythian et al., 2011), but might not return viable results, as he/she might not be able to objectively reflect upon his/her interactions with the animals, e.g. when answering a questionnaire (Waiblinger et al., 2003).

Stubsjøen et al. (2011) used a test in ewes where the stock person was actually involved without knowing about his/her role. As this was not thought to be feasible for the purposes of the draft protocol and seemed quite dishonest to the stock person, it was not adopted.

A so-called approach test which is also used in the dairy cattle protocol of WelfareQuality® (2009a) relies on the assumption that an animal's reaction to an unfamiliar human would - at least to some extent - reflect its response to the stock

person. Within this test, animals have the chance to approach and eventually touch a test person that quietly stands in a central place of the pen in a standardised manner. However, this test seems to bring along some difficulties in the interpretation of the results: the behaviour of an animal, and therefore also the extent to which it avoids people, always reflects a mixture of motivations (Stubsjøen et al., 2011). This means that not approaching the test person does not automatically reflect fear and suspicion, but maybe simply a lack of interest (Jago et al., 1999). Additionally, (subtle) behaviours of the animals might not be understood and therefore misinterpreted (Lawrence & Coneington, 2008). Also other factors not primarily linked to the quality of the human-animal relationship like the presence of peers, as has been shown in calves, play a role in the animals' reaction (Grignard et al., 2000).

Since there is a lack of other validated testing procedures, an approach test was included in the draft protocol. Within the draft protocol testing the approach behaviour was combined with a qualitative behaviour assessment. Standing motionless in the pen for 15min the test person was doing a qualitative behaviour assessment, at the same time counting the number of ewes approaching and touching him/her and registering the time they needed to approach.

During the on-farm testing it became clear that carrying out the approach test and the second qualitative behaviour assessment at once was not suitable for on-farm welfare assessment. It was not possible for the observer to concentrate on both tasks at the same time. Recording the time individual ewes needed to approach the test person was not feasible, as it was not possible to take any equipment (e.g. paper and pencil to take notes) into the pen in order not to disturb the animals. Therefore, it was decided to do the approach test separately.

Furthermore, the test did not seem to be applicable to a species as fearful as sheep, because they are much more hesitant and suspicious than for example cows and usually do not show pronounced approach behaviour. As sheep show a distinct herd behaviour and are very likely to more or less react as a group, the test was further developed, putting a lower value on the approach behaviour of single animals, but measuring the overall reaction of a flock. Similar to the first test, the test person entered the pen and remained motionlessly in a central place; in contrast to the first version of the test, the test person crouched down and only remained in the group for 10min. The fact that the test person crouched down might be criticised as this is not the normal posture stock persons take when they are working with the ewes. However, as sheep are much

Table 3.13: Assessment of *reaction to an unfamiliar human* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
reaction to an unfamiliar human	10min continuous group observation within the group; the assessor enters the group, crouches down in a central place, and observes the overall reaction of the group	0 = trusting (ewes are not irritated, eventually seeking contact) 1 = shy (ewes are very attentive, remaining at distance) 2 = highly fearful (ewes are highly disturbed, fleeing and crowding together at maximum distance)	overall reaction of a group

smaller than other livestock, it would only be fair to face them at eye level as done with cows when standing upright. Crouching down is also done in testing fear of humans in sows within the pig protocol of WelfareQuality® (2009b). As sheep are prey animals who might experience humans as a potential predator (Beausoleil et al., 2002, quoted in Goddard, 2008), crouching down seems even more plausible.

A 3-point scoring system was established describing different possible reactions of the flock to the test person. Score 0 describes a trusting flock, score 1 identifies a flock as being shy, and score 2 represents a highly fearful reaction of the animals.

This newly developed test (see Table 3.13) does not seem to be affected by the difficulties of interpretation of the animals' reaction, as the overall reaction of a flock is taken into account, rather than only the approach behaviour itself. Hence, the test could be integrated into the final protocol (see Appendix).

3.2.4 Proper healthcare

Another aim towards good sheep welfare is proper healthcare. Roger (2008) defines disease as "a state of disturbance to the health status of an animal...[which] can be caused by any factors that alter this status". Consequently, such a state causes adverse welfare to an individual or a flock (Gougoulis et al., 2010), which becomes apparent in many different ways (Fitzpatrick et al., 2006). Additionally, the presence of disease often reduces the body's defence mechanisms and predisposes animals to further illness (FSA, 2007). Proper healthcare is therefore crucial when talking about sheep welfare.

Parameters concerning health have to be taken into account when welfare is to be assessed; however, the assessment of welfare goes far beyond the simple judgement on whether disease or other health disturbances are present or absent (Goddard, 2011). This is specifically true if the disease is accompanied by the sensation of pain. Recently, in the course of the FP7-project Animal Welfare Indicators, scientists have started to investigate the impact of several common diseases on the welfare of sheep, and how they are related to pain (AWIN, n.d.). Animals that suffer from a disease might not be able to behave normally or take up as much feed as they need to remain in a good body condition (Roger, 2008).

Diseases can be of infectious and non-infectious origins (Martin & Aitken, 2000), and their consequences range from chronic affliction to sudden death (Fitzpatrick et al., 2006). In contrast to other species, sheep losses because of disease can be relatively high and can occur rapidly (Roger, 2008). Clinical conditions with high on-farm prevalences that are associated with severe pain and discomfort as well as diseases that are long in duration are of special concern, because they severely affect short-term and long-term welfare of a sheep (e.g. lameness, parasites, mastitis; Fitzpatrick et al., 2006).

Sheep are vulnerable to a large number of different diseases with diseases of the claws and feet (e.g. footrot), parasites (endo- and ectoparasites), respiratory diseases (e.g. pneumonia), diseases of the udder (e.g. mastitis), diseases connected to the gestation period (e.g. pregnancy toxaemia) and diseases connected to lambing (e.g. vaginal prolapse), diseases of the alimentary tract (e.g. diarrhoea), dental diseases (e.g. periodontal disease), infections of the eyes (e.g. conjunctivitis), bacterial infections (e.g. pseudotuberculosis), and viral infections (e.g. ORF) mentioned in literature (Martin & Aitken, 2000). All of these clinical problems can be accompanied by several different symptoms, sometimes very similar ones. A detailed diagnosis can only be made by

a veterinary surgeon in the course of an accurate physical examination of an individual or several animals of a flock (Lovatt, 2010).

Since the health of an animal directly affects its welfare, several authors suggest that the health status of an animal should also be recorded within a more general welfare assessment (Sevi, 2009; Phythian et al., 2011). As part of an on-farm welfare assessment only certain clinical signs can be recorded (Phythian, 2011) that are indicative of the presence of one or more diseases and further can be reported to the stock person and/or veterinary surgeon. Some of them are relatively straight-forward as deviations from the normal appearance of a sheep can easily be detected (e.g. alterations in the gait; Dawkins, 2006). Several measures assessing signs of poor welfare related to the health status of a dairy ewe will be described in the following part.

Lameness

Lameness is one of the major disease concerns in sheep (DEFRA, 2003; Roger, 2008) in all countries around the world where sheep husbandry is practised (MAFF, 1999; Goddard, 2011). It is estimated that lame sheep can be found in 80% of all sheep flocks, and prevalences of certain clinical conditions (e.g. scald) might be as high as 15% (Winter, 2004a). Lameness has a substantial impact on a sheep's welfare as it can cause pain, discomfort (Fitzpatrick et al., 2006), and debilitation (Ley et al., 1995).

Even though Dwyer and Bornett (2004) state that this common cause of suffering and distress in sheep, and its impact on welfare is often under-emphasised, and Dwyer (2009) claims that lameness is not taken seriously enough by stock people, this could not be supported by the results of the present questionnaire study. Here - for good as well as for poor welfare - the most important sub-category of *indicators of overall appearance* was *claws/movement* (see Chapter 2.2.2). Answers like "style of movement", "limping animals" or "walking slowly while bending the back" underline the recognition abilities and awareness of farmers concerning lameness.

In dairy sheep breeds, special attention has to be paid to the health of the claws and feet, since they are especially susceptible to disease of these body parts (DEFRA, 2003). There is a wide variety of clinical symptoms of lameness, depending on the severity of the disease (Dwyer & Bornett, 2004). Direct signs range from slight alteration of the gait to severe impairment of walking abilities and reluctance to move (Dwyer & Bornett, 2004); more indirect effects of lameness include weight loss and poor body condition due to a reduced feed intake (Egerton, 2000). This in turn decreases the

productivity of a ewe, in terms of fertility, lamb survival (Nieuwhof & Bishop, 2005), milk and wool yield (MAFF, 1999) and also affects the susceptibility of sheep for other diseases (e.g. metabolic diseases during pregnancy; Winter, 2004a). Lameness also is a predisposing factor for myiasis (Winter, 2004b). Consequently, lameness is of economic concern for a farmer (MAFF, 1999; Winter, 2008), because of productivity losses, additional labour time, and cost of drugs (Hodgkinson, 2010).

Although lameness can originate in the feet or the joints, the feet are usually the first to be affected (DEFRA, 2003; Winter, 2004a). Causes for lameness are widespread (Winter, 2008). The two most important types of lameness originating in the foot and caused by infectious agents are interdigital dermatitis and footrot (Winter, 2008). Interdigital dermatitis is caused by Fusobacterium necrophorum, usually after the skin has been irritated by wet or damp conditions (Winter, 2008). Footrot is caused by Fusobacterium necrophorum and Dichelobacter nodosus and is accompanied by a characteristically foul smell (Winter, 2008). It either appears in a benign form or a virulent form with extensive separation of the horn from deeper structures (Winter, 2008). Other causes for lameness are white line disease, granulomas or laminitis as well as some other rarer diseases or causes (e.g. trauma; Winter, 2008).

Regular observation of a sheep's gait, inspection of its feet, and professional routine foot care treatment are crucial in the management of dairy ewes (DEFRA, 2003). The EuropeanConvention (1992) as well as several authors (Sevi, 2009; Caroprese et al., 2010; Gougoulis et al., 2010; Lovatt, 2010; Phythian et al., 2011) also emphasise to observe animals for any signs of lameness.

To assess lameness usually an observation of the animals when walking and/or a physical examination of their legs and claws is carried out (Phythian, 2011). However, to be used as an on-farm welfare indicator clear definitions of different signs of lameness and their interpretation (Kaler & Green, 2008) have to be established to create a parameter which can be used in a standardised way (Phythian, 2011); otherwise marked deviations in the assessment may occur, sometimes because of the diverse backgrounds, experiences, and trainings of assessors (e.g. stock people, veterinary surgeons; Phythian, 2011).

Observing the gait of a ewe and assigning it a lameness score is suggested to be a valid indirect method to assess foot disease (Napolitano et al., 2009). Usually, scoring scales are used where lame sheep can be allocated to different classes according to the severity of their lameness. Various forms of these scales using different numbers of categories are employed in practice (Phythian, 2011). Kaler et al. (2009) propose a 7-point lameness scale for which they found high levels for reliability when testing it by

analysing short video clips of (lame) animals. Also 5-point scales are commonly used (e.g. Stubsjøen et al., 2011). However, results for reliability were not found to be good when Harkins (2005, quoted in Phythian, 2011) tested a 5-point scoring scale on-farm.

In her project, Phythian (2011) used two methods to observe lameness in sheep: a group observation of several sheep at the same time and an individual observation of single sheep. She used a binary rating scale to score a sheep as either being 'sound' or 'lame' and came to the conclusion that this parameter was a valid and reliable measure for on-farm welfare assessment applied during a group observation as well as during an individual observation (Phythian, 2011). Good reliability was also found by Napolitano et al. (2009) who similarly used a 2-point scoring scale and reported significant correlations between observers.

Based on these literature findings, a 3-point lameness scoring scale was developed and included in the draft protocol, as scoring scales with more categories seemed to be too difficult to apply within an on-farm welfare assessment (Phythian, Cripps, et al., 2013). Due to the fact that a binary scoring scale would give only limited information on the severity of the lameness issue on a certain farm, with mildly lame sheep being scored equally to those reluctant to move at all, a category within the two extremes 'sound' and 'lame' was established. This is very similar to the scoring system found in the dairy cattle protocol of WelfareQuality® (2009a). Score 0 applied to sheep without any sign of impaired walking abilities, score 1 referred to sheep which show shortened stride and uneven weight bearing on feet, and score 2 described sheep showing extreme nodding of the head when walking, relieving single legs when standing or walking, and such animals reluctant to move at all.

It was decided to assess lameness within an individual observation, letting the ewes walk on a hard, non-slippery surface on which they would normally walk and viewing them from the back as well as from one side (WelfareQuality®, 2009a). It is important that lameness is tested on proper flooring, because the gait of an animal might be changed due to a slippery surface without actually indicating the presence of disease (Gougoulis et al., 2010).

During the visits on the test farms it became obvious that assessing lameness within an individual observation as described in the draft protocol was not feasible at all. As the procedure of assessing lameness was adopted from the dairy cattle protocol of WelfareQuality® (2009a), the species-specific differences between sheep and cows became fully evident here. Capturing individual sheep and separating them from their

group highly disturbed the animals and put great stress on them - on the selected animals as well as on the whole flock. This resulted in nervous animals, either freezing or running around in a nervous manner, which made the assessment of a normally walking animal nearly impossible. The situation was aggravated when the observer moved around to look at the walking animal from the side and from behind.

Furthermore, capturing all single ewes and testing their gait would be way too time-consuming in terms of an on-farm assessment, particularly in large flocks as stated by Phythian (2011).

The fact that tested ewes should walk on a non-slippery, hard surface they are used to walking on, further complicated the assessment. Usually, sheep are kept in deep litter systems without hard flooring which is in contrast to dairy cows kept in loose house systems with hard flooring in the activity area. On some farms, there might not be non-slippery, hard floors in any part of the animal area, so driving ewes to such places to carry out lameness scoring might simply be not possible. This is especially problematic if sheep are on pasture where no such flooring is available.

After carefully reconsidering species-specific behaviour and taking into account the constraints of on-farm conditions, a new method of assessing lameness was found: as dairy ewes are driven into the milking parlour twice a day, this movement could be used to look at the gait of the individuals. Usually, the access to the milking parlour is a hard, non-slippery surface for hygienic reasons, and sheep are used to walk on this surface. Dairy ewes will normally enter the milking parlour as a group walking in single file. This enables the assessor to observe the animals one by one without disturbing them by separating individuals from the flock. Furthermore, assessment from behind and from the side is possible. Recording the number of lame sheep and putting it into relation to all of the observed animals should provide information about the welfare of the flock with regard to lameness.

Against earlier consideration, the scoring had to be simplified: within the final protocol (see Appendix) the observer has only to assess whether a sheep is lame (combining former score 1 and 2) or not (equal to former score 0; see Table 3.14). This had to be done because the ewes at the test farms showed to be highly motivated to enter the milking parlour quickly, and differentiation between three distinct scores therefore had been too complicated. In addition to that, Phythian (2011) suggested that fewer scoring categories might show higher reliability results and might be less time-consuming.

Table 3.14: Assessment of *lameness* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
lameness	continuous observation of milking batch while the animals enter the milking parlour; the number of affected animals is counted	lame animals show abnormal walking patterns (bearing weight unevenly on feet, shortening of stride, nodding of head when walking combined with short stride, reluctant to move)	percentage of lame animals

Condition of the claws

In addition to lameness scoring, an examination of the claws can help to find out if an animal is likely to experience poor welfare with regard to its walking abilities. Healthy claws greatly contribute to good welfare in sheep (Zeiler, 2010). However, steadily increasing demands for higher milk yields and associated intensification of housing and feeding noticeably affect claw health negatively (Zeiler, 2010). Also incorrect claw trimming can lead to claw problems (Hodgkinson, 2010).

Answers like ”healthy claws” or ”injuries of the claws” for indicators of good or poor sheep welfare, respectively, were also given by farmers, showing the importance of claw condition and inspection (see Chapter 2.2.2).

The necessity of regular inspection of the claws to control them for adequate length (BMGF, 2006) and to detect problems that can result in lameness is pointed out by several authors (e.g. Hodgkinson, 2010; Lovatt, 2010). If necessary cautious trimming should be done, paring claws only with a sharp pair of clippers or a sharp knife and not causing bleeding to the foot (Winter, 2004a, 2008).

A healthy claw exhibits a dry interdigital space and a cleft, covered with short hairs (Winter, 2004a). The hooves are of roughly the same size, and their soles slightly concave, with the outer wall of the hoof protruding a little (Winter, 2004a), thus protecting the sole from sharp stones, etc. (Winter, 2004b).

A systematic examination of all four feet should make it possible to notice any abnormalities (e.g. granulomas) or deformities (e.g. separation of the horn; Hodgkinson, 2010; Phythian, 2011) and to detect a foul smell which is typical for claws infected with footrot (Kenyon, n.d.). Palpation of the claws, starting at the tip of the foot, makes it possible to identify pain or the presence of heat or swellings (Winter, 2004a; Altenbrunner-

Martinek, 2005; Hodgkinson, 2010). Parting of the hairs above the hooves can help to make areas of reddened skin visible (Altenbrunner-Martinek, 2005). If any of these signs are present, the examined ewe is probably experiencing a negative state of welfare, and action should be taken. Economic concerns due to impaired claw health mainly refer to loss in body condition and decreased wool growth (Marshall et al., 1991).

Inspection of the claws of sheep for the presence of any foot lesions was done by Phythian (2011) within an individual examination of turned sheep. Even though diagnosing the exact condition of the claws was not found to be very reliable, scoring either the presence or absence of abnormalities has resulted in good reliability (Phythian, 2011).

In their study, Napolitano et al. (2009) also looked at the condition of the claws in sheep, but only with the purpose of assessing the presence of hoof overgrowth (either present or absent), and found good reliability between different observers for this single characteristic.

Claw examination was included in the draft protocol in the shape of several questions regarding claw health which could easily be answered by yes or no (e.g. "Is/are one or more claws overgrown?"). The hind claws were looked at and palpated when the animals were standing in the milking parlour; single hooves could be picked up for closer inspection. In order to ensure feasibility of the assessment and not to put additional stress on the animals (Kaler et al., 2001), ewes did not have to be turned.

When testing the parameter on-farm it became obvious that filling in the draft protocol by answering several questions about the claws was too elaborate and too time-consuming. Therefore, a 3-point scoring system was developed which groups together several characteristics of claws in a good (score 0), slightly affected (score 1), and poor (score 2) condition. This does not only facilitate the assessment, but also makes the outcomes more comparable.

Additionally, the examination had to be reduced to only visual inspection, because palpation and picking up of single hooves is not feasible due to time constraints during milking. However, visual inspection seems to be sufficient to get an insight into the condition of a sheep's claws.

This adapted version of the parameter (see Table 3.15) is now included in the final protocol (see Appendix).

Table 3.15: Assessment of *condition of the claws* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
condition of the claws	individual assessment in milking parlour; the condition of the hind claws is visually assessed	0 = good (adequate length and normal position) 1 = slightly affected (too long and/or malposition) 2 = poor (far too long and malposition/ swellings/ foul smell)	percentage of animals with slightly affected claws (score 1) percentage of animals with claws in poor condition (score 2)

Grazing on carpal joints

Sometimes sheep can be observed to move forward on their carpal joints while grazing. This is usually the result of severe lameness caused by several different factors (Scott, 2007), as described earlier.

Even though this behaviour was not mentioned within the farmer questionnaires (see Chapter 2) it is of relevance for animal welfare as reported in literature (Tilgner, n.d.).

Affected animals are unable to bear their own weight on their fore legs anymore. They keep their hind legs in a normal position, but their forelegs are bent at their carpal joints (Tilgner, n.d.). This is highly unnatural and only occurs in unhealthy sheep probably experiencing severe pain (e.g. because of lameness or inflammation). It leads to animals being restricted in their normal behaviour and activities - a fact that negatively influences their health and welfare.

As part of the draft protocol animals showing this behaviour were recorded in the course of a group observation as a further sign of severe lameness being present in the flock.

Since affected animals will mainly move forward on their carpal joints when grazing, the parameter could not be integrated into the final protocol because the assessor will not get the chance to observe animals on pasture on all farms. Leaving out this parameter was further justified by the fact that animals affected by severe health conditions

that would result in this behaviour should in any case be detected by the application of other parameters of the protocol, such as assessing lameness or condition of the claws.

Rubbing, scratching, and nibbling at own body parts

Parasitism in sheep is one of the most important welfare issues of this species (Goddard et al., 2006). If sheep are infested with ectoparasites (e.g. psoroptes ovis, lucilia cuprina, bovicola ovis), the infection can lead to pruritus and chronic pain (Fitzpatrick et al., 2006). Pruritus is known to be an aversive condition resulting in impaired welfare and obvious distress (Scott et al., 2007).

Whereas, within the questionnaires (see Chapter 2), farmers did not mention any behavioural signs of pruritus, literature findings suggest that they can be useful in on-farm welfare assessment (EuropeanConvention, 1992; Dwyer & Bornett, 2004; Phythian et al., 2012).

Such behavioural indicators include intense head tossing (Bates, 2000), excessive lip licking (Sargison, 1995; both of them described later on), rubbing (Phythian, 2011), nibbling at own body parts (Phythian, 2011), stamping (Dwyer & Bornett, 2004), and vigorous shaking of the tail (Dwyer & Bornett, 2004). Some authors also describe the so-called "nibble test" which uses manual stimulation (rubbing the fingertips on a sheep's skin) to look whether the animal reacts with behaviours that are typical for ectoparasitic infections (e.g. extension of head and neck; D'Angelo et al., 2007). As carrying out this test on a large number of sheep seemed to be too extensive for the purposes of the draft protocol, it is not included.

In contrast to that, observing sheep for the occurence of rubbing or nibbling behaviour seems to be a feasible option to detect ectoparasitic infections within a flock. However, it is important to note that excessive rubbing can also be a sign of other clinical conditions, such as scrapie; rubbing was also found to be a stereotypic expression in lambs exposed to environmental and social stress (Miranda-de la Lama et al., 2012). Phythian (2011) found promising levels of reliability for the parameter rubbing and nibbling at own body parts assessed within a group observation. Looking for signs of stamping or vigorous shaking of the tail was not thought to be feasible, because of ambiguous interpretation and possible difficulties in detecting these behaviours.

Even though the reliability results described by Phythian (2011) might be biased, for this condition only was observed on very few of her test farms, it was decided to include this parameter in the draft protocol, since assessing these behaviours seemed to

Table 3.16: Assessment of *rubbing, scratching, and nibbling at own body parts* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
rubbing/ scratch- ing/ nibbling at own body parts	15min continuous group observation from outside; every event of rubbing/ scratching/ nibbling at own body parts is counted	rubbing: scrubbing the body against equipment of the pen (> 5s) scratching: lifting a hind leg to scrub at own body parts (> 5s) nibbling: biting and plucking own wool or skin (> 5s)	average number of events of rubbing/ scratching/ nibbling at own body parts per animal

be a plausible approach to the issue of ectoparasites. Within the draft protocol every single event (lasting longer than 5s) of rubbing against objects (scrubbing the body against equipment of the pen) or nibbling at own body parts (biting and plucking own wool or skin) had to be recorded during a group observation.

In the course of the on-farm testing, the parameter turned out to be feasible, but was extended for 'scratching' (lifting a hind leg to scrub at own body parts) as sheep were found to sometimes scratch themselves using their hind legs. The parameter (see Table 3.16) could then be included in the final protocol (see Appendix).

Intense head tossing

Sheep infested with ectoparasites often show behavioural symptoms in response to indisposition and pruritus (Dwyer & Bornett, 2004), some of them already described above.

Even though within the farmer questionnaires (see Chapter 2) no behavioural indicators related to excessive pruritus could be found, literature findings suggest intense head tossing as an indicator of parasitic infection in addition to rubbing, scratching or nibbling at own body parts, which is described earlier. Intense head tossing is a defence reaction and can be an indicator of mites that have entered a sheep's ear canal (Bates, 2000). Additionally, head tossing behaviour can be a sign of aggression in sheep (Anderson et al., 2004), potentially caused by factors concerning housing and/or management, and therefore can indicate welfare problems. However, to present knowl-

Table 3.17: Assessment of *intense head tossing* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
intense head tossing	15min continuous group observation from outside; every event of intense head tossing is counted	intense head tossing: vehement head shaking at least 10x/min	average number of events (one event = at least 10x/min) of intense head tossing per animal

edge head tossing was not tested as an indicator for on-farm welfare assessment in sheep yet.

Since this parameter seemed to be a plausible opportunity to get aware of parasitic infections, it was included in the draft protocol. The number of events of intense head tossing, defined as vehement head shaking carried out at least 10 times per min, had to be counted.

Although the behaviour of intense head tossing was not observed at any of the three test farms, probably because of the relatively little study population, this parameter remained in the protocol, as its assessment seemed to be feasible within a group observation. Therefore, neither its definition nor the way of its assessment were changed in order to include the parameter (see Table 3.17) in the final protocol (see Appendix).

Excessive lip licking

When assessing the welfare of sheep, observation of the mouth region can be of interest.

Even though not mentioned by the farmers within the questionnaires (see Chapter 2), literature reports that sheep experiencing pain or stress (eventually evoked by poor housing conditions or management) show lip licking behaviour (Stubsjøen et al., 2009). The same is true for sheep which are infected with certain diseases (Brookes et al., 2007) or ectoparasites (Sargison, 1995).

However, to present knowledge there are no studies which have been made to prove lip licking behaviour as a possible parameter for assessing the welfare of sheep.

Excessive lip licking was incorporated into the draft protocol, as it is evident that this behaviour is shown in situations aversive to the welfare of sheep. During a group

Table 3.18: Assessment of *excessive lip licking* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
excessive lip licking	15min continuous group observation from outside; every event of excessive lip licking is counted	excessive lip licking: repeated pronounced mouthing behaviour shown without appropriate stimulus	average number of events of excessive lip licking per animal

observation the number of events of excessive lip licking, defined as repeated pronounced mouthing behaviour shown without appropriate stimulus, had to be recorded.

Within the relatively small sample size at the three test farms the behaviour of excessive lip licking was not observed, but as the parameter (see Table 3.18) seemed to be easy to integrate into a group observation, it was included in the final protocol (see Appendix).

Integument alterations

Integument alterations represent a disturbance of the integrity of an animal, may alter its health status and can cause adverse welfare.

Integument alterations like scratches, wounds, swellings, etc. can for example be caused by scramble if resources are limited, by bites from herding dogs, or by collision with rough edges of housing equipment, as "animals that are driven aggressively...are more likely to panic and collide with handling facilities" (Roger, 2008). Infestation with ectoparasites specifically can lead to skin lesions (Phythian, 2011). Even if some integument alterations do not result in a painful condition, they can cause loss in normal bodily functions (e.g. joint injuries may lead to stiffness of the gait without causing pain; Gougoulis et al., 2010).

Interestingly, within the farmer questionnaires (see Chapter 2), no answers were directly connected to the issue of integument alterations. Some answers referring to the category *indicators of overall appearance* might indirectly include this aspect, but it was never mentioned explicitly.

Several authors point out the importance of integument alterations as parameter in animal welfare assessment (EuropeanConvention, 1992; DEFRA, 2003; Sevi, 2009; Caroprese et al., 2010; Lovatt, 2010; Phythian et al., 2011, 2012), and measures for assessing integument alterations have been included in assessment schemes for dairy

cattle, sows, and broilers (WelfareQuality®, 2009a). The parameter is also suggested for sheep by Pines et al. (2007).

Within her study, Phythian (2011) examined sheep for possible injuries (e.g. wounds, bruises, cuts, scratches) and skin lesions (including abscesses, areas of scabby/scaly/flaking skin, and moist/reddened areas) and scored the integrity of an animal along a 4-point scoring scale by looking at the skin of the entire body (including the head). Only low levels of reliability were found for these measures, maybe because of the low incidences of injuries and lesions that were found in the flocks studied. Phythian (2011) proposes that a less sophisticated scoring system might lead to better reliability in the results. She also assessed the presence of joint swellings and found excellent levels of reliability.

Napolitano et al. (2009) found significant correlations between observers for a measure that dealt with the presence or absence of integument alterations (including skin damages due to ectoparasites, wool-less patches, and hyperkeratosis). They did not, however, find good levels of reliability when assessing the presence/absence of lesions (swellings, wounds, and scabs), probably because lesions were often small and hidden by the fleece (Napolitano et al., 2009). Only because lesions are little does not mean that their impact on welfare is little as well (Phythian, 2011), and therefore, reliable measures to also assess small lesions have to be established.

Stubsjøen et al. (2011) also applied the parameters skin lesion, skin irritation, and swollen joints when assessing sheep welfare, scoring them according to their severity. They also assessed whether the ear tags are in place or were torn out thereby having caused an injury. The tissue of the ears is sensitive, and the obligatory insertion of ear tags already results in an inflammatory response of parts of the ear (Edwards et al., 2001). Ear tags that are ripped out can cause longer-lasting severe pain and can lead to inflammations and infections with pathogens which was shown in goats (Muri & Stubsjøen, 2013). The importance of looking at the ears of a sheep is also stated by the EuropeanConvention (1992).

The parameter of integument alterations found in the protocol of WelfareQuality® (2009a) for dairy cattle was adapted for sheep with respect to the literature findings described above, before including it in the draft protocol.

While an animal was standing in the milking parlour the number of hairless patches (area with hair loss or extensive thinning of the coat, $>$ 2cm in diameter), lesions (damaged skin, fresh or incrusted, $>$ 3cm in length or $>$ 1cm in diameter), and swellings (abnormally enlarged area, eventually showing heightened temperature) was counted.

Only the body parts not covered with wool were taken into account. The appearance of the wool was assessed within another step. Detailed assessment of the skin under the wool was not carried out because of time constraints during an on-farm assessment and the assumption that lesions resulting from ectoparasites would also become obvious when looking at the other body parts.

The ewe had to be viewed from one side, so that the area of the head, all four legs, one side of the udder, and one side of the ventral abdomen could be examined for the presence of integument alterations. Ewes were not to be turned because of feasibility and welfare reasons, but viewed from the back and one side. Phythian (2011) also assessed the presence of ingrowing horns as an injury related, welfare limiting indicator. This was, however, not included in the draft protocol due to the fact that in dairy sheep breeds, ewes do not bear horns. However, if any other kind of injury - not mentioned within the definition of integument alterations (e.g. fractions) - was observed during the assessment, additional notes could be taken within the draft protocol.

When applying the parameter of integument alterations at the test farms, it became clear that viewing ewes from the side was not possible when they were standing next to each other in the milking parlour. Additionally, looking at the fore legs and the ventral abdomen was not possible during the milking procedure, and therefore these areas had to be eliminated from the assessment process.

It was hence decided to only assess the presence of integument alterations at the udder (viewed from behind), the hind legs (including back view, inner and outer side), and - after the observer had changed position - the head (from the front). It was assumed that these parts of the body will provide a sufficient insight into the parameter of integument alterations to draw conclusions about their impact on sheep welfare.

When assessing the udder lesions and swellings have to be counted, as hairless patches do not occur on this body part. The examination of the hind legs and the head includes all three categories: the number of lesions, swellings, and hairless patches has to be counted.

This adapted version of the parameter (see Table 3.19) was included in the final protocol (see Appendix).

Table 3.19: Assessment of *integument alterations* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
lesions on udder	individual assessment in milking parlour; the number of lesions is counted; the back view of the udder is assessed;both hind legs (including back view, inner and outer side) are assessed; the head is assessed from the front	lesion: damaged skin (fresh or incrusted wound; > 3cm in length or > 1cm in diameter)	average number of lesions on udder per animal
lesions on hind legs			average number of lesions on hind legs per animal
lesions on head			average number of lesions on head per animal
swellings on udder	individual assessment in milking parlour; the number of swellings is counted; the back view of the udder is assessed visually and by palpation; both hind legs (including back view, inner and outer side) are assessed visually and by palpation; the head is visually assessed from the front	swelling: abnormally enlarged area, eventually showing heightened temperature	average number of swellings on udder per animal
swellings on hind legs			average number of swellings on hind legs per animal
swellings on head			average number of swellings on head per animal
hairless patches on hind legs	individual assessment in milking parlour; the number of hairless patches is counted; both hind legs (including back view, inner and outer side) are assessed; the head is assessed from the front	hairless patch: area with hair loss or extensive thinning of the coat (> 2cm in diameter)	average number of hairless patches on hind legs per animal
hairless patches on head			average number of hairless patches on head per animal

Coughing

Coughing in animals can be a sign of a clinical disorder (e.g. pneumonia; Pugh & Baird, 2012) which might be accompanied by alterations in respiration. Air pollution (e.g. ammonia, microorganisms, dust) in the animal area can irritate the respiratory tract and lead to coughing which, in turn, influences welfare in a negative way (Caroprese, 2008).

The outcomes of the farmer questionnaires revealed that "coughing animals" are recognised as an indicator of poor welfare by practitioners (see Chapter 2.2.2).

Stubsjøen et al. (2011) recorded the presence or absence of coughing and also scored the severity of the condition along a 4-point scale.

Phythian (2011) also carried out an assessment of the parameter coughing, but in two different ways: within a group observation and within the examination of individuals. In both cases, coughing was scored as being present if coughing or any difficulty with breathing was heard or observed (Phythian, 2011). She came to the conclusion that either way, coughing was no feasible on-farm welfare measure and that this measure did not show clear results for reliability when assessed by different observers, either (Phythian, 2011).

Since coughing is a common condition of negative welfare in (intensive) dairy sheep husbandry and leaving out this issue entirely seemed to be unacceptable, the assessment of coughing was included in the draft protocol, even though no clear results for reliability are reported. Furthermore, the group observation during which coughing was assessed was designed slightly differently than the one by Phythian (2011), and so it was possible to again test the feasibility of the parameter.

In the draft protocol, within a group observation every single event of coughing (either noticed by means of hearing or seeing or both) had to be recorded, regardless whether it was shown by the same ewe or varying individuals. A coughing event was hereby defined as "a sudden and noisy expulsion of air from the lungs" (WelfareQuality®, 2009a).

The assessment of coughing turned out to be feasible when tested on-farm and no amendments had to be made. The parameter (see Table 3.20) was included in the final protocol (see Appendix).

Table 3.20: Assessment of *coughing* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
coughing	15min continuous group observation from outside; every event of coughing is counted	coughing: sudden, noisy expulsion of air from the lungs	average number of events of coughing per animal

Diarrhoea

Diarrhoea describes the altered state of faeces where manure appears loose or liquid. This condition is usually evoked by clinical causes, especially by the presence of endoparasites (Taylor et al., 2007), but can also be the result of the feed taken up (e.g. fresh grazing; Thamsborg et al., 1996). As diarrhoea is a sign for gastrointestinal disturbances, it can place severe stress upon the body. Additionally, diarrhoea often leads to soiled areas around the tail which has a great impact on hygiene and can predispose sheep to myiasis (French & Morgan, 1996) or several bacterial infections (FSA, 2007) like mastitis (Phythian, 2011).

In the farmer questionnaires "diarrhoea" was named several times as a sign of poor welfare (see Chapter 2.2.2), and also in literature (e.g. Lovatt, 2010) and sheep husbandry guidelines (e.g. EuropeanConvention, 1992) it is recommended to look for the presence of diarrhoea as an indicator of poor welfare.

Stubsjøen et al. (2011) assessed the parameter of diarrhoea along a 4-point scale, reaching from firm faeces to profuse-watery or blood containing faeces in addition to a dull, depressed, and dehydrated appearance of the individual.

Concerning cows, the assessment procedure found in the protocol of WelfareQuality® (2009a) also includes to check animals for the presence of diarrhoea.

For the draft protocol the assessment procedure as described in the protocol for dairy cattle of WelfareQuality® (2009a) was adopted as the one used for sheep by Stubsjøen et al. (2011) seemed a bit too sophisticated. Diarrhoea was hence defined as "loose watery manure below the tail head on both sides of the tail" (WelfareQuality®, 2009a) and was scored as present (score 1) when stainings reached at least the size of the palm of a hand. Assessment took place in the milking parlour.

When testing the parameter it became obvious that, in contrast to cows, it was more difficult to only assess the region around the tail in sheep because they are relatively small animals with short legs. An assessment of the cleanliness of the whole rear turned out to be easier and hence more feasible. Additionally, it can be assumed that faecal stainings would also spread to the udder and hind legs in sheep and therefore would also become visible in these areas.

As a parameter that assesses the cleanliness of the rear of the animal was already included in the draft protocol, it was decided to leave out the parameter of diarrhoea, but to record all kinds of stainings (including faecal stainings) within the assessment of cleanliness. Furthermore, the fact that it was hard to distinguish between faecal stainings and stainings originating from other sources like wet pasture in several cases, underlined the decision to include the presence of diarrhoea in the assessment of cleanliness.

Vaginal discharge

It is known that severe vaginal problems like vaginal prolapse or injuries occur in ewes (especially in the context of lambing; Lovatt, 2010) and hence should be of great concern.

Although vaginal discharge is of importance for animal health, none of the farmers mentioned it within the questionnaire study (see Chapter 2), and in literature, reports on its assessment in sheep in the course of an on-farm welfare assessment are not available either.

Regardless of the relatively little information in literature on vaginal discharge in sheep, it was decided to include it in the draft protocol to test its feasibility when assessed during milking. As this parameter is also integrated into the dairy cattle protocol of WelfareQuality® (2009a), and dairy cattle as well as dairy sheep are highly prolific ruminants, the definition used there was adopted. Therefore, in the draft protocol, vaginal discharge was scored as present (score 1) if the animal showed purulent discharge from the vulva or plaques of pus on the inner side of the tail (WelfareQuality®, 2009a). However, sometimes healthy animals also show signs of viscous mucus in late pregnancy, which is no sign of clinical disturbance (WelfareQuality®, 2009a).

At every single test farm, vaginal discharge was assessed, but not found in any one of the examined ewes. It was decided to eliminate the parameter from the protocol, because vaginal discharge is a specific symptom of severe clinical disorders, and the

purpose of the prototype protocol is to assess the welfare of dairy ewes in general, but not to examine them in a veterinary way. If such diseases are present in a flock, it is very likely that they will become visible within the whole assessment anyway. Removing this parameter seemed further to be justified by the fact that none of the farmers mentioned it within the questionnaire study, and also literature findings did not explicitly propose it for inclusion in sheep welfare schemes.

Condition of the teeth

Sound, well-functioning dentition is very important for sheep to ensure feed intake and hence good welfare and productivity (Ridler & West, 2010). A healthy adult sheep has 32 permanent teeth consisting of 8 incisors (only in the lower jaw), 12 premolars, and 12 molars (Scott, n.d.).

None of the farmers explicitly mentioned the condition of the teeth or the importance of tooth examination in the course of the questionnaire study (see Chapter 2). However, some answers could be interpreted as more indirect indicators relating to the condition of the teeth (e.g. ”body condition”, ”feeding behaviour”, ”poor feed intake”).

Further indirect indicators of tooth problems can be found in literature and include weight loss or poor weight gain, problems with chewing of fibrous food, jerky movements of the jaw with the mouth held slightly open, food dropping from the mouth, staining around the sides of the mouth, impaction of food in the cheeks or raising the head high while masticating (Ridler & West, 2010; Scott, n.d.).

In literature problems such as loose incisors, incisor loss, periodontal disease, dentigerous cycts, overgrown molar teeth, excessively worn premolar and molar teeth, brachygnathia or prognathia are reported as dental disorders (Ridler & West, 2010; Scott, n.d.). Only little is known about the causes for dental problems, which complicates proper prevention of adverse welfare states (Ridler & West, 2010). The fact that stock persons often have to cull sheep because of serious tooth problems (Ridler & West, 2010), is of additional welfare concern.

Tooth examination can give a more precise insight into the condition of a sheep’s teeth as suggested by literature (DEFRA, 1997; Lovatt, 2010; Ridler & West, 2010; Phythian, 2011; Phythian et al., 2011; Scott, n.d.).

According to Ridler and West (2010) the inspection of the incisor teeth is relatively easy and carried out by restraining the head of a standing sheep and retracting its lips. Assessment of the premolar and molar teeth, however, is reported to be more complicated because it is difficult to open a sheep’s mouth wide enough for precise

examination (Kenyon, n.d.). Since examination of the premolar and molar teeth is usually not done routinely, problems with these teeth are often not recognised (Ridler & West, 2010), even though they seem to have greater impact on a sheep's welfare because of their function of grinding fibrous matter (Scott, n.d.).

When examining the incisors, loose as well as lost teeth, inflammation of the gum, and teeth with an elongated appearance (Scott, n.d.) due to regression of the gum can easily be detected (Ridler & West, 2010). Teeth should be checked in terms of number, size, and shape (Ridler & West, 2010). Additionally, it is possible to run a finger along the dental pad of a ewe with its mouth closed to feel if there is normal contact between the teeth and the dental pad or if there is any malposition (Scott, n.d.).

Phythian (2011) tested the reliability of tooth examination in individual sheep, looking for missing incisors and palpating premolars and molars to prove their condition and to detect any abnormalities. She found that observers were able to identify the presence or absence of tooth abnormalities; however, the assessment of the molars turned out to be difficult (Phythian, 2011).

Due to these reported difficulties in cheek teeth evaluation, only the assessment of the condition of a ewe's incisors was intended to be carried out within the draft protocol. This was done by carefully retracting the lips and palpating the teeth when the ewes were standing in the milking parlour. Several questions regarding the condition of the teeth had to be answered (e.g. "Are there any signs of gum inflammation?") in the draft protocol.

The assessment of the condition of the teeth described within the draft protocol was feasible in the sense that the teeth of the ewes could easily be palpated when the animals were restrained in the milking parlour. However, answering several questions about the condition of the teeth of every single sheep did not seem to be feasible as the time ewes spend in the milking parlour is restricted. Therefore, a 3-point scoring scale was developed grouping together characteristics of teeth in a good (score 0), impaired (score 1), and poor condition (score 2).

This adapted version of the measure (see Table 3.21) proved to be feasible, and no further changes were made before integrating it into the final protocol (see Appendix).

Table 3.21: Assessment of *condition of the teeth* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
condition of the teeth	individual assessment in milking parlour; the condition of the teeth is assessed by palpation of the incisors (i.) and the dental pad (d.p.)	0 = good (regular contact of i. and d.p., intact teeth) 1 = impaired (irregular contact of i. and d.p. or one/ two teeth loose/ broken off/ elongated) 2 = poor (irregular contact of i. and d.p., and more than two teeth loose/ broken off/ missing/ elongated)	percentage of animals with impaired teeth (score 1) percentage of animals with teeth in poor condition (score 2)

Nasal discharge

Unilateral or bilateral mucoid, purulent or haemmorrhagic nasal discharge (Phythian, 2011) can be a sign of several clinical disorders and hence has an impact on health and welfare of a sheep (EuropeanConvention, 1992). Reasons for nasal discharge are for example endoparasites, infections of the respiratory system, or any obstructions (Kenyon, n.d.).

The importance of the assessment of nasal discharge in the course of an on-farm welfare assessment becomes evident when looking at the results of the farmer questionnaires where ”sinus infection” and ”nasal discharge” were mentioned as signs of poor sheep welfare (see Chapter 2.2.2).

Also Lovatt (2010) and Phythian et al. (2011) point out the importance of proving whether nasal discharge is present in a sheep (in clinical assessments as well as in welfare assessments), as it usually indicates the presence of an underlying disease. Such suggestions can be found in writings of the EuropeanConvention (1992), too.

Assessing the presence of nasal discharge was done in the course of some studies (Phythian, 2011; Stubsjøen et al., 2011) and was found to be a reliable measure when assessed by different observers (Phythian, 2011).

This measure was also included in the draft protocol using the following definition from WelfareQuality® (2009a): ”clearly visible flow/discharge from the nostrils; transparent to yellow/green and often of thick consistency”. While ewes were restrained in the milking parlour it had to be scored whether nasal discharge was present (score 1)

Table 3.22: Assessment of *nasal discharge* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
nasal discharge	individual assessment in milking parlour; the nose is checked for nasal discharge	0 = not present (no sign of discharge) 1 = present (discharge from nostrils; transparent/ yellow/ green, often of thick consistency)	percentage of animals with nasal discharge (score 1)

or not (score 0). However, it is important to note that "slight serous nasal discharge may be present in normal sheep" (Kenyon, n.d.) and hence is not to be counted as nasal discharge.

At all test farms, nasal discharge was assessed in individually examined ewes during milking, but not seen in any of the animals. The parameter (see Table 3.22) was nevertheless included in the final protocol (see Appendix), because examining the nose of the ewes standing in the milking parlour was easily feasible.

Ocular discharge

Another sign of reduced welfare in sheep can be any abnormal condition of their eyes. The reason for abnormal eye conditions can be a disease (e.g. tetanus) or the presence of ammonia in the air which irritates the mucous membranes of the eyes (BMGF, 2006).

Farmers stated that "shiny eyes" are a sign of good welfare (see Chapter 2.2.2), and assessment of the eye condition in sheep is recommended in literature (EuropeanConvention, 1992; Lovatt, 2010; Phythian, 2011; Phythian et al., 2011; Stubsjøen et al., 2011). This usually includes to look for discharge (EuropeanConvention, 1992), signs of conjunctivitis (Stubsjøen et al., 2011), signs of blepharospasm (Lovatt, 2010), signs of keratits (Phythian, 2011), entropion (Phythian, 2011), or other abnormalities (Stubsjøen et al., 2011).

Assessment of the eye condition has already been proven for its reliability which turned out to be good between observers (Phythian, 2011).

For the purposes of the draft protocol, the assessment of eye condition was only limited to the assessment of ocular discharge, because it was thought to be easily recognisable and indicative of most ocular disorders. The scoring system that is used within the protocol of WelfareQuality® (2009a) for dairy cattle was adopted, and ocular dis-

Table 3.23: Assessment of *ocular discharge* in the final protocol

Indicator	**Procedure**	**Definition**	**Parameter**
ocular discharge	individual assessment in milking parlour; both eyes are checked for ocular discharge	0 = not present (no sign of discharge) 1 = present (wet or dry discharge from eye(s), at least 3cm long)	percentage of animals with ocular discharge (score 1)

charge was defined as "clearly visible flow/discharge (wet or dry) from the eye, at least 3cm long". Its presence (score 1) or absence (score 0) was assessed during the milking procedure.

During the on-farm testing it was easily feasible to look at both eyes of the ewes, and hence there seemed to be no need to modify the assessment procedure, even though no animal with ocular discharge was observed within this relatively small study population. The original version of the parameter (see Table 3.23) could be integrated into the final protocol (see Appendix).

3.2.5 Summary: Parameter revision at a glance

Table 3.24 gives an overview of the revision process of all parameters in the course of the on-farm testing. It shows whether a measure could be accepted without any modifications (acc.) or had to be eliminated (elim.) or modified (mod.) in order to include it in the final protocol. The reasons for these decisions are given in the last column.

Apart from revising the parameters in course of the on-farm testing, the chronological order of the draft protocol and its structure have been revised. The formatting of the draft protocol was refined to ensure easy use. There was no need to include a new parameter which had not been part of the draft protocol.

Table 3.24: Overview of the on-farm revision process of all parameters

Indicator	**acc.**	**elim.**	**mod.**	**Reason**
cleanliness			x	restrictions in observation because of design of milking parlour; definition imprecise
appearance of the wool			x	restrictions in observation because of design of milking parlour; definition imprecise
respiration			x	procedure too difficult; interpretation too difficult
synchronicity of behaviour	x			-
agonistic interactions		x		time constraints
abnormal behaviour	x			-
qualitative behaviour assessment			x	procedure too difficult; time constraints; ambiguous terms
body condition	x			-
water provision			x	definition too narrow

capture time for milking		x		precise recording not possible; differences in on-farm conditions; interpretation too difficult
behaviour during milking	x			-
ear temperature			x	precise scoring system needed
vocalisation		x		assessment too complicated; risk of ambiguous interpretation
length of the tail			x	scoring system too sophisticated
approach test			x	procedure too difficult; species-specific characteristics of sheep; interpretation difficult
lameness			x	pronounced flock instinct of sheep; differences in on-farm conditions; scoring system too sophisticated
condition of the claws			x	precise scoring system needed
grazing on carpal joints		x		differences in on-farm conditions
rubbing, scratching, and nibbling at own body parts			x	definition too narrow
intense head tossing	x			-
excessive lip licking	x			-
integument alterations			x	restrictions in observation because of design of milking parlour
coughing	x			-

diarrhoea		x		small size of animals; too hard to distinguish from other stainings –> integrated into parameter cleanliness
vaginal discharge		x		too specifically clinical aspect for welfare assessment
condition of the teeth			x	precise scoring system needed
nasal discharge	x			-
ocular discharge	x			-

Chapter 4

Final version of the prototype protocol

After testing the draft protocol at three Austrian dairy sheep farms and refining it constantly during this process, the prototype on-farm welfare assessment protocol for dairy sheep including detailed explanations for assessment could be completed.

The final protocol (see Appendix) consists of nine distinct modules, each of them grouping together parameters that could be assessed within one step (see Table 4.1). Organising the final protocol in a way that makes it possible for certain measures to be taken at the same time, is also done within the dairy cattle protocol of WelfareQuality® (2009a). This structure should facilitate the assessment and optimise time management. Furthermore, the chronological order ensures that all farms are assessed in a standardised way. If the procedure was not fixed, the outcome could be affected; for example, qualitative behaviour assessment has to take place at the beginning, because if the sheep had already undergone other steps of the assessment (e.g. an individual examination) beforehand, they might be a little disturbed and behave differently compared to a situation where they have not been irritated by unusual events in advance (WelfareQuality®, 2009a). However, in exceptional cases, it is possible to shift some modules, such as the interview with the farmer.

The structure of the final protocol should also simplify the assessment of a flock that is divided into several groups, as some modules can be applied to the whole flock, whereas others have to be assessed for each group individually. As the final protocol is split up into modules, only those modules that are needed more than once (according to the number of groups at a farm) have to be photocopied, while the others can remain singular; unnecessary paperwork is therefore prevented. Within the explanations

accompanying the final protocol (see Appendix) detailed information is given on the number of groups and individual animals that have to be assessed in the course of the assessment (according to group number and flock size). A description of the parameters and the proper use of scores are given in the explanations as well.

The time needed for one visit can roughly be calculated the following way: one hour to get familiar with the farmer and the facilities of the farm and to fill in Modules 1, 2, and 3; additionally, one hour per group for assessing Modules 4, 5, 6, and 7 and one to three hours (depending on farm routines and flock size) for Modules 8 and 9 which are assessed during milking. The final protocol is designed to be carried out by one single assessor within one day. This is similar to comparable protocols for goats, where the average assessment time was found to be six hours and thirty minutes when done by one person (Muri & Stubsjøen, 2013).

The final protocol should preferably be applied to lactating dairy ewes as they can be easily caught in the milking parlour within the daily routine, and Module 8 cannot be applied to dry sheep.

The final protocol represents a management tool for farmers, veterinarians, and farm inspectors to monitor the welfare of the flock as well as the welfare of individuals. It should allow to highlight areas of good welfare and possible areas of improvement. Similar to the dairy cattle protocol of WelfareQuality® (2009a), the final protocol is not to be used as a tool for diagnosing specific health problems, but to point out acute welfare problems and to make constant monitoring possible.

Proving the feasibility of the final protocol also helped adjust the measures to the species-specific characteristics of sheep, so that the assessment procedure puts only very little stress on the animals. This is the only way for the daily routine ewes experience at a farm to be truly reflected.

Table 4.1: Structure of the final protocol

Number	**Name**	**Content/Indicator**
Module 1	general data	name and address of the farm; name of the assessor; date
Module 2	interview with the farmer	data on milk production; data on treatment incidence; data on lamb production; data on mortality
Module 3	design of the housing system	housing conditions
Module 4	qualitative behaviour assessment	nine fixed terms for scoring along a visual analogue scale
Module 5	behavioural observations of the flock	instantaneous scan sampling: synchronicity of behaviour; respiration; continuous observation: coughing; rubbing, scratching, and nibbling at own body parts; excessive lip licking; intense head tossing; abnormal behaviour
Module 6	reaction to an unfamiliar human	reaction score
Module 7	water provision	water flow/volume; cleanliness; mechanical functioning; access
Module 8	observations during milking	lameness; behaviour during milking
Module 9	assessment of individual ewes	body condition; appearance of the wool; length of the tail; integument alterations; cleanliness; condition of the claws; ear temperature; ocular discharge; nasal discharge; condition of the teeth

Chapter 5

General discussion and outlook

In the course of this master's project, a prototype on-farm welfare assessment protocol for dairy ewes mainly using animal-based parameters was developed to approach the current need for such a tool in dairy sheep production systems. To ensure proper use of this management tool, additional explanations were established to go with the protocol. In the following part general aspects of the project and its realisation will be discussed, and several points which are thought to require further input from research will be outlined.

5.1 General discussion

The structure of the present project involving a farmer questionnaire and literature research to develop a draft protocol and afterwards testing this protocol on-farm was chosen to fit best the aim of developing a protocol that should in the end serve practical purposes. Especially, the combination of the literature findings with farmers' opinion seemed important to cover the majority of current dairy sheep welfare issues in Austria. A similar approach was taken by Phythian (2011) who combined literature research with the opinion of an expert panel to develop a list of the most important welfare indicators for sheep in the UK. Gathering the consensus opinions of experts coming from different fields and representing all stakeholder groups of dairy sheep husbandry, however, was not possible within the present project. Furthermore, it seemed important to getting the farmers a chance to speak about a topic in which they are highly involved.

5.1.1 Selection of the parameters

When choosing the parameters for the draft protocol, the main goal was to use animal-based measures, which are taken when directly looking at an animal (e.g. observing its behaviour; WelfareQuality®, 2009a). Currently, these measures are increasingly emphasised in scientific research (Goddard, 2011). Their use, however, is often challenging and time-consuming (Goddard, 2011), which is why in the course of establishing the prototype protocol, attention was paid to designing the assessment in such a way that it was possible for one person to apply the protocol on-farm within a one-day visit. Carefully structuring the protocol was also important with regard to the assessment of individual ewes, because individual observation can cause considerable logistic challenges in welfare assessment (Fitzpatrick et al., 2006).

As animal welfare is a matter of subjective experience of an individual sheep, it seemed to be necessary to look not only at the whole flock, but to also include measures that refer to single animals. This is of importance because although welfare relates to individuals, stock persons tend to primarily view the overall welfare of the flock in their daily rounds (Goddard, 2011); a definition of flock welfare, however, does not exist (Goddard, 2008). As individual care might be difficult to be provided in large flocks in particular, individual welfare might be neglected even more (Goddard, 2011).

In animal welfare assessment not only parameters that recognise the absence of poor welfare, but also such parameters that indicate good welfare should be used to contribute to the fact that welfare is a multi-dimensional concept, and assessment should take different aspects into account (Fitzpatrick et al., 2006; Goddard, 2011). Therefore, to gain a complete picture of the welfare of a flock and its individuals, an attempt was made to use composite and integrated measures as suggested by Dwyer and Lawrence (2008). By incorporating parameters such as qualitative behaviour assessment or behavioural observations, an effort was made to look at signs of good welfare.

Within this project thorough literature research and especially the inclusion of the farmer questionnaires' results helped to avoid a mere 'translation' of existing welfare assessment protocols for other species into the sheep's context, since opinions about the adaptation of already existing measures for welfare assessment in other species differ: While according to Goddard (2011) diverse sources "suggest that the approach for assessing welfare in sheep systems can be broadly based on those already developed

and widely promoted for other livestock", Phythian (2011) clearly rejects this approach, as "indicators need to be sensitive to the current welfare issues for sheep".

5.1.2 Validity and reliability of the parameters

Initially, the intention was to only include parameters in the prototype protocol that were reported in literature as being valid and reliable. This aim, however, could not be completely fulfilled because not all parameters which seemed to be important in the welfare assessment of dairy ewes had such information readily available. For some measures (e.g. appearance of the wool, qualitative behaviour assessment) reliability was tested (e.g. by Napolitano et al., 2009 and by Phythian, 2011). However, these measures were not specifically applied to dairy sheep, but to sheep in general. The testing procedures of the measures used by Phythian (2011) and of the measures used in the present protocol vary (e.g. claw inspection of the turned versus of the standing sheep). Additionally, it is important to note that sheep production systems in those countries where these studies took place differ from those common in Austria. Consequently, reliability results these authors found could not be fully adopted. Nevertheless, the findings were viewed as a good starting point in the development of the prototype protocol. For parameters which were suggested by farmers only, but were not described in literature as parameters commonly used for welfare assessment values for validity and reliability are lacking. Within the scope of this study it was not possible to test the parameters for these scientific properties. Therefore, the outcome remains a prototype protocol, and further research is needed.

5.1.3 On-farm testing of the draft protocol

Apart from being valid and reliable, scientifically used measures in animal welfare have to be feasible, otherwise they cannot be used in on-farm assessments. The importance of considering the feasibility of welfare measures used on-farm is also pointed out by Phythian et al. (2011). In contrast to validity and reliability it was possible to test the measures for their feasibility to a certain extent in the course of this project. To this end, three Austrian dairy sheep farms were visited. Every single measure was tested and refined to ensure its feasibility. The structure and the formatting of the draft protocol were tested as well, with special regard to easy handling, the chronological order of the assessment steps, and the time needed to carry out an on-farm assessment. This procedure was meant to ensure that the final outcome of the project is easy to use

for people involved in dairy sheep husbandry, e.g. stock persons, veterinarians, independent assessors, and therefore to have a protocol with practical significance. Due to time constraints, it was only possible to test the draft protocol at three different farms. However, it was possible to gain a first insight into different on-farm situations, as all visited farms differed very much with regard to their size and management. This can be seen as an advantage, as a first step into the direction of testing whether the protocol was flexible enough to be applied under different circumstances, but at the same time standardised enough to make comparisons between farms. Similar to the participants of the questionnaire study also the stock persons whose farms were visited showed interest in the project; hence, they were promised to receive the final protocol as soon as it was finished.

The testing of the draft protocol was carried out by only one person. On the one hand, this limits statements about the actual feasibility, as it would have been of greater value if several different people had applied the draft protocol. On the other hand, the fact that this person did not have much knowledge about the practical handling of sheep beforehand may confirm the easy use of the protocol, even for people who do not have much experience in sheep handling (e.g. independent farm assessors).

Since the aim was not only to look at the overall welfare of a flock, but also to assess ewes individually, it was decided to observe the animals during milking. This seemed to be the most promising, most time-efficient opportunity to observe individual animals without placing great stress on them by catching and separating them. Causing stress while assessing individual welfare might not only unnecessarily disturb the animals, but might also distort the results as some signs of an individual's welfare state might become masked when the animal is put into a frightening situation (Lovatt, 2010). As the prototype protocol should contribute to an improvement of dairy sheep welfare, testing was deliberately carried out to impose the least possible amount of stress on the animals. The importance of such a thoughtful assessment is also pointed out by Phythian (2011). When the prototype protocol was established, the high vigilance of sheep as prey animals and their pronounced flock behaviour were always kept in mind.

For the measures that were assessed within the individual examination an attempt was made to look at every individual ewe at a farm. Therefore, there was no bias in choosing individual animals for assessment, and various animals in different conditions could be observed. This contributed to a refinement of the scores of the measures. All

farmers whose units were visited either had already had contact with the university before or were cooperating with the organisers of sheep conferences, which may have meant that welfare standard at these farms was relatively high compared to other Austrian farms, and mainly sheep in a good welfare condition were seen. However, since the aim of the visits was to test the feasibility of the measures, this did not influence the outcome of the project.

5.2 Outlook

After carrying out all three steps of the project (farmer questionnaire, development of a draft protocol, on-farm testing of the draft protocol), the final on-farm welfare assessment protocol could be finished. As this was a student's project conducted by one person, it is evident that it can only be understood as a prototype protocol in need of further research input. It represents the first step of developing an on-farm welfare assessment protocol for dairy sheep with particular focus on the Austrian production system.

Further investigation is needed, especially concerning the validity and reliability testing of measures. The measures that were mainly included based on farmers' suggestions (ear temperature, vocalisation) would have to be tested in particular. Concerning the protocol's feasibility, further testing might be of value to ensure that the protocol can be applied under various on-farm conditions.

In addition, if such protocols are to be used in a large-scale manner, adequate training of assessors would be essential in order to carry out reliable assessment and make meaningful comparisons between different farms and within farms over a longer time period (WelfareQuality®, 2009a).

Another area in which further research is needed is the interpretation of data collected when using such an on-farm welfare assessment scheme for sheep. Developing a system in which collected data can easily be used to assign a farm to one of several categories according to its welfare standard - ranging from good to poor - as was done in the course of the project WelfareQuality® (2009a) would be an important step towards an improvement of animal welfare. The development of such a system, however, would require the establishment of validated cut-off points for parameters in sheep wel-

fare assessment. Currently, research on such thresholds is very limited. Only recently, Phythian (2011) cooperated with a panel of experts to identify thresholds for selected parameters to fill this gap. As establishing such cut-off points for the parameters used within the present prototype protocol would have gone beyond the scope of this work, no exact guidelines for the interpretation of data collected with the present protocol were worked out. Therefore, further projects dealing with the establishment of such detailed instructions will have to be carried out. However, even though such investigations would be of value for animal welfare, scientists are aware that "there is no gold standard measure of overall animal welfare and no available information on the relative importance animals attribute to the various welfare aspects" (WelfareQuality®, 2009a).

It is a well-known problem of on-farm welfare assessment tools in general that they only provide a "'snapshot' in time of an entire production system" (Goddard, 2011). These tools have great difficulties in reflecting the lifetime experience of an animal (Goddard, 2011). On the one hand, the fact that the prototype protocol can be applied within one day can be seen as an advantage for the assessors, as described earlier. On the other hand, however, doubts may arise that "an assessment of welfare in [sic!] short-term tells us something meaningful about welfare over longer-periods of time" (Lawrence & Conington, 2008).

The final protocol should preferably be applied to lactating animals. Nevertheless, it is possible to assess the welfare of dry ewes with this protocol as well, apart from some parameters which have to be recorded during milking. However, it would be of value, to regularly apply the protocol at several stages of the production cycle of the animals. Such a frequent assessment of the animal's welfare status at a unit could contribute to enhancing animal welfare at least to a certain extent and may even help to prevent certain welfare problems from developing. Therefore, expanding the present prototype protocol by adding parameters which evaluate welfare during other periods of the life of a dairy sheep (e.g. the period in which lambs are with their ewes) would be interesting and would contribute to covering more parts of the production cycle.

Like all welfare assessment tools, this prototype protocol will also be in need of an ongoing revision process and will have to be constantly updated (WelfareQuality®, 2009a) in accordance with new scientific findings.

Chapter 6

Conclusion

Within this project, an effort was made to develop a prototype on-farm welfare assessment protocol for dairy sheep. This goal was accomplished by underlining scientific knowledge from subject-specific literature with information from farmer questionnaires. By applying the newly developed draft protocol on-farm and revising it, its feasibility was ensured. The present prototype protocol is the first step in the direction of creating standardised schemes for on-farm welfare assessment of dairy sheep in Austria, comprising mainly animal-based measures.

The need for such a protocol expressed by the Veterinary Health Service ('Tiergesundheitsdienst') in Austria, and the interest shown by participating farmers - in the course of the questionnaire study as well as the on-farm visits - give hope that the protocol will reach practical significance as a management tool. It could then contribute to an increased awareness of the welfare of this species and furthermore lead to improvement strategies where necessary. This should be beneficial for all parties involved: farmers, veterinarians, independent farm assessors, consumers - and above all the dairy sheep itself. As this work was a pilot study, it is, however, evident, that comprehensive research is needed to further develop the prototype protocol.

Working towards an improvement of the welfare of sheep should contribute to meeting the ethical demands inevitably evoked by the fact that these animals are kept under human custody for production purposes. Even if it is certain that welfare is nothing that can be easily communicated - neither between humans nor across the boundaries of species - facing this challenge and trying to take the sheep's viewpoint should be the priority.

References

Altenbrunner-Martinek, B. (2005). Lahmheitsursachen beim kleinen Wiederkäuer: Klauenerkrankungen und Erkrankungen der distalen Extremität. *Klauentierpraxis*, *13*, 11-15.

Anderson, U., Maple, T., & Bloomsmith, M. (2004). A close keeper-nonhuman animal distance does not reduce undesirable behavior in contact yard goats and sheep. *Journal of Applied Animal Welfare Science*, *7*(1), 59-69.

Archer, J. (1973). Tests for emotionality in rats and mice: A review. *Animal Behaviour*, *21*, 205-235.

ARD. (2005). *What's the score: Sheep. Body condition scoring (BCS) guide.* Agriculture and Rural Development, Alberta, *http://www1.agric.gov.ab.ca/£department/deptdocs.nsf/all/agdex9622/£FILE/bcs-sheep.pdf*, date of access: April 13, 2014.

Arnold, G., & Maller, R. (1974). Some aspects of competition between sheep for supplementary feed. *Animal Production*, *19*(3), 309-319.

AWIN. (n.d.). *Animal welfare indicators project.* EU project (VII Framework Program FP7-KBBE-2010-4), *http://www.animal-welfare-indicators.net/site/*, date of access: April 13, 2014.

Bates, P. (2000). Sheep scab. In W. Martin & I. Aitken (Eds.), *Diseases of sheep* (3rd ed., p. 281-285). Oxford, UK: Blackwell science.

Bøe, K., Berg, S., & Andersen, I. (2006). Resting behaviour and displacements in ewes - effects of reduced lying space and pen shape. *Applied Animal Behaviour Science*, *98*(3-4), 249-259.

Beausoleil, N., Stafford, K., & Mellor, D. (2002). Do sheep regard humans as predators? In *Animal welfare and behaviour: From science to solution. Programme of an international conference* (p. 29). Hamilton, New Zealand.

Bell, A., Hales, J., King, R., & Fawcett, A. (1983). Influence of heat stress on exercise-induced changes in regular blood flow in sheep. *Journal of Applied Physiology: Respiratory, Environmental and excercise physiology*, *55*(6), 1916-1923.

Bergonier, D., de Crémoux, R., Rupp, R., Lagriffoul, G., & Berthelot, X. (2003). Mastitis of dairy small ruminants. *Veterinary Research*, *34*, 689-716.

BMGF. (2006). *Selbstevaluierung - Tierschutz Handbuch Schafe.* Bundesministerium für Gesundheit und Frauen und Bundesministerium für Land- und Forstwirtschaft, Umwelt- und Wasserwirtschaft, *http://bmg.gv.at/cms/home/attachments/2/0/9/CH1122/CMS1157545064200/handbuch_schafe.pdf*, date of access: April 13, 2014.

Boivin, X., Tournadre, H., & Le Neindre, P. (2000). Hand-feeding and gentling influence early-weaned lambs' attachment responses to their stockperson. *Journal of Animal Science*, *78*, 879-884.

Braunreiter, C. (2012). *Körperkonditionsbeurteilung (BCS) beim Milchschaf. Praktische Durchführung.* Tierproduktion der Landwirtschaftskammer Oberösterreich, Linz.

Breuer, K., Hemsworth, P., Barnett, J., Matthews, L., & Coleman, G. (2000). Behavioural response to humans and the productivity of commercial dairy cows. *Applied Animal Behaviour Science*, *66*, 273-288.

Brookes, S., Klopfleisch, R., Müller, T., Healy, D., Teifke, J., Lange, E., ... Fooks, A. (2007). Susceptibility of sheep to European bat lyssavirus type-1 and -2 infection: A clinical pathogenesis study. *Veterinary Microbiology*, *125*, 210-223.

Broom, D. (2007). Quality of life means welfare: How is it related to other concepts and assessed? *Animal Welfare*, *16(S)*, 45-53.

ÖBSZ. (2012). *Österreichs Schaf- und Ziegenzucht in Zahlen.* Österreichischer Bundesverband für Schafe und Ziegen.

ÖBSZ. (2013). *Jahresbericht ÖBSZ 2012.* Österreichischer Bundesverband für Schafe und Ziegen, *http://www.alpinetgheep.com/jahresberichte.html*, date of access: July 8, 2014.

Caroprese, M. (2008). Sheep housing and welfare. *Small Ruminant Research*, *76*, 21-25.

Caroprese, M., Casamassima, D., Rassu, S., Napolitano, F., & Sevi, A. (2010). Monitoring the on-farm welfare of sheep and goats. *Italian Journal of Animal Science*, *8*(1s), 343-354.

Clarkson, M. (2000). Pregnancy toxaemia. In W. Martin & I. Aitken (Eds.), *Diseases of sheep* (3rd ed., p. 315-317). Oxford, UK: Blackwell science.

Cockram, M. (2004). A review of behavioural and physiological responses of sheep to stressors to identify potential behavioural signs of distress. *Animal Welfare*, *13*, 283-291.

D'Angelo, A., Maurella, C., Bona, C., Borrelli, A., Caramelli, M., Careddu, M., ...

Ru, G. (2007). Assessment of clinical criteria to diagnose scrapie in Italy. *The Veterinary Journal*, *174*, 106-112.

Dawkins, M. (2006). A user's guide to animal welfare science. *Trends in Ecology and Evolution*, *21*(2), 77-82.

DBV. (2012). *Situationsbericht 2012/2013.* Deutscher Bauernverband, Berlin, *http://www.bauernverband.de/33-betriebe-und-betriebsgroessen*, date of access: July 8, 2014.

DEFRA. (1997). *Condition scoring of sheep.* Department for Environment, Food and Rural Affairs, London, *http://adlib.everysite.co.uk/adlib/defra/content.aspx?id=000IL3890W.180RQ70NYDG2VQ*, date of access: April 13, 2014.

DEFRA. (2003). *Code of recommendations for the welfare of livestock: Sheep.* Department for Environment, Food and Rural Affairs, London, *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69365/pb5162-sheep-041028.pdf*, date of access: April 13, 2014.

Deix, C.-M., Rosenwirth, C., Janko, M., Rockenbauer-Peirl, C., Puchta, A., Kirner, L., & Hambrusch, J. (2009). *Schaf- und Ziegenmilchproduktion in Österreich und Europa.* Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien.

Duncan, I. (2005). Science-based assessment of animal welfare: Farm animals. *Revue Scientifique et Technique: Office International des Epizooties*, *24*(2), 483-492.

Dwyer, C. (2009). Welfare of sheep: Providing for welfare in an extensive environment. *Small Ruminant Research*, *86*, 14-21.

Dwyer, C., & Bornett, H. (2004). Chronic stress in sheep: Assessment tools and their use in different management conditions. *Animal Welfare*, *13*, 293-304.

Dwyer, C., & Lawrence, A. (2008). Introduction to animal welfare and the sheep. In C. Dwyer (Ed.), *The welfare of sheep* (p. 1-40). Springer.

Edwards, D., Johnston, A., & Pfeiffer, D. (2001). A comparison of commonly used ear tags on the ear damage of sheep. *Animal Welfare*, *10*, 141-151.

Egerton, J. (2000). Foot-rot and other conditions. In W. Martin & I. Aitken (Eds.), *Diseases of sheep* (3rd ed., p. 243-249). Oxford, UK: Blackwell science.

EuropeanConvention. (1992). *Welfare recommendation concerning sheep.* Standing Committee of the European Convention for the Protection of Animals kept for Farming Purposes, *http://adlib.everysite.co.uk/resources/000/107/852/CoE_Sheep.pdf*, date of access: April 13, 2014.

FAO. (2014). Food and Agriculture Organization of the United Nations, *http://faostat.fao.org/site/569/DesktopDefault.aspx*, date of access: April 13, 2014.

FAWC. (2011). *Five freedoms.* Farm Animal Welfare Committee, London, *http://www.defra.gov.uk/fawc/about/five-freedoms/*, date of access: April 13, 2014.

Fisher, A., & Matthews, L. (2001). The social behaviour of sheep. In L. Keeling & H. Gonyou (Eds.), *Social behaviour in farm animals* (p. 211-245). CABI Publishing.

Fitzpatrick, J., Scott, M., & Nolan, A. (2006). Assessment of pain and welfare in sheep. *Small Ruminant Research*, *62*(1), 55-61.

Fraser, A., & Broom, D. (1997). *Farm animal behaviour and welfare* (3rd ed.). CAB International.

Fraser, D. (2003). Assessing animal welfare at the farm and group level: the interplay of science and values. *Animal Welfare*, *12*, 433-443.

French, N., & Morgan, K. (1996). A model of ovine cutaneous myosis using the predicted abundance of *Lucilia sericata* and a pattern of sheep susceptibility. *Preventive Veterinary Medicine*, *26*, 143-155.

French, N., Wall, R., & Morgan, K. (1994). Lamb tail docking: A controlled field study of the effects of tail amputation on health and productivity. *Veterinary Record*, *134*, 463-467.

FSA. (2007). *Clean sheep for slaughter. A guide for producers.* Food Standards Agency, UK, *http://multimedia.food.gov.uk/multimedia/pdfs/publication/cleansheep0507.pdf*, date of access: April 13, 2014.

Fuerst-Waltl, B., & Baumung, R. (2009). Economic values for performance and functional traits in dairy sheep. *Italian Journal of Animal Science*, *8*, 341-357.

Ganter, M. (2008). Veterinary consultancy and health schemes in sheep: Experiences and reflections from a local German outlook. *Small Ruminant Research*, *76*(1-2), 55-67.

Goddard, P. (2008). The management of sheep. In C. Dwyer (Ed.), *The welfare of sheep* (p. 291-323). Springer.

Goddard, P. (2011). Welfare assessment in sheep. *In Practice*, *33*, 508-516.

Goddard, P., Waterhouse, T., Dwyer, C., & Stott, A. (2006). The perception of the welfare of sheep in extensive systems. *Small Ruminant Research*, *62*, 215-225.

Gougoulis, D., Kyriazakis, I., & Fthenakis, G. (2010). Diagnostic significance of behaviour changes of sheep: A selected review. *Small Ruminant Research*, *92*,

52-56.

Grignard, L., Boissy, A., Boivin, X., Garel, J., & Le Neindre, P. (2000). The social environment influences the behavioural responses of beef cattle to handling. *Applied Animal Behaviour Science*, *68*, 1-11.

Harkins, L. (2005). *Development of a prototype welfare tool for use in sheep* (Thesis, Master of Science). University of Glasgow.

Hemsworth, P. (2003). Human-animal interactions in livestock production. *Applied Animal Behaviour Science*, *81*, 185-198.

Hodgkinson, O. (2010). The importance of feet examination in sheep health management. *Small Ruminant Research*, *92*, 67-71.

Hogan, J., Philipps, C., & Agenäs, S. (2008). Nutrition and the welfare of sheep. In C. Dwyer (Ed.), *The welfare of sheep* (p. 267-290). Springer.

Hörth, J., Ringdorfer, F., Tiefenthaller, F., Hofer, F., & Braunreiter, C. (2009). *Fütterung von Schafen und Ziegen zur Milcherzeugung.* Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien.

Hutson, G. (2007). Behavioural principles of sheep-handling. In T. Grandin (Ed.), *Livestock handling and transport* (3rd ed., p. 155-174). CAB International.

Ingram, J., Cook, C., & Harris, P. (2002). The effect of transport on core and peripheral body temperatures and heart rate of sheep. *Animal Welfare*, *11*, 103-112. (Technical Contribution)

ISU. (1986). *Sheep management.* Iowa State University, Cooperative Extension Service, fact sheet no. 14, *http://www.case-agworld.com/cAw.IU.framescore.html*, date of access: April 13, 2014.

Jago, J., Krohn, C., & Matthews, L. (1999). The influence of feeding and handling on the development of the human-animal interactions in young cattle. *Applied Animal Behaviour Science*, *62*, 137-151.

Kaler, J., George, T., & Green, L. (2001). Why are sheep lame? Temporal associations between severity of foot lesions and severity of lameness in 60 sheep. *Animal Welfare*, *20*, 433-438.

Kaler, J., & Green, L. (2008). Recognition of lameness and decisions to catch for inspection among sheep farmers and specialists in GB. *BMC Veterinary Research*, *4*(41).

Kaler, J., & Green, L. (2013). Sheep farmer opinions on the current and future role of veterinarians in flock health management on sheep farms: A qualitative study. *Preventive Veterinary Medicine*, *112*, 370-377.

Kaler, J., Wassink, G., & Green, L. (2009). The inter- and intra-observer reliability of

a locomotion scoring scale for sheep. *The Veterinary Journal*, *180*(2), 189-194.

Kauppinen, T., Vainio, A., Valros, A., Rita, H., & Vesala, K. (2010). Improving animal welfare: qualitative and quantitative methodology in the study of farmers' attitudes. *Animal Welfare*, *19*, 523-536.

Kendrick, K. (2008). Sheep senses, social cognition and capacity for consciousness. In C. Dwyer (Ed.), *The welfare of sheep* (p. 135-157). Springer.

Kennedy, J. (1992). *The new anthropomorphism.* Cambridge, UK: Cambridge University Press.

Kenyon, S. (n.d.). *Physical examination of sheep.* Lecture script "Intro to Clinics".

Kiley-Worthington, M. (1977). *Behavioural problems of farm animals.* Northumberland, UK: Oriel Press.

Kilgour, R., Waterhouse, T., Dwyer, C., & Ivanov, I. (2008). Farming systems for sheep production and their effect on welfare. In C. Dwyer (Ed.), *The welfare of sheep* (p. 213-265). Springer.

Kirchner, M., Schulze Westerath-Niklaus, H., Knierim, U., Tessitore, E., Cozzi, G., Vogl, C., & Winckler, C. (2014). Attitudes and expectations of beef farmers in Austria, Germany and Italy towards the Welfare Quality ® assessment system. *Livestock Science*, *160*, 102-112.

Klumpp, C., Häring, A., & Boos, S. (2003). *Die Entwicklungspotenziale der Ökologischen Schafhaltung in Deutschland.* `http://orgprints.org/5275/1/5275-020E590-hohenh-klumpp-et-al-2003-schaf.pdf`, date of access: July 8, 2014.

Krenn, V., Nowak, V., Penker, E., & Zeiler, M. (2011). *Schaf- und Ziegenzucht.* Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien.

Lawrence, A., & Conington, J. (2008). Sheep welfare: A future perspective. In C. Dwyer (Ed.), *The welfare of sheep* (p. 343-360). Springer.

Lenz, V., Waiblinger, S., & Ofner-Schröck, E. (2012). *Stallbau für die Biotierhaltung Schafe.* Landtechnische Schriftenreihe 234, Österreichisches Kuratorium für Landtechnik und Landentwicklung (ÖKL), Wien.

Ley, S., Waterman, A., & Livingston, A. (1995). A field study of the effect of lameness on mechanical thresholds in sheep. *Veterinary Record*, *137*, 85-87.

Litzllachner, C., Fucik, S., Schoder, G., & Grassauer, B. (2010). *The veterinary health service - quality assurance in agricultural animal husbandry.* Federal Institute for Rural Education and Training (LFI Österreich), Wien.

Lovatt, F. M. (2010). Clinical examination of sheep. *Small Ruminant Research*, *92*(1-3),

72-77.

Lowe, T., Cook, C., Ingram, J., & Harris, P. (2005). Changes in ear-pinna temperature as a useful measure of stress in sheep (Ovis aries). *Animal Welfare*, *14*, 35-42.

LTW. (2006). *Condition scoring of sheep.* Lifetime Wool Project, Australia, *http://www.lifetimewool.com.au/*, date of access: April 13, 2014.

MAFF. (1999). *Lameness in sheep.* Ministery of Agriculture, Forestry and Fisheries, London.

Main, D., Leeb, C., Whay, H., Hovi, M., & Webster, J. (2004). *Bristol Welfare Assurance Programme: Animal based assessment tool for farm animal welfare certification.* *http://www.vetschool.bris.ac.uk/animalwelfare/images/BWAPweboverview.pdf*, date of access: April 13, 2014.

Marshall, D., Walker, R., Cullis, B., & Luff, M. (1991). The effect of footrot on body weight and wool growth of sheep. *Australian Veterinary Journal*, *68*(2), 45-49.

Martin, W., & Aitken, I. (Eds.). (2000). *Diseases of sheep* (3rd ed.). Oxford, UK: Blackwell science.

Mayer, H., & Fiechter, G. (2012). Physical and chemical characteristics of sheep and goat milk in Austria. *International Dairy Journal*, *24*(2), 57-63.

McGlone, J. (1986). Agonistic behaviour in food animals: review of research and techniques. *Journal of Animal Science*, *62*, 1130-1139.

Miranda-de la Lama, G., Villarroel, M., & María, G. (2012). Behavioural and physiological profiles following exposure to novel environment and social mixing in lambs. *Small Ruminant Research*, *103*, 158-163.

Müller, M., & Hörnig, B. (2011). Haltung von Milchschafen in Deutschland. In G. Leithold et al. (Eds.), *Es geht ums Ganze: Forschen im Dialog von Wissenschaft und Praxis. 11. Wissenschaftstagung Ökologischer Landbau* (Vol. 2). Verlag Dr. Köster, Berlin.

Muri, K., & Stubsjøen, P., S.M. Valle. (2013). Development and testing of an on-farm welfare assessment protocol for dairy goats. *Animal Welfare*, *22*, 385-400.

Napolitano, F., de Rosa, G., Ferrante, V., Grasso, F., & Braghieri, A. (2009). Monitoring the welfare of sheep in organic and conventional farms using an ANI 35 L derived method. *Small Ruminant Research*, *83*(1), 49-57.

Napolitano, F., de Rosa, G., Girolami, A., Scavone, M., & Braghieri, A. (2011). Avoidance distance in sheep: Test-retest reliability and relationship with stockmen attitude. *Small Ruminant Research*, *99*(2-3), 81-86.

Nieuwhof, G., & Bishop, S. (2005). Costs of the major endemic diseases of sheep in Great Britain and the potential benefits of reduction in disease impact. *Animal*

Science, *81*, 23-29.

Nowak, R., Porter, R., Blache, D., & Dwyer, C. (2008). Behaviour and the welfare of the sheep. In C. Dwyer (Ed.), *The welfare of sheep* (p. 81-157). Springer.

Phythian, C. (2011). *Development of indicators for the on-farm assessment of sheep welfare* (PhD thesis). University of Liverpool.

Phythian, C., Cripps, P., Grove-White, D., Jones, P., Michalopoulou, E., & Duncan, J. (2013). Observing lame sheep: Evaluating test agreement between group-level and individual animal methods of assessment. *Animal Welfare*, *22*, 417-422.

Phythian, C., Cripps, P., Michalopoulou, E., Jones, P., Grove-White, D., Clarkson, M., ... Duncan, J. (2012). Reliability of indicators of sheep welfare assessed by a group observation method. *The Veterinary Journal*, *193*, 257-263.

Phythian, C., Michalopoulou, E., Duncan, J., & Wemelsfelder, F. (2013). Inter-observer reliability of qualitative behavioural assessments of sheep. *Applied Animal Behaviour Science*, *144*, 73-79.

Phythian, C., Michalopoulou, E., Jones, P., Winter, A., Clarkson, M., Stubbings, L., ... Duncan, J. (2011). Validating indicators of sheep welfare through a consensus of expert opinion. *Animal*, *5*(6), 943-952.

Pines, M., Petherick, J., Gaughan, J., & Phillips, C. (2007). Stakeholders' assessment of welfare indicators for sheep and cattle exported by sea from Australia. *Animal Welfare*, *16*, 489-498.

Plant, J. (2006). Sheep ectoparasite control and animal welfare. *Small Ruminant Research*, *62*, 109-112.

Pugh, D., & Baird, A. (2012). *Sheep and goat medicine* (Second ed.). Elsevier Saunders.

Ridler, A., & West, D. (2010). Examination of teeth in sheep health management. *Small Ruminant Research*, *92*, 92-95.

Ringdorfer, F. (n.d.). *Wirtschaftlichkeit der Schaf- und Ziegenmilcherzeugung.* LFZ Raumberg-Gumpenstein, Österreich, *http://www.raumberg-gumpenstein.at/filearchive/fodok_1_10226_zed_2011.pdf*, date of access: April 13, 2014.

Ringdorfer, F. (2008). *Stand und Entwicklungen der Milchschafhaltung in Europa.* *http://www.raumberg-gumpenstein.at/cm4/de/forschung/publikationen/downloadsveranstaltungen/finish/1832-2302-schaf-ziegenmilch/14073-stand-und-entwicklungen-der-milchschafhaltung-in-europa.html*, date of access: July 8, 2014.

Ringdorfer, F. (2010). Bedarfsgerechte und kostengünstige Winterfütterung der Mutterschafe als Grundlage einer erfolgreichen Lämmerproduktion. In G. Rahmann

& U. Schumacher (Eds.), *Neues aus der Ökologischen Tierhaltung* (p. 99-106).

Roger, P. (2008). The impact of disease and disease prevention on welfare in sheep. In C. Dwyer (Ed.), *The welfare of sheep* (p. 159-212). Springer.

Roger, P. (2012). Welfare issues in the reproductive management of small ruminants. *Animal Reproduction Science*, *130*(3-4), 141-146.

RSPCA. (2013). *RSPCA welfare standards for sheep.* The Royal Society for the Prevention of Cruelty to Animals, UK, *http://www.rspca.org.uk/ImageLocator/LocateAsset?asset=document&assetId=1232731812601&mode=prd*, date of access: April 13, 2014.

Rushen, J. (1990). Use of aversion learning techniques to measure distress in sheep. *Applied Animal Behaviour Science*, *28*, 3-14.

Rushen, J., Taylor, A., & de Passillé, A. (1999). Domestic animals' fear of humans and its effect on their welfare. *Applied Animal Behaviour Science*, *65*, 285-303.

Russel, A. (1984). Body condition scoring of sheep. *In Practice*, *6*, 91-93.

Sargison, N. (1995). Differential diagnosis and treatment of sheep scab. *In Practice*, *17*, 3-9.

Scott, P. (n.d.). *Tooth problems in sheep.* Department for Environment, Food and Rural Affairs, London, *http://www.nadis.org.uk/pdfs/ToothProblemsinSheep.pdf*, date of access: April 13, 2014.

Scott, P. (2005). The management and welfare of some common ovine obstetrical problems in the United Kingdom. *The Veterinary Journal*, *170*, 33-40.

Scott, P. (2007). *Sheep medicine.* Manson Publishing Ltd.

Scott, P., Sargison, N., & Wilson, D. (2007). The potential for improving welfare standards and productivity in United Kingdom sheep flocks using veterinary flock health plans. *The Veterinary Journal*, *173*, 522-531.

Sevi, A. (2009). Animal-based measures for welfare assessment. *Italian Journal of Animal Science*, *8*(S2), 904-911.

Sevi, A., Casamassima, D., Pulina, G., & Pazzona, A. (2010). Factors of welfare reduction in dairy sheep and goats. *Italian Journal of Animal Science*, *8*(S1), 81-102.

Sevi, A., Taibi, L., Albenzio, M., Muscio, A., Dell'Aquila, S., & Napolitano, F. (2001). Behavioral, adrenal, immune, and productive responses of lactating ewes to regrouping and relocation. *Journal of Animal Science*, *79*, 1457-1465.

Silanikove, N. (2000). Effects of heat stress on the welfare of extensively managed domestic ruminants. *Livestock Production Science*, *67*(1), 1-18.

StatistikAustria. (2013a). *Kuhmilcherzeugung und -verwendung 2012. https://*

www.statistik.at/web_de/statistiken/land_und_forstwirtschaft/viehbestand_tierische_erzeugung/milch/023277.html, date of access: April 13, 2014.

StatistikAustria. (2013b). *Schafmilcherzeugung und -verwendung 2007 bis 2012 in Tonnen.* *https://www.statistik.at/web_de/statistiken/land_und_forstwirtschaft/viehbestand_tierische_erzeugung/milch/036655.html*, date of access: April 13, 2014.

StatistikSchweiz. (2013). *Nutztierhalter und Nutztierbestände.* *http://www.bfs.admin.ch/bfs/portal/de/index/themen/07/01/new/nip_detail.html?gnpID=2014-134*, date of access: July 8, 2014.

Stolba, A., Hinch, G., Lynch, J., Adams, D., Munro, R., & Davies, H. (1990). Social organisation of merino sheep of different ages, sex and family structure. *Applied Animal Behaviour Science*, *27*, 337-349.

Stubsjøen, S., Bohlin, J., Skjerve, E., Valle, P., & Zanella, A. (2010). Applying fractal analysis to heart rate time series of sheep experiencing pain. *Physiology & Behavior*, *101*, 74-80.

Stubsjøen, S., Flo, A., Moe, R., Janczak, A., Skjerve, E., Valle, P., & Zanella, A. (2009). Exploring non-invasive methods to assess pain in sheep. *Physiology & Behavior*, *98*, 640-648.

Stubsjøen, S., Hektoen, L., Valle, P., Janczak, A., & Zanella, A. (2011). Assessment of sheep welfare using on-farm registrations and performance data. *Animal Welfare*, *20*(2), 239-251.

Taylor, M., Coop, R., & Wall, R. (2007). *Veterinary parasitology* (3rd ed.). Oxford: Blackwell Pub Professional.

Thamsborg, S., Jørgensen, R., Waller, P., & Nansen, P. (1996). The influence of stocking rate on gastrointestinal nematode infections of sheep over a 2-year grazing period. *Veterinary Parasitology*, *67*, 207-224.

THVO. (2004). *Tierhaltungsverordnung.* (Fassung vom 17.12.2004, BGBl. II Nr. 485, 13-15)

Tilgner, H. (n.d.). *Moderhinke.* Arbeitsgemeinschaft für artgerechte Nutztierhaltung e.V. (gemeinnütziger Tierschutzverein).

Vaarst, M. (2003). Evaluating a concept for an animal welfare assessment system providing decision support using qualitative interviews. *Animal Welfare*, *12*, 541-546.

Waiblinger, S., Menke, C., & Fölsch, D. (2003). Influences on the avoidance and approach behaviour of dairy cows towards humans on 35 farms. *Applied Animal*

Behaviour Science, *84*, 23-39.

Waiblinger, S., Menke, C., Korff, J., & Bucher, A. (2004). Previous handling and gentle interactions affect behaviour and heart rate of dairy cows during a veterinary procedure. *Applied Animal Behaviour Science*, *85*, 31-42.

Wechsler, B. (1995). Coping and coping strategies: A behavioural view. *Applied Animal Behaviour Science*, *43*, 123-134.

WelfareQuality®. (2009a). Welfare Quality®assessment protocol for cattle. *Welfare Quality®Consortium*, *Lelystad, Netherlands*.

WelfareQuality®. (2009b). Welfare Quality®assessment protocol for pigs. *Welfare Quality®Consortium*, *Lelystad, Netherlands*.

Wemelsfelder, F. (1997a). Life in captivity: Its lack of opportunities for variable behaviour. *Applied Animal Behaviour Science*, *54*, 67-70.

Wemelsfelder, F. (1997b). The scientific validity of subjective concepts in models of animal welfare. *Applied Animal Behaviour Science*, *53*, 75-88.

Wemelsfelder, F. (2007). How animals communicate quality of life: The qualitative assessment of behaviour. *Animal Welfare*, *16(S)*, 25-31.

Wemelsfelder, F., & Farish, M. (2004). Qualitative categories for the interpretation of sheep welfare: A review. *Animal Welfare*, *13*, 261-268.

Wemelsfelder, F., Hunter, E., Mendl, M., & Lawrence, A. (2000). The spontaneous qualitative assessment of behavioural expressions in pigs: First explorations of a novel methodology for integrative animal welfare measurement. *Applied Animal Behaviour Science*, *67*, 193-215.

Wemelsfelder, F., Hunter, T., Mendl, M., & Lawrence, A. (2001). Assessing the 'whole animal': A free choice profiling approach. *Animal Behaviour*, *62*, 209-220.

Wemelsfelder, F., & Millard, F. (2009). Qualitative behaviour assessment. In B. Forkman & L. Keeling (Eds.), *Assessment of animal welfare measures for sows, piglets and fattening pigs, Welfare Quality®Reports, No.10* (p. 213-219). University of Cardiff.

Winter, A. (2004a). Lameness in sheep: 1. Diagnosis. *In Practice*, *26*(2), 58-63.

Winter, A. (2004b). Treatment and control of lameness in sheep. *In Practice*, *26*, 130-139.

Winter, A. (2008). Lameness in sheep. *Small Ruminant Research*, *76*(1-2), 149-153.

Wood, G., & Molony, V. (1992). Welfare aspects of castration and tail docking of lambs. *In Practice*, *14*, 2-7.

Zeiler, E. (2010). Kann die Spurenelementversorgung die Klauengesundheit beeinflussen? In *Lammfleischerzeugung Tiergesundheit* (p. 29-31).

Appendix

Farmer questionnaire (German)

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Fragebogen zum Thema „Tiergesundheit und Wohlbefinden bei Schafen“

Liebe Teilnehmerin! Lieber Teilnehmer!

Schafhaltung hat in Österreich eine lange Tradition, eine wichtige Bedeutung in der bäuerlichen Kultur und ist eine naturnahe und tiergerechte Produktionsform mit großem Entwicklungspotential. Bisher gibt es allerdings wenig wissenschaftliche Arbeiten zu Schafhaltung und -gesundheit in Österreich.
Im Rahmen einer Masterarbeit an der Universität für Bodenkultur Wien möchten wir ein standardisiertes, praxistaugliches Beurteilungsschema für Gesundheit und Wohlbefinden von Schafen entwickeln, mit dem Ziel, ein objektives und wertvolles Managementinstrument für den Betrieb zur Verfügung zu stellen. Dabei ist es uns wichtig, Ihre Erfahrungen und Meinungen als Grundlage heranzuziehen, weshalb wir diese Befragung zum Thema „Tiergesundheit und Wohlbefinden bei Schafen“ durchführen.
Wir freuen uns, wenn Sie bereit sind, dazu einige Fragen aus Ihrem persönlichen praktischen Erfahrungshintergrund zu beantworten und gegebenenfalls Zutreffendes anzukreuzen. Alle Angaben werden vertraulich behandelt.

Vielen Dank!
Marie-Theres Schlemmer

1. Allgemeine Daten

- **Welche Art** der Schafhaltung betreiben Sie? (Mehrfachnennungen möglich)
  O Milchschafhaltung O Mutterschafhaltung mit Lämmeraufzucht O Lämmermast
  O andere
- **Wie viele** Schafe halten Sie in etwa? (Mehrfachnennungen möglich)
  ___ Milchschafe; ___ Mutterschafe; ___ Mastlämmer; ___ Widder; ___ Nachzucht;
  ___andere
- **Welche Schafrasse**(n) halten Sie?
  _____
- Wird der landwirtschaftliche Betrieb **konventionell oder biologisch** bewirtschaftet?
  O konventionell O biologisch
- **Wie erfolgt die Schafhaltung**?
  O Stallhaltung ohne Auslauf/Weide
  O Stallhaltung mit befestigtem Auslauf (keine Weide)
  O Stallhaltung mit Sommerweide
  O Stallhaltung mit Almauftrieb in den Sommermonaten
  O vorwiegend Freilandhaltung mit Unterstand
  O andere: _____

2. Tiergesundheit und –wohlbefinden

- Was sind die **3 wichtigsten Anzeichen**, anhand welcher Sie **an den Tieren selbst**erkennen können, dass es Ihren Schafen **gut** geht?
    1. _____
    2. _____
    3. _____
- Was sind die **3 wichtigsten Anzeichen**, anhand welcher Sie **an den Tieren selbst**erkennen können, dass es Ihren Schafen **nicht gut** geht?
    1. _____
    2. _____
    3. _____
- Nennen Sie **3 konkrete Probleme**, welche im Bestand auftreten/aufgetreten sind und die Gesundheit und das Wohlbefinden Ihrer Schafe beeinträchtigen/beeinträchtigt haben.
    1. _____
    2. _____
    3. _____
- Nennen Sie **3 Bedingungen**, welche Ihrer Meinung nach erfüllt sein müssen, umein gutes Wohlbefinden der Schafe zu gewährleisten.
    1. _____
    2. _____
    3. _____

3. Informationsangebot zu Tiergesundheit und Wohlbefinden bei Schafen

- **Wen kontaktieren** Sie, wenn Sie Fragen in Bezug auf die Gesundheit Ihrer Schafe haben?
  O Landwirtschaftliche Berater/-innen O Tierarzt/-in O Kollegen/-innen O niemanden
  O andere:_____
- Gibt es Ihrer Meinung nach auf dem Gebiet der Schafhaltung ausreichende **(Weiter-)Bildungsangebote**?
  O Ja. O Nein.
  Wenn ja, welche?_____
  Wenn nein, zu welchen Themen bzw. in welcher Form sollten Ihrer Meinung nach (Weiter-)bildungsmöglichkeiten angeboten werden?
  _____

Sollten Sie prinzipiell an einer weiteren Kontaktaufnahme im Rahmen dieser Arbeit interessiert sein, bitte ich Sie, Ihre Kontaktdaten bekannt zu geben:

_____
_____

Vielen Dank für Ihre Mitarbeit!

On-farm welfare assessment protocol for dairy sheep - a prototype (English version)

On-farm welfare assessment protocol for dairy sheep
–
a prototype

Explanations and definitions for the welfare assessment can be found in additional guidelines (in German).

Module 1 – General Data

Name and address of the farm: _____
_____

Name of the assessor (incl. organisation/institution): _____
_____

Date: _____

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Module 2 – Interview with the farmer

General information about the farm

In which way is the farm managed? **O conventional O organic**

Are there additional branches of production at the farm? **O YES O NO**

...if yes, which one(s)? _____

Which breed(s) of dairy sheep do you keep? _____

How many sheep are kept at the farm at the moment? _____

How many lactating ewes are there at the moment? _____

In how many groups are the lactating ewes kept? _____

How many dry ewes are there at the moment? _____

At which age are the lambs separated from their mother? _____

The animals have access to:

	Lactating ewes		**Dry ewes**	
	hours/day	**days/year**	**hours/day**	**days/year**
outdoor run				
pasture				
alpine pasture				

Data on milk production

Average of all data collected over the last 12 months

Days	**Number of animals**	**Milk yield**	**Fat (%)**	**Fat (kg)**	**Protein (%)**	**Protein (kg)**	**Fat+Protein (kg)**
		kg	%	kg	%	kg	kg

Number of animals with milk somatic cell count higher than 300 000 cells/ml (last milk sample): ____

Treatment Incidence (within the last 12 months)

Average number of sheep kept at the farm within the last 12 months: ____

Reason for treatment	**Number of treatments**	**Percentage of treatments (with regard to the average number of sheep)**
mastitis		
lameness		
ectoparasites		
endoparasites		
respiratory disease		
ketosis		

Data on lamb production and animal sale/loss

Average number of dairy ewes kept at the farm within the last 12 months: ___

Lambing percentage within the last 12 months: ___%

How many dairy sheep were sold within the last 12 months? ___ (= ___%)

How many dairy sheep died/were culled at the farm within the last 12 months? ___ (= ___%)

Notes:

_____

_____

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Module 3 – Design of the housing system

Details about the housing system

Are the dairy sheep housed in an open barn? **O YES O NO**

Are the dairy sheep kept in a deep litter system? **O YES O NO**

…if "NO", which system is used? _____

Drawing of the housing system

WP ... water points
FP ... feeding place
AO…access to outdoor run
AP…access to pasture
MP ... milking parlour (incl. alleys leading to milking parlour)
WA ... waiting area for milking
PL ... pens for lambing
R … ram
Note all pens including group size, number of group and current phase of production (lactating, dry,…).

Notes: _____

_____

_____

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On-farm welfare assessment protocol for dairy sheep – a prototype
Farm: _____ Assessor: _____ Date: _____
Number of assessed group: ____ Number of animals in group: ____

Module 4 – Qualitative behaviour assessment

Minimum	**Maximum**
fearful	
active	
apathetic	
attentive	
relaxed	
exhausted	
curious	
uneasy	
content	

Notes: _____
_____

Module 5 – Behavioural observations of the flock

Instantaneous scan sampling

Segment				
Time				
Number of visible animals				
Number of animals feeding				
Number of animals lying				
Number of animals showing an increased respiration rate and/or abnormal respiration				

Continuous Observation

Segment				
Number of events of coughing				
Number of events of rubbing/scratching/nibbling at own body parts				
Number of events of excessive lip licking				
Number of events of intense head tossing				
Abnormal behaviour (short description)				

Notes: _____

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Farm: _____ Assessor: _____ Date: _____
Number of assessed group: ____ Number of animals in group: ____

Module 6 – Reaction to an unfamiliar human

Reaction Score	

Notes: _____
_____
_____

Module 7 – Water provision

Location	Kind of water point	Water flow (l/min) or volume (l)	Clean-liness	Mechan. function-ing	Access	All criteria met
Indoors						
Outdoor run						
Pasture						

Notes: _____
_____
_____

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Farm: _____ Assessor: _____ Date: _____
Number of assessed group: ____

Module 8 – Observations during milking

Number of milking batch					
Number of animals in milking batch					
Number of lame animals					
Number of events of kicking during milking					
Number of events of defecation during milking					
Number of events of urination during milking					

Notes: _____
_____
_____

M-T Schlemmer, C Leeb and C Winckler – University of Natural Resources and Life Sciences, Department of Sustainable Agricultural Systems, Division of Livestock Sciences, Gregor-Mendel-Straße 33, 1180 Vienna, Austria, resi@schlema.com

On-farm welfare assessment protocol for dairy sheep – a prototype
Farm: _____ Assessor: _____ Date: _____
Number of assessed group: _____ Number of milking batch: _____

Module 9 – Assessment of individual ewes

number of individual											**average score/number**
body condition score (1/2/3/4/5)											
appearance of wool (0/1/2)											
length of tail (0/1/2)											
number of lesions on udder											
number of swellings on udder											
cleanliness of hind legs (0/1)											
cleanliness of udder (0/1)											
number of hairless patches on hind legs											
number of lesions on hind legs											
number of swellings on hind legs											
condition of claws (0/1/2)											
number of hairless patches on head											
number of lesions on head											
number of swellings on head											
ear temperature (0/1)											
ocular discharge (0/1)											
nasal discharge (0/1)											
condition of teeth (0/1/2)											

Notes: _____

_____

_____

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On-farm welfare assessment protocol for dairy sheep - a prototype (German version)

Checkliste zur Erhebung des **Wohlergehens von Milchschafen** auf landwirtschaftlichen Betrieben

-

ein Prototyp

Hinweise zur Durchführung sind in „Erläuterungen zur ‚Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp'" zu finden.

Modul 1 – Datenblatt

Name und Anschrift des Betriebes: _____
_____

Name der erhebenden Person (inkl. Organisation/Institution): _____
_____

Datum: _____

M-T Schlemmer, C Leeb und C Winckler – Universität für Bodenkultur Wien, Department für Nachhaltige Agrarsysteme, Institut für Nutztierwissenschaften, Gregor-Mendel-Straße 33, 1180 Wien, Österreich, resi@schlema.com

Modul 2 – Gespräch mit dem/der Landwirt/Landwirtin

Allgemeine Angaben

Wie wird der Betrieb bewirtschaftet? **O konventionell O biologisch**

Gibt es außer der Milchschafhaltung noch andere Produktionszweige? **O JA O NEIN**

...wenn ja, welche? _____

Welcher Rasse gehören die Milchschafe an? _____

Wie viele Schafe werden im Moment auf dem Betrieb gehalten? _____

Wie viele laktierende Schafe gibt es im Moment auf dem Betrieb? _____

In wie vielen Gruppen werden die laktierenden Schafe im Moment gehalten? _____

Wie viele trockenstehende Schafe gibt es im Moment auf dem Betrieb? _____

Wie alt sind die Lämmer in etwa bei der Trennung vom Mutterschaf? _____

Die Schafe haben Zugang zu:

	Laktierende Schafe		**Trockenstehende Schafe**	
	Stunden/Tag	**Tage/Jahr**	**Stunden/Tag**	**Tage/Jahr**
Auslauf				
Weide				
Alm				

Daten zur Milchleistung (gleitender Stalldurchschnitt der letzten 12 Monate)

Tage	Tier-anzahl	Milch-menge	Fett%	Fett kg	Eiweiß%	Eiweiß kg	Fett+Eiweiß-Kilogramm
		kg	%	kg	%	kg	kg

Anzahl der Tiere mit einer Zellzahl über 300 000 Zellen/ml (letzte Probemelkung): ____

Tierärztliche Behandlungen (innerhalb der letzten 12 Monate)

Durchschnittliche Tierzahl innerhalb der letzten 12 Monate: ____

Ursache tierärztlicher Behandlung	**Anzahl Behandlungen**	**Anzahl Behandlungen in % (bezogen auf die durchschnittliche Tierzahl)**
Mastitis		
Lahmheit		
Ektoparasiten		
Endoparasiten		
Atemwegserkrankungen		
Ketose		

Daten zu Geburten und Tierabgängen

Durchschnittliche Anzahl der Milchschafe in den letzten 12 Monaten: ___

Wie hoch war die Ablammrate in den letzten 12 Monaten? ___%

Wie viele Milchschafe sind in den letzten 12 Monaten verkauft worden? ___ (=___%)

Wie viele Milchschafe sind in den letzten 12 Monaten am Betrieb verendet/notgeschlachtet worden? ___ (= ___%)

Raum für Anmerkungen: _____

_____

_____

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Name des Betriebes: _____ Name der erhebenden Person: _____ Datum: _____

Modul 3 – Aufbau des Stalles

Angaben zum Milchschafstall

Handelt es sich beim Milchschafstall um einen Außenklimastall? **O JA O NEIN**

Handelt es sich beim Milchschafstall um einen Tiefstreustall? **O JA O NEIN**

...wenn nein, um was für ein Aufstallungssystem handelt es sich? _____

Skizze des Milchschafstalles

WS ... Wasserstellen (Tränken, Tröge,…)
F ... Futtertisch (bzw. Futterstelle)
ZA ... Zugang zu Auslauf
ZW ... Zugang zu Weide
M ... Melkstand (inkl. Melkwege)
WB ... Wartebereich
A ... Ablammbuchten
WI … Widder
Für alle eingezeichneten Buchten muss angegeben werden, welche Gruppe von Tieren (laktierend, trockenstehend,...) sich darin befindet (inkl. Anzahl der Tiere; nötigenfalls beim/bei der Landwirt/Landwirtin erfragen) und alle Buchten müssen mit einer Nummerierung versehen werden.

Raum für Anmerkungen: _____

_____

_____

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Name des Betriebes: _____ Name der erhebenden Person: _____ Datum: _____
Nummer der beobachteten Gruppe: _____ Anzahl der Tiere in der Gruppe: _____

Modul 4 – Qualitative Verhaltensbeurteilung

Minimum	**Maximum**
ängstlich	
aktiv	
apathisch	
aufmerksam	
entspannt	
erschöpft	
neugierig	
unruhig	
zufrieden	

Raum für Anmerkungen:
_____
_____

Modul 5 – Verhaltensbeobachtung

Punktuelle Übersichtsbeobachtung

Betrachtetes Segment				
Zeitpunkt				
Anzahl der insgesamt sichtbaren Tiere				
Anzahl der fressenden Tiere				
Anzahl der liegenden Tiere				
Anzahl der Tiere, die eine erhöhte Atemfrequenz und/oder auffällige Atmung zeigen				

Kontinuierliche Übersichtsbeobachtung

Betrachtetes Segment				
Anzahl des Ereignisses „Husten”				
Anzahl des Ereignisses „Scheuern”/„Kratzen”/ „Beknabbern“ eigener Körperstellen				
Anzahl des Ereignisses „vermehrtes Lippenlecken”				
Anzahl des Ereignisses „heftiges Kopfschütteln”				
Beobachtetes auffälliges Verhalten (kurze Beschreibung)				

Raum für Anmerkungen: _____
_____

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Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp
Name des Betriebes: _____ Name der erhebenden Person: _____ Datum: _____
Nummer der beobachteten Gruppe: _____ Anzahl der Tiere in der Gruppe: _____

Modul 6 – Reaktion auf einen unbekannten Menschen

Bewertung	

Raum für Anmerkungen: _____
_____
_____

Modul 7 – Wasserversorgung

Ort	**Art der Wasser-stelle**	**Durchflussrate (in l/min)/ Volumen (in l)**	**Sauber-keit**	**Mechan. Betriebs-tauglich-keit**	**Zugäng-lichkeit**	**Alle Kriterien erfüllt**
Stall						
Auslauf						
Weide						

Raum für Anmerkungen: _____
_____
_____

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Name des Betriebes: _____ Name der erhebenden Person: _____ Datum: _____
Nummer der beobachteten Gruppe: _____

Modul 8 – Beobachtung während des Melkens

Nummer der Melkpartie					
Anzahl der Tiere in der Melkpartie					
Anzahl der lahmenden Tiere					
Anzahl des Ereignisses „Treten" während des Melkens					
Anzahl des Ereignisses „Koten" während des Melkens					
Anzahl des Ereignisses „Urinieren" während des Melkens					

Raum für Anmerkungen: _____

_____

_____

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Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp
Name des Betriebes: _____ Name der erhebenden Person: _____ Datum: _____
Nummer der beobachteten Gruppe: ____ Nummer der beobachteten Melkpartie: _____

Modul 9 – Einzeltierbeurteilung

Nummer des Tieres											**Durchschnittl. Score/Anzahl**
Körperkondition (1/2/3/4/5)											
Wollbild (0/1/2)											
Länge des Schwanzes (0/1/2)											
Anzahl Läsionen am Euter											
Anzahl Schwellungen am Euter											
Sauberkeit der Hinterbeine (0/1)											
Sauberkeit des Euters (0/1)											
Anzahl haarloser Stellen an den Hinterbeinen											
Anzahl Läsionen an den Hinterbeinen											
Anzahl Schwellungen an den Hinterbeinen											
Zustand der Klauen (0/1/2)											
Anzahl haarloser Stellen am Kopf											
Anzahl Läsionen am Kopf											
Anzahl Schwellungen am Kopf											
Ohrtemperatur (0/1)											
Augenausfluss (0/1)											
Nasenausfluss (0/1)											
Zustand der Zähne (0/1/2)											

Raum für Anmerkungen: _____

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Additional explanations (German)

Erläuterungen zur „Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp“

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Frühjahr 2014

Die vorliegenden Erläuterungen sowie die dazugehörige „Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben - ein Prototyp“ sind im Rahmen einer Masterarbeit an der Universität für Bodenkultur Wien entstanden. Für Quellenangaben siehe: „Development of a prototype on-farm welfare assessment protocol for dairy sheep“, Marie-Theres Schlemmer (2014)

Inhalt

ABBILDUNGSVERZEICHNIS 2

EINLEITUNG 3

BENÖTIGTES ZUBEHÖR 4

TEILE DER ERHEBUNG/MODULE 4

ABLAUF 5

ZEITAUFWAND 6

MODULBESCHREIBUNGEN 7

Modul 1 – Datenblatt 7

Modul 2 – Gespräch mit dem/der Landwirt/Landwirtin 7

Modul 3 – Aufbau des Stalles 9

Modul 4 – Qualitative Verhaltensbeurteilung 10

Modul 5 – Verhaltensbeobachtung 12

Modul 6 – Reaktion auf einen unbekannten Menschen 18

Modul 7 – Wasserversorgung 21

Modul 8 – Beobachtung während des Melkens 25

Modul 9 – Einzeltierbeurteilung 26

SCHLUSSWORT 43

Abbildungsverzeichnis

Abb. 1: Durchführung des Tests „Reaktion auf einen unbekannten Menschen“; 0 – „zutraulich“ 20

Abb. 2: Sauberkeit der Wasserstellen; 0 – „sauber“ (Schalentränke) 23

Abb. 3: Sauberkeit der Wasserstellen; 1 – „verschmutzt“ (Schalentränke) 23

Abb. 4: Wollbild; 0 – „gut“ 31

Abb. 5: Wollbild; 1 – „beeinträchtigt“ 31

Abb. 6: Wollbild; 2 – „schlecht“ 31

Abb. 7: Länge des Schwanzes; 0 – „natürliche Länge“ 32

Abb. 8: Länge des Schwanzes; 1 – „gekürzt“ 32

Abb. 9: Länge des Schwanzes; 2 – „nahezu nicht vorhanden“ 32

Abb. 10: Sauberkeit der Hinterbeine; 0 – „sauber“ 34

Abb. 11: Sauberkeit der Hinterbeine; 1 – „verschmutzt“ 34

Abb. 12: Sauberkeit des Euters; 0 – „sauber" 35

Abb. 13: Sauberkeit des Euters; 1 – „verschmutzt“ 35

Abb. 14: Zustand der Klauen; 0 – „gut“ 38

Abb. 15: Zustand der Klauen; 1 – „beeinträchtigt“ 38

Abb. 16: Zustand der Klauen; 2 – „schlecht“ 38

Abb. 17: Haarlose Stelle am Kopf 39

Abb. 18: Läsion am Kopf (Ohrbereich) 39

M-T Schlemmer, C Leeb und C Winckler – Universität für Bodenkultur Wien, Department für Nachhaltige Agrarsysteme, Institut für Nutztierwissenschaften, Gregor-Mendel-Straße 33, 1180 Wien, Österreich, resi@schlema.com

Einleitung

Die vorliegenden Erläuterungen dienen der Anwendung der „Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp“.

Die Checkliste ist als Management-Instrument einerseits für Landwirte und Landwirtinnen zur Selbstkontrolle, andererseits aber auch für Tierärzte und Tierärztinnen sowie für Berater und Beraterinnen gedacht, um eine Evaluierung eines Betriebes zu ermöglichen und Stärken und Schwächen aufzeigen zu können. Eine in regelmäßigen Abständen durchgeführte Anwendung der Checkliste ermöglicht nicht nur vergleichbare Betriebe einander gegenüberzustellen, sondern auch einzelne Betriebe längerfristig zu beobachten.

Ursprünglich ist die Checkliste zwar auf Gegebenheiten der österreichischen Landwirtschaft abgestimmt, sie kann aber auch in anderen Ländern (v.a. im deutschsprachigen Raum) angewendet werden. Auch eine englische Version der Checkliste ist vorhanden. Sie ist so konzipiert, dass ihre Anwendung von einer einzelnen Person in einem Tag durchgeführt werden kann.

Die Checkliste ist in neun Module untergliedert und beinhaltet in erster Linie tierbezogene Parameter. Ihre Stärke ist es daher, das Wohlergehen der Milchschafe an den Tieren selbst, hauptsächlich anhand ihres Verhaltens und ihrer äußeren Erscheinung, zu messen. Dennoch sind vereinzelt ressourcenbezogene Parameter in die Checkliste eingebaut – insbesondere dort, wo für bestimmte Bereiche noch keine wissenschaftlich fundierten tierbezogenen Parameter vorhanden sind. Durch die Auswahl unterschiedlicher Beobachtungsformen und Parameter wurde versucht einen ganzheitlichen Einblick in das Wohlergehen der Milchschafe eines Betriebes zu gewinnen. Wesentlich hierbei ist, dass sowohl Parameter, welche sich auf die ganze Herde (bzw. Gruppe) beziehen, als auch Parameter, die sich mit dem Einzeltier beschäftigen, gewählt wurden. Es soll dadurch dem Gesamteindruck der Herde (bzw. Gruppe) sowie dem Wohlergehen des einzelnen Individuums gleichermaßen Rechnung getragen werden.

Der Anwendungsbereich der Checkliste bezieht sich in erster Linie auf laktierende Milchschafe. Eine Beurteilung trockenstehender Schafe mit dieser Checkliste ist zwar auch möglich, allerdings muss dann beachtet werden, dass Modul 8 nicht vollständig durchgeführt werden kann und die Tiere für die Durchführung von Modul 9 eigens im Melkstand eingefangen werden müssten ohne tatsächlich gemolken zu werden.

Bei der Entwicklung der Checkliste wurde besonderer Wert darauf gelegt, dass die Anwendung so standardisiert wie möglich stattfinden kann, gleichzeitig aber auch Flexibilität gegeben ist, um den individuellen Gegebenheiten (z.B. Bauweise des Melkstandes, Gruppengröße, Zugang zur Weide) der verschiedenen Betriebe Rechnung zu tragen.

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Benötigtes Zubehör

Für die Anwendung der „Checkliste zur Erhebung des Wohlergehens von Milchschafen auf landwirtschaftlichen Betrieben – ein Prototyp“ werden benötigt:

- Checkliste (einige Module in mehrfacher Ausführung)
- Erläuterungen zur Checkliste
- Schreibgerät
- Klemmbrett
- Stoppuhr
- Messbecher
- Maßband

Insbesondere wenn betriebsfremde Personen die Erhebung durchführen, ist es wichtig, dass Hygienevorschriften eingehalten werden und mitgebrachtes Zubehör entsprechend desinfiziert wird.

Teile der Erhebung/Module

Die Checkliste ist in neun einzelne Module unterteilt, die der Reihe nach ausgefüllt werden müssen:

Modul 1 – Datenblatt

Modul 2 – Gespräch mit dem/der Landwirt/Landwirtin

Modul 3 – Aufbau des Stalles

Modul 4 – Qualitative Verhaltensbeurteilung

Modul 5 – Verhaltensbeobachtung

Modul 6 – Reaktion auf einen unbekannten Menschen

Modul 7 – Wasserversorgung

Modul 8 – Beobachtung während des Melkens

Modul 9 – Einzeltierbeurteilung

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Modul 1, Modul 2 und Modul 3: Diese Module werden für den gesamten Betrieb erhoben. Es wird pro Modul ein Vordruck zum Ausfüllen benötigt.

Modul 4, Modul 5, Modul 6 und Modul 7: Diese Module werden der Reihe nach für die ganze Schafherde erhoben. Werden die Schafe auf einem Betrieb in einer einzigen Herde gehalten, so werden diese Module jeweils einmal für die ganze Herde angewendet. Ist die Herde jedoch auf mehrere Gruppen aufgeteilt, so werden diese Module für jede einzelne Gruppe erhoben. Es wird pro Modul also entweder ein Vordruck (für die ganze Herde) oder so viele Vordrucke wie Gruppen (z.B. 5 Vordrucke jedes Moduls für 5 Gruppen) zum Ausfüllen benötigt.

Modul 8 und Modul 9: Diese Module werden während des Melkens abwechselnd für einzelne Melkpartien erhoben. Eine Melkpartie umfasst jene Tiere, die zugleich in den Melkstand getrieben werden. Die erste Melkpartie wird mit Modul 8 beurteilt, die zweite mit Modul 9, die dritte wieder mit Modul 8 usw. Ist ein Melkkarussell vorhanden und sind die einzelnen Melkpartien daher nicht eindeutig abgrenzbar, so wird die Gesamtzahl der Tiere lediglich gedanklich in Melkpartien eingeteilt (z.B. immer 20 Tiere). Die Anzahl der benötigten Vordrucke richtet sich nach Anzahl und Größe der Melkpartien, Anzahl der Tiere pro Melkpartie und Bauweise des Melkstandes.

Für den Fall, dass ein Parameter nicht bewertet werden kann (z.B. weil die Sicht verdeckt ist) und an der entsprechenden Stelle keine Beurteilung eingetragen werden kann, so ist dort das Symbol „X“ einzutragen.

Jedes Modul beinhaltet außerdem einen Raum für Notizen, wo etwaige Anmerkungen zum entsprechenden Modul gemacht werden können. Hier kann vermerkt werden, wenn sich z.B. ein Tier im Verhalten besonders von der restlichen Herde/Gruppe unterscheidet oder wenn z.B. das Verhalten der gesamten Herde/Gruppe durch nicht vorhersehbare Einflüsse (wie etwa Geräusche) offensichtlich stark beeinflusst wird.

Die einzelnen Parameter werden in Kapitel „Modulbeschreibungen“ erklärt.

Ablauf

Die Reihenfolge, welche durch die Module vorgegeben wird, muss eingehalten werden, um eine standardisierte Vorgehensweise zu gewährleisten. Würde die Reihenfolge nicht eingehalten werden und bspw. Modul 4 im Anschluss an Modul 7 durchgeführt werden, so könnten die Tiere durch das in Modul 7 erforderliche mehrmalige Durchqueren des Stalles durch den/die Beobachter/Beobachterin beunruhigt sein und die anschließende qualitative Beurteilung ihres Verhaltens im Zuge von Modul 4 verzerrt werden.

Eine Ausnahme, was die Reihenfolge der Erhebung betrifft, stellt Modul 2 – Gespräch mit dem/der Landwirten/Landwirtin dar; dieses kann – wenn gar nicht anders möglich – auch zu einem anderen Zeitpunkt, bspw. am Schluss des Betriebsbesuches, durchgeführt werden. Zu

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beachten ist aber, dass dann Informationen über die Herdengröße und Gruppenanzahl dennoch im Vorhinein eingeholt werden müssen. Sind mehrere Gruppen von Milchschafen auf einem Betrieb vorhanden, so ist es wesentlich, dass Modul 4, Modul 5, Modul 6 und Modul 7 immer aufeinanderfolgend für eine Gruppe erhoben werden. Erst wenn diese Module für eine Gruppe abgeschlossen worden sind, kann mit der Erhebung dieser vier Module bei der nächsten Gruppe begonnen werden.

Ist es aufgrund betrieblicher Gegebenheiten nicht möglich, bei der zweiten Tagesmelkung dabei zu sein und Modul 8 und Modul 9 am Schluss der Erhebung durchzuführen, so besteht die Möglichkeit, diese beiden Module der restlichen Checkliste voranzustellen. Sollte dies gemacht werden, so muss dies unbedingt in der Checkliste als Notiz vermerkt werden.

Zeitaufwand

Die Checkliste kann von einer einzelnen Person innerhalb eines Tages komplett ausgefüllt werden.

Der Zeitaufwand setzt sich wie folgt zusammen:

- eine Stunde, um den/die Landwirten/Landwirtin kennenzulernen und mit den betrieblichen Gegebenheiten vertraut zu werden (Modul 1, Modul 2 und Modul 3)
- eine Stunde pro Schafgruppe (Modul 4, Modul 5, Modul 6, Modul 7)
- ein bis drei Stunden (in Abhängigkeit von Herdengröße und Routine am Betrieb) für die Erhebungen der Parameter während des Melkens (Modul 8 und Modul 9)

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Modulbeschreibungen

Im Folgenden finden sich die detaillierten Beschreibungen der einzelnen Module.

Modul 1 – Datenblatt

1 Datenblatt	
Relevanz	Das ausgefüllte Datenblatt dient der eindeutigen Zuordnung der erhobenen Daten zu einem Betrieb und gewährleistet eine einfache Rückverfolgbarkeit dieser.
Vorgehensweise	Das Datenblatt wird von der erhebenden Person vollständig ausgefüllt.
Definition	–
Interpretation	–
Anmerkungen	–

Modul 2 – Gespräch mit dem/der Landwirt/Landwirtin

Für das gesamte Modul 2 gilt, dass das Gespräch mit jener Person durchgeführt werden muss, welche in erster Linie mit der Versorgung der Milchschafe betraut ist und für die Tiere verantwortlich ist - auch wenn hier gemeinhin die Begriffe „Landwirt/Landwirtin“ gebraucht werden.

2.1 Allgemeine Angaben	
Relevanz	Der erste Teil des Gespräches soll einen kurzen Einblick in das Management des Betriebes geben und die weitere Erhebung erleichtern.
Vorgehensweise	Die erhebende Person führt ein kurzes Gespräch mit dem Landwirt/der Landwirtin und nimmt allgemeine Daten zur Betriebsbewirtschaftung auf.
Definition	–
Interpretation	Während die ersten Fragen von 2.1 eher rein informativer Natur sind, lassen letztere Möglichkeiten der Interpretation zu. Sehr frühes Trennen der Lämmer von der Mutter wird meist negativ betrachtet.

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	Was den Zugang zu Auslauf/Weide/Alm betrifft, so stellt dieser zumeist eine Vergrößerung der den Tieren zur Verfügung stehenden Fläche dar und ermöglicht auch eine relativ naturnahe Haltung. Regelmäßiger, längerfristiger Zugang zu Auslauf/Weide/Alm wirkt sich positiv auf das Wohlergehen der Tiere aus.
Anmerkungen	Auch wenn hier gemeinhin die Begriffe „Landwirt/Landwirtin“ gebraucht werden, so gilt, dass das Gespräch mit jener Person durchgeführt werden muss, welche in erster Linie mit der Versorgung der Milchschafe betraut ist und für die Tiere verantwortlich ist; dies gilt für das gesamte Modul 2.

2.2 Daten zur Milchleistung	
Relevanz	Die Daten zu Milchmenge und -inhaltsstoffen lassen Rückschlüsse auf das Wohlergehen der Milchschafe zu und sind auch von ökonomischer Bedeutung für den/die Landwirt/Landwirtin.
Vorgehensweise	Die Milchleistungsdaten sollen Aufzeichnungen über den Zeitraum der letzten 12 Monate entnommen werden (z.B. Bericht des Landeskontrollverbandes).
Definition	–
Interpretation	Vergleichswerte der österreichischen Schafmilchproduktion (September 2011 bis August 2012): Durchschnittliche Milchmenge pro Schaf und Jahr: 466kg Prozentueller Fettgehalt: 6,01% Fett-Kilogramm: 28kg Prozentueller Eiweißgehalt: 5,15% Eiweiß-Kilogramm: 24kg Fett+Eiweiß-Kilogramm: 52kg Ab einer Zellzahl von 300 000 Zellen/ml wird empfohlen Maßnahmen im Sinne einer Senkung der Zellzahl zu ergreifen. (Daten zur Verfügung gestellt vom Österreichischen Bundesverband für Schafe und Ziegen)
Anmerkungen	–

2.3 Tierärztliche Behandlungen	
Relevanz	Die Anzahl der tierärztlichen Behandlungen kann Auskunft über den allgemeinen Gesundheitszustand einer Herde geben.
Vorgehensweise	Die Anzahl und Ursache der tierärztlichen Behandlungen während der letzten 12 Monate sollen dem Medikamentenbuch entnommen werden. Außerdem wird die Anzahl der Behandlungen in Prozent, bezogen auf die durchschnittliche Anzahl der Tiere der letzten 12 Monate, berechnet.
Definition	–
Interpretation	Grundsätzlich gilt: je weniger auftretende Krankheiten, desto besser.

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Anmerkungen	Zusätzlich zu den in der Tabelle bereits genannten Krankheiten bieten einige leere Zeilen die Möglichkeit für den Eintrag etwaiger anderer aufgetretener Behandlungsursachen.

2.4 Daten zu Geburten und Tierabgängen	
Relevanz	Trächtigkeitserfolg und Lebenserwartung lassen Rückschlüsse auf das Wohlergehen von Milchschafen zu. Daten dazu können also Einblick in das Wohlergehen der Tiere geben und Anlass zur Identifikation negativer Einflussfaktoren bieten.
Vorgehensweise	Die Daten werden den betrieblichen Aufzeichnungen entnommen. Die Ablammrate ist der Quotient aus Anzahl lebend geborener Lämmer und der Anzahl der Erstbesamungen mal 100.
Definition	–
Interpretation	Eine Ablammrate gleich oder größer 100% (in Abhängigkeit der Rasse) ist erstrebenswert. Die Anzahl der am Betrieb verendeten/notgeschlachteten Tiere sollte möglichst niedrig sein.
Anmerkungen	–

Modul 3 – Aufbau des Stalles

3.1 Angaben zum Milchschafstall	
Relevanz	Da die Milchschafe tagaus tagein mit ihrer Haltungsumwelt konfrontiert sind, ist diese unmittelbar mit dem Wohlergehen der Tiere verknüpft.
Vorgehensweise	Wichtig ist, dass sich die Person, die die Checkliste anwendet, ein Bild von der aktuellen Situation der Milchschafhaltung macht und die Fragen dementsprechend beantwortet.
Definition	–
Interpretation	–
Anmerkungen	–

3.2 Skizze des Milchschafstalles	
Relevanz	Das Anfertigen einer groben Skizze des Milchschafstalles soll der Vereinfachung der weiteren Datenerhebung dienen.
Vorgehensweise	Die erhebende Person zeichnet den Stall auf, wobei in jedem Fall alle Gruppen der am Betrieb gehaltenen Milchschafe eingetragen und mit einer Nummer versehen werden müssen. Außerdem werden die Gruppengrößen und aktuelle Phase des Produktionszyklus, in dem sich die Tiere der jeweiligen Gruppe befinden, vermerkt. Einzuzeichnen sind weiters alle Wasserstellen (Tränken, Tröge,...), der Futtertisch (bzw. die Futterstelle), Zugänge zu Auslauf und/oder Weide, der Melkstand (inkl. Melkwege), der Wartebereich und gegebenenfalls

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	vorhandene Ablammbuchten. Gibt es am Betrieb einen oder mehrere Widder, so ist einzuzeichnen, wie und wo diese/r gehalten wird/werden (z.B. mitlaufend in der Gruppe der Milchschafe oder in einer getrennten Bucht).
Definition	–
Interpretation	–
Anmerkungen	Sollten die Tiere in unterschiedlichen Gebäuden gehalten werden, so ist von jedem einzelnen Stall eine Skizze anzufertigen und entsprechend zu beschriften

Modul 4 – Qualitative Verhaltensbeurteilung

4.1 Qualitative Verhaltensbeurteilung	
Relevanz	Mithilfe der qualitativen Verhaltensbeurteilung kann der **Gesamteindruck** der Stimmungslage einer Gruppe von Schafen betrachtet werden. Dies ist insofern von Bedeutung, als sich das Wohlergehen der Tiere in ihrem Ausdruck widerspiegelt und diese Art von Erhebungsmethode dem/der Betrachter/Betrachterin einen Einblick in den Gemütszustand der Tiere ermöglicht.
Vorgehensweise	Bei der qualitativen Verhaltensbeurteilung muss zu vorgegebenen Stimmungsbegriffen auf einer Linie, die von Minimum bis Maximum reicht, jene Stelle markiert werden, die am besten das Verhalten der Tiere widerspiegelt. **Minimum** bedeutet, dass der jeweilige Begriff nicht auf das gezeigte Verhalten der Tiere zutrifft, während **Maximum** anzeigt, dass der jeweilige Begriff genau auf das gezeigte Verhalten der Tiere zutrifft. Die angezeichnete Stelle entspricht dann dem subjektiven Eindruck, den der/die Beobachter/Beobachterin von der Gruppe gewonnen hat. Es zählt der Gesamteindruck der Gruppe. Die qualitative Verhaltensbeurteilung wird in der für die Tiere gewohnten Umgebung durchgeführt – dies kann sowohl der Stall als auch der Auslauf oder die Weide sein. Die beobachtende Person befindet sich dabei außerhalb der Gruppe bspw. am Futtertisch oder im Mittelgang des Stalles, um die Gruppe so wenig wie möglich zu beeinflussen. Mit der Beobachtung darf erst 5 min nachdem der/die Beobachter/Beobachterin seinen/ihren (ersten) Standort eingenommen hat, begonnen werden, um den Tieren ein wenig Zeit zu geben, sich an die Anwesenheit der fremden Person zu gewöhnen und zu verhindern,

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	dass ein falscher Eindruck der Gruppe entsteht, da die Tiere durch ungewohnte Einflüsse (mehrmaliges Durchqueren des Stalles durch den/die Beobachter/Beobachterin,...) zunächst irritiert sein könnten. Der gesamte Bereich, in dem sich die Gruppe aufhalten kann, muss entweder von einem Ort einsehbar sein oder durch Aufteilung der Beobachtungsstandorte, welche nach einander eingenommen werden, abgedeckt werden. Die **Beobachtungszeit** beträgt in Summe 10 min. Ist es also nicht möglich, die ganze Gruppe von einem Standort aus zu betrachten, so wird die Beobachtungszeit auf die verschiedenen Standorte aufgeteilt. Von jedem Standort aus wird nur ein bestimmter Teil des Bereiches (=Segment), in dem sich die Gruppe aufhalten kann, betrachtet. Der gesamte Bereich soll, sofern erforderlich, in maximal vier etwa gleich große Segmente aufgeteilt werden. Jedes einzelne dieser Segmente wird getrennt betrachtet.

Anzahl der zu beobachtenden Segmente	**Dauer der Beobachtungszeit pro Segment**
Ein zu beobachtendes Segment (=ganzer Bereich)	10 min Gesamtbetrachtungsdauer
Zwei zu beobachtende Segmente	10 min Gesamtbetrachtungsdauer; 5 min pro Segment
Drei zu beobachtende Segmente	10 min Gesamtbeobachtungsdauer; etwa 3 min pro Segment
Vier zu beobachtende Segmente	10 min Gesamtbeobachtungsdauer; 2,5 min pro Segment

Das Wechseln der Standorte zur Betrachtung einzelner Segmente sollte möglichst ruhig erfolgen, um jegliche Irritation der Tiere weitestgehend zu vermeiden. Wichtig ist, dass der/die Betrachter/Betrachterin die Tiere während der gesamten Beobachtungszeit nicht stört, sich ruhig verhält und nicht absichtlich mit den Tieren interagiert.

Das Ausfüllen des Moduls 4 darf nicht während der Beobachtung der Gruppe stattfinden, sondern erst in einem zweiten Schritt: nachdem die Beobachtungsposition verlassen worden ist und der/die Beobachter/Beobachterin sich von der Gruppe abgewandt hat, wird von ihm/ihr jedem Begriff ein Punkt auf der Minimum-Maximum-Skala zugeordnet. Wurde die Gruppe anfangs zwecks der besseren

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	Übersichtlichkeit in verschiedene Segmente eingeteilt, wird das Erhebungsblatt für die qualitative Verhaltensbeurteilung dennoch nur einmal für die Gruppe ausgefüllt.
Definition	–
Interpretation	Die Interpretation der auf der Minimum-Maximum-Linie eingezeichneten Stelle erfolgt je nach Bedeutung des vorgegebenen Begriffes. Es ist erstrebenswert, dass die Herde einen entspannten, zufriedenen und auch eher neugierigen Eindruck macht, die Markierungen zu diesen Begriffen sich also in der rechten Hälfte der Minimum-Maximum-Linie befinden. Sollten die meisten Markierungen für die Begriffe „apathisch", „erschöpft" oder „unruhig" im rechten Bereich der Linie angesiedelt sein, so sollte der Ursache für diese Stimmungslagen nachgegangen werden. Der Begriff „aktiv" kann sowohl positiv als auch negativ gewertet werden und ist in Relation zu den anderen Bewertungen zu sehen.
Anmerkungen	Die Begriffe schließen einander nicht zwangsläufig aus, was zur Folge hat, dass jeweils mehrere Begriffe mit „Minimum" oder „Maximum" bewertet werden können.

Modul 5 – Verhaltensbeobachtung

Achtung: Dieses Modul besteht aus einer punktuellen und einer kontinuierlichen Übersichtsbeobachtung (siehe Vorgehensweisen von 5.1 und 5.3). Alle Erhebungen des Moduls 5 werden zeitgleich durchgeführt!

5.1 Anzahl der fressenden Tiere und Anzahl der liegenden Tiere	
Relevanz	Da Schafe ausgeprägte Herdentiere sind, führen sie die meisten Aktivitäten gemeinsam zur selben Zeit aus, d.h. ihr Verhalten weist eine große Synchronizität auf, wenn ihnen artgerechte Lebensbedingungen geboten werden und somit gutes Wohlergehen ermöglicht wird.
Vorgehensweise	Bei der Verhaltensbeobachtung einer Gruppe stellt sich der/die Betrachter/Betrachterin außerhalb der Gruppe laktierender Schafe an eine Stelle, von wo aus er/sie die ganze zu betrachtende Gruppe gut einsehen kann (z.B. am Futtertisch). Es kann (bzw. können) dazu derselbe Standort (bzw. dieselben Standorte) wie für Modul 4 gewählt werden. Wie für Modul 4 gilt auch hier, dass der gesamte Bereich, in dem sich die Gruppe aufhalten kann, entweder von einem Ort aus einsehbar sein

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	muss oder durch entsprechende Aufteilung der Beobachtungsstandorte, welche nach einander aufgesucht werden, abgedeckt sein muss. Die Beobachtung wird in der für die Tiere gewohnten Umgebung durchgeführt – dies kann sowohl der Stall als auch der Auslauf oder die Weide sein. Die beobachtende Person befindet sich dabei außerhalb der Gruppe bspw. am Futtertisch oder im Mittelgang des Stalles, um die Gruppe so wenig wie möglich zu beeinflussen. Die Erhebung erfolgt mittels einer **punktuellen Übersichtsbeobachtung**. Hierbei handelt es sich um eine Beobachtungsmethode, bei der zu bestimmten Zeitpunkten eine Momentaufnahme eines Zustandes des Verhaltens einer Gruppe von Tieren gemacht wird. Es wird zu vier ausgewählten Zeitpunkten festgehalten, wie viele Tiere zum jeweiligen Zeitpunkt eindeutig sichtbar sind (bzw. ihre Tätigkeit erkennbar ist) und das zu beobachtende Verhalten zeigen. Ein Tier wird dann als sichtbar bezeichnet, wenn es soweit eingesehen werden kann, dass seine Tätigkeit erkennbar ist. In das Feld „Zeitpunkt" muss zur besseren späteren Nachvollziehbarkeit nicht nur die Uhrzeit eingetragen werden, sondern es müssen auch die Zeitpunkte durchnummeriert werden (z.B. Zeitpunkt 1 – 09:15Uhr; Zeitpunkt 2 – 09:20Uhr usw.). Die Nummer des betrachteten Segmentes muss ebenso wie alle anderen Beobachtungen in die Tabelle eingetragen werden. Der gesamte Bereich, in dem sich die Gruppe aufhalten kann, muss entweder von einem Ort einsehbar sein oder durch Aufteilung der Beobachtungsstandorte, welche nach einander aufgesucht werden, abgedeckt werden. Die **Beobachtungszeit** beträgt in Summe 15 min. Ist es also nicht möglich, die ganze Gruppe von einem Standort aus zu betrachten, so wird die Beobachtungszeit auf die verschiedenen Standorte aufgeteilt. Von jedem Standort aus wird nur ein bestimmter Teil des Bereiches (=Segment), in dem sich die Gruppe aufhalten kann, betrachtet. Der gesamte Bereich soll, sofern erforderlich, in maximal vier etwa gleich große Segmente aufgeteilt werden. Jedes einzelne dieser Segmente wird getrennt betrachtet.

Anzahl der zu beobachtenden Segmente	**Dauer der Beobachtungszeit pro Segment**	**Zeitpunkte für die punktuelle Übersichts-beobachtung**
Ein zu beobachtendes Segment	15 min Gesamtbeobachtungsdauer	Zeitpunkt 1 = Min0 Zeitpunkt 2 = Min5 Zeitpunkt 3 = Min10 Zeitpunkt 4 = Min15

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	Zwei zu beobachtende Segmente	15 min Gesamtbeobachtungsdauer; 7,5 min pro Segment (für den Segmentwechsel selber sind hier 0,5 min anberaumt)	Zeitpunkt 1 = Min0 Zeitpunkt 2 = Min7,5 SEGMENTWECHSEL Zeitpunkt 3 = Min8 Zeitpunkt 4 = Min15,5
	Drei zu beobachtende Segmente	15 min Gesamtbeobachtungsdauer; 5 min pro Segment (für den Segmentwechsel selber sind hier 0,5 min anberaumt)	Zeitpunkt 1 = Min0 SEGMENTWECHSEL Zeitpunkt 2 = Min5,5 SEGMENTWECHSEL Zeitpunkt 3 = Min11 Zeitpunkt 4 = Min16
	Vier zu beobachtende Segmente	15 min Gesamtbeobachtungsdauer; 3,5 min pro Segment (für den Segmentwechsel selber sind hier 0,5 min anberaumt)	Zeitpunkt 1 = Min0 SEGMENTWECHSEL Zeitpunkt 2 = Min5,5 SEGMENTWECHSEL Zeitpunkt 3 = Min11 SEGMENTWECHSEL Zeitpunkt 4 = Min16,5
	Das Wechseln der Standorte zur Betrachtung einzelner Segmente sollte möglichst ruhig erfolgen, um jegliche Irritation der Tiere weitestgehend zu vermeiden. Wichtig ist, dass der/die Betrachter/Betrachterin die Tiere während der gesamten Beobachtungszeit nicht stört, sich ruhig verhält und nicht absichtlich mit den Tieren interagiert. In jeder Spalte wird die entsprechende Anzahl der Tiere in Form einer Strichliste notiert. Anschließend werden die erfassten Zahlen in Prozent (bezogen auf die Anzahl der sichtbaren Tiere) angegeben.		
Definition	Als **Fressen** wird gewertet, wenn ein Tier eindeutig Nahrung aufnimmt. Erkennbar ist dies an mehrmaligem Aufnehmen von Nahrungsbissen vom Futtertisch/Futtertrog oder vom Boden, gefolgt von Abschlucken. Dies erfolgt zumeist direkt am Fressgitter oder auf der Weide. Steht ein Tier am Fressgitter, ist aber nicht eindeutig mit der Futteraufnahme beschäftigt, so gilt dies nicht als Fressen. Wiederkauen, Trinken oder Lecken am Salz-/Mineralstein gilt nicht als Fressverhalten. Als **Liegen** wird gewertet, wenn ein Schaf eindeutig eine Ruheposition eingenommen hat, bei der es nicht auf seinen Beinen steht. Die Tiere liegen hierbei zumeist auf dem Bauch, wobei die Beine entweder unter dem Körper verborgen sein können oder aber ein oder mehrere Beine auch halb seitlich abgewinkelt oder nach vorne ausgestreckt sein können. Manchmal ist auch eine komplette Seitenlage der Schafe zu beobachten. Ob das Schaf während des Liegens wiederkaut oder nicht, bleibt unbeachtet.		

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Interpretation	Hohe Synchronizität (80% der Tiere führen das gleiche Verhalten aus) zeigt an, dass die Tiere in artgerechter Weise ihr Herdenverhalten leben können.
Anmerkungen	Fällt besonders auf, dass eines oder einige wenige Tiere gar nicht an den Aktivitäten einer Herde teilnimmt/teilnehmen (z.B. dauerndes, mattes Abseitsliegen während die Herde sich deutlich entfernt), kann dies im Raum für Notizen vermerkt werden.

5.2 Anzahl der Tiere, die eine erhöhte Atemfrequenz und/oder auffällige Atmung zeigen	
Relevanz	Das Wohlergehen der Milchschafe kann durch verschiedene Faktoren beeinträchtigt sein, die sich in einer erhöhten Atemfrequenz oder auffälligen Atmung zeigen (z.B. extreme Hitze, Stress, Lungenerkrankungen etc.).
Vorgehensweise	Siehe 5.1
Definition	Eine **erhöhte Atemfrequenz** liegt dann vor, wenn ein Schaf 20-40 oder mehr Atemzüge/Minute macht. Eine **auffällige Atmung** liegt dann vor, wenn ein Schaf mit stark geöffnetem Maul atmet („hecheln“), die Atmung wie ein „schweres Pumpen“ erscheint oder andere auffällige Abweichungen in Rhythmus und Art beobachtbar sind.
Interpretation	Je geringer die Anzahl der Tiere, die eine erhöhte Atemfrequenz und/oder auffällige Atmung zeigen, desto besser.
Anmerkungen	Der Normalbereich der Atmung liegt bei Schafen bei einer Atemfrequenz von etwa 12-20 Atemzügen/Minute, wobei die exakten Werte je nach Alter, Größe etc. variieren.

5.3 Anzahl des Ereignisses „Husten“	
Relevanz	Das Wohlergehen eines Milchschafes kann u.a. durch schlechtes Stallklima oder Erkrankungen (z.B. Atemwegserkrankungen) negativ beeinflusst werden, was sich in vermehrtem Husten äußern kann.
Vorgehensweise	Für die Rahmenbedingungen der Erhebung siehe 5.1 Die Erhebung selbst erfolgt allerdings mittels einer **kontinuierlichen Übersichtsbeobachtung**. Hierbei wird über einen bestimmten Zeitraum hinweg das Verhalten einer Gruppe von Tieren durchgehend beobachtet. Jedes einzelne Ereignis wird dabei notiert, ungeachtet dessen, ob es wiederholt von einem Tier (z.B. ein konkretes Schaf hustet zehnmal) oder von mehreren Tieren (z.B. 10 Schafe husten je einmal) gezeigt wird. Es zählt also immer das Ereignis, nicht die Anzahl der Tiere. In jeder Spalte wird die entsprechende Anzahl beobachteter Ereignisse in Form einer Strichliste notiert. Anschließend wird die durchschnittliche Anzahl an Ereignissen pro Tier errechnet.
Definition	**Husten** ist definiert als plötzlicher, lautstarker Ausstoß von Luft.

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Interpretation	Je weniger Tiere husten, desto weniger scheint ihr Wohlergehen durch Faktoren, die die Lunge und Atemwege belasten, beeinträchtigt zu sein.
Anmerkungen	Das Ereignis „Husten“ wird gezählt, sobald es von der erhebenden Person entweder gehört oder gesehen wird.

5.4 Anzahl des Ereignisses „Scheuern“/„Kratzen“ /„Beknabbern“ eigener Körperstellen	
Relevanz	Juckreiz (z.B. hervorgerufen durch Ektoparasiten) kann das Wohlergehen maßgeblich stören und in Extremfällen zu langanhaltendem Leiden führen. Wenn er durch Ektoparasiten hervorgerufen ist, stellt dies zusätzlich eine Bedrohung des Wohlergehens der ganzen Herde dar, da Ektoparasiten rasch von Tier zu Tier übertragen werden.
Vorgehensweise	Siehe 5.3 **Achtung:** Erst wenn ein Schaf die Verhaltensweisen „Scheuern“, „Kratzen“ oder „Beknabbern“ eigener Körperstellen über eine Dauer von mindestens 5s zeigt, wird dies als Ereignis gewertet.
Definition	Beim **Scheuern** des Körpers suchen die Tiere Teile der Stalleinrichtung auf (z.B. Einfanggitter, abstehende Teile von Boxentrennwänden etc.) und reiben ihren Körper schwungvoll daran. **Kratzen** ist bei Schafen zumeist daran erkennbar, dass sie eines ihrer Hinterbeine aufheben und zu Bauch, Körperseite oder Kopf führen, um dort rasche, kurz aufeinanderfolgende Bewegungen durchzuführen und so einem Juckreiz entgegenzuwirken. Richtet ein Schaf seinen Kopf gegen seinen eigenen Körper und zupft relativ heftig mit Lippen und Zähnen an Fell bzw. Wollkleid, so ist dies als **Beknabbern** zu werten.
Interpretation	Gutes Wohlergehen von Milchschafen ist (unter anderem) dann gewährleistet, wenn in einer Herde keine Anzeichen von extremem Juckreiz gezeigt werden. Andernfalls kann nicht nur der Juckreiz selbst, sondern auch seine zugrundeliegende Ursache das Wohlergehen der Tiere schwer beeinträchtigen.
Anmerkungen	–

5.5 Anzahl des Ereignisses „vermehrtes Lippenlecken“	
Relevanz	Da vermehrtes Lippenlecken von Schafen dann gezeigt wird, wenn sie langandauerndem Stress ausgesetzt sind, der ihre Bewältigungsstrategien übersteigt, ist dies ein Indikator für beeinträchtigtes Wohlergehen.
Vorgehensweise	Siehe 5.3
Definition	Als **vermehrtes Lippenlecken** wird Lippenlecken bezeichnet, das ohne einen entsprechenden Stimulus (z.B. Futter während des

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	Fressvorganges) mehrmals in kurz aufeinanderfolgenden Abständen gezeigt wird.
Interpretation	In einer Herde mit gutem Wohlergehen der Tiere sollte vermehrtes Lippenlecken nicht zu beobachten sein.
Anmerkungen	–

5.6 Anzahl des Ereignisses „heftiges Kopfschütteln“	
Relevanz	Leiden Tiere unter Parasiten kann sich dies in heftigem Kopfschütteln äußern, da sie so versuchen, dem Juckreiz und unangenehmen Empfindungen im Kopfbereich zu entgehen.
Vorgehensweise	Siehe 5.3
Definition	**Heftiges Kopfschütteln** ist definiert als heftiges, ruckartiges Kopfschütteln, welches mindestens zehnmal innerhalb einer Minute gezeigt wird.
Interpretation	Zeigen Tiere vermehrt heftiges Kopfschütteln, so weist dies auf beeinträchtigtes Wohlergehen hin.
Anmerkungen	–

5.7 Beobachtetes auffälliges Verhalten	
Relevanz	Auffälliges Verhalten wird von Tieren meist dann gezeigt, wenn die Ansprüche, die sie an ihre Umwelt stellen, nicht erfüllt werden und ihre Anpassungsfähigkeiten an das Haltungssystem überfordert werden. Da diese Verhaltensweisen nicht natürlich sind und keinen eindeutigen Zweck erfüllen, sind sie als Merkmale schlechten Wohlergehens einzustufen.
Vorgehensweise	Siehe 5.3 **Achtung:** Hier wird nicht die Anzahl der Ereignisse oder Tiere aufgezeichnet, sondern wenn auffälliges Verhalten beobachtet wird, dieses kurz beschrieben.
Definition	Als **auffälliges Verhalten** wird ein Verhalten bezeichnet, welches nicht im normalen Verhaltensrepertoire von Schafen vorhanden ist und zumeist nur von einem oder mehreren Schafen, nicht aber von der ganzen Gruppe gezeigt wird. Hierzu zählen bspw. Stereotypien oder abnorme Verhaltensweisen (wie etwa ständiges Beknabbern von Stalleinrichtungen).
Interpretation	Jegliches Auftreten von auffälligem Verhalten muss als Anzeichen für beeinträchtigtes Wohlergehen angesehen werden.
Anmerkungen	–

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<table>
<tr><th colspan="3">6.1 Reaktion auf einen unbekannten Menschen</th></tr>
<tr><td>Relevanz</td><td colspan="2">Da Milchschafe täglich mit dem Menschen konfrontiert sind, beeinflussen dessen Handlungen und Gegenwart das Wohlergehen der Tiere – positiv wie negativ. Um einen möglichst ganzheitlichen Eindruck vom Wohlergehen der Tiere zu erhalten, muss also auch ihr Verhältnis zum Menschen miteinbezogen werden.</td></tr>
<tr><td>Vorgehensweise</td><td colspan="2">Die Testperson betritt den Bereich, in dem sich die zu betrachtende Gruppe der Milchschafe aufhält, und positioniert sich an einer zentralen Stelle, welche für die Tiere gut einsehbar ist und ihnen eine gute Annäherungsmöglichkeit von allen Seiten bietet (keine Positionierung in Ecken der Bucht oder mit dem Rücken zur Wand).

Die Person geht in eine Art Kniesitz, sodass sie in etwa auf Augenhöhe mit den Tieren ist. Ein Bein wird dabei abgewinkelt vor dem Körper aufgestellt, die Hände kommen auf den Oberschenkeln zu ruhen.
Eine frontale Positionierung gegenüber der Gruppe soll vermieden werden; die Testperson soll dem Großteil der Tiere halb seitlich zugewandt sein.

Die Beobachtungsperson verharrt nun für 10 min mehr oder weniger reglos an Ort und Stelle, wobei sowohl ein Anlocken der Tiere mit der Stimme oder mit Gesten sowie ein Anstarren der Tiere vermieden werden soll. Der Test beginnt in dem Moment, in dem die Testperson den Bereich, in dem sich die Tiere aufhalten, betritt. Innerhalb der gegebenen 10 min wird die Reaktion der Schafe auf die Testperson beobachtet.

Die Verhaltensbeobachtung wird in der für die Tiere gewohnten Umgebung durchgeführt – dies kann sowohl der Stall als auch der Auslauf oder die Weide sein.
Nachdem die Testperson die Gruppe verlassen hat, bewertet sie die Gruppe mit jener Zahl, welche per definitionem am ehesten das Verhalten der Tiere während des Tests beschreibt.</td></tr>
<tr><td>Definition</td><td>0 – „nicht scheu“</td><td>die Tiere scheinen durch die Gegenwart der Testperson nicht maßgeblich irritiert

nach einem etwaigen anfänglichen Zurückziehen beginnt sich die Herde/Gruppe wieder der Testperson anzunähern

allmählich (nach etwa 5 min) beginnen die Tiere wieder ihre ursprünglichen Tätigkeiten aufzunehmen (Fressen etc.), ohne dabei stark von der Testperson beeinträchtigt zu wirken

einige der Tiere bleiben entweder bereits zu Beginn des Testes liegen oder legen sich im Laufe der Testzeit (wieder) hin

eventuell nähern sich einige Tiere neugierig der Testperson und berühren sie möglicherweise

die Mehrzahl der Tiere wirkt aufmerksam, interessiert, entspannt, neugierig, zutraulich, kontaktfreudig, vereinzelt eventuell sogar „aufdringliche“ Tiere</td></tr>
<tr><td></td><td>1 – „scheu“</td><td>die Tiere scheinen durch die Gegenwart der Testperson irritiert und wirken ängstlich

die Tiere drängen sich in einem Bereich zusammen, möglichst weit von der Testperson entfernt

auch wenn nach längerer Zeit (über 8 min) einige Tiere wieder ihre ursprünglichen Tätigkeiten aufnehmen (Fressen etc.), so ist ihre Aufmerksamkeit dennoch eindeutig der Testperson zugewandt

keines der Tiere legt sich in Gegenwart der Testperson (wieder) hin oder bleibt von Testbeginn an liegen

auch wenn die Tiere allmählich die zur Testperson maximal einnehmbare Distanz eventuell verringern, so scheint keines der Tiere dabei an einer Kontaktaufnahme bzw. an Körperkontakt mit dem Menschen interessiert zu sein

die Mehrzahl der Tiere wirkt irritiert, ängstlich, scheu, misstrauisch</td></tr>
<tr><td></td><td>2 – „sehr ängstlich“</td><td>die Tiere scheinen durch die Gegenwart der Testperson stark verschreckt

alle Tiere flüchten Hals über Kopf panisch in einen Bereich der zur Verfügung stehenden Fläche, möglichst weit von der Testperson entfernt

die Tiere nehmen über die ganze Testzeit hinweg nicht wieder ihre ursprünglichen Tätigkeiten auf (Fressen etc.), sondern wirken stark angespannt und haben ihre ganze Aufmerksamkeit auf die</td></tr>
</table>

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		Testperson gerichtet, jederzeit zur Flucht bereit keines der Tiere legt sich in Gegenwart der Testperson (wieder) hin einige der Tiere zeigen eine stark erhöhte Atemfrequenz, die durch die Gegenwart der Testperson ausgelöst wird die Tiere zeigen keinerlei Anstalten sich der Testperson zu nähern, im Gegenteil: die max. mögliche Distanz wird eingenommen und beibehalten die Mehrzahl der Tiere wirkt panisch, angespannt, gestresst, schreckhaft, unruhig, vermeidend
	Die Übergänge zwischen den einzelnen Bewertungszahlen sind fließend. Es ist jeweils jene zu wählen, welche dem Verhalten einer Herde/Gruppe am nächsten kommt.	
Interpretation	Die Zahl 0 weist auf eine gute Mensch-Tier-Beziehung hin und ist daher im Sinne des Wohlergehens der Tiere die bestmögliche Bewertung. Die Zahlen 1 und 2 hingegen entsprechen einer schlechteren Einstufung.	
Anmerkungen	Es soll keine Ausrüstung, wie etwa Stifte oder Aufzeichnungsbögen, in die Gruppe mitgenommen werden. Der/die Landwirt/Landwirtin bzw. Personen, die den Tieren durch den täglichen Umgang bekannt sind, dürfen sich während des Tests nicht in der Gruppe befinden.	

Abb. 1: Durchführung des Tests „Reaktion auf einen unbekannten Menschen"; 0 – „zutraulich"

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Da eine Erhebung der Wasserversorgung der Tiere mithilfe von tierbezogenen Parametern nicht möglich ist, muss hier auf einige ressourcenbezogene Parameter zurückgegriffen werden.

Achtung: Die folgenden Parameter (7.1 bis 7.4) müssen für alle Selbsttränken und Tröge, die den Schafen zur Verfügung gestellt werden, erhoben werden. Dies gilt für alle Bereiche, in denen sich die Schafe aufhalten können (Stall, Auslauf, Weide). Erfolgt die Wasserversorgung auf der Weide durch Fließgewässer, welches für alle Tiere gut zugänglich ist, so fällt die detaillierte Beurteilung weg, muss aber im Raum für Notizen unbedingt vermerkt werden.

7.1 Wasserdurchflussrate/Wasservolumen		
Relevanz	Eine ausreichende Wasserversorgung der Schafe mit sauberem Trinkwasser muss gewährleistet sein, da eine Unterversorgung zu Beeinträchtigung des Wohlergehens, Schädigung der Gesundheit und Einbußen in der Produktionsleistung führen kann.	
Vorgehensweise	Für jede Wasserstelle wird die Wasserdurchflussrate in l/min (bei Tränken) bzw. das Wasservolumen in l (bei Trögen) ermittelt. Die **Wasserdurchflussrate** einer Tränke lässt sich mithilfe eines Messbechers feststellen. Dazu lässt man zuerst die Tränke ganz volllaufen, hält dann den Messbecher an den Tränkenrand und betätigt den Tränkehebel für 30 s. Die so im Messbecher aufgefangene Wassermenge in Litern multipliziert mit der Zahl 2 ergibt die Wasserdurchflussrate in l/min. Um das **Wasservolumen** eines Troges zu ermitteln, werden mit einem Maßband Höhe, Länge und Tiefe des Troges abgemessen, sodass anschließend mittels Multiplikation das Volumen und die Wassermenge in Litern errechnet werden kann.	
Definition	**0 – „angemessen"**	Wasserversorgung durch Selbsttränke: Wasserstelle weist eine Durchflussrate von 7 l/min oder mehr auf Wasserversorgung durch Tröge: Summe der Volumina aller Tröge gewährleistet eine Wasseraufnahme von 15 l/Schaf und Tag*
	1 – „unzureichend"	Wasserversorgung durch Selbsttränke: die Wasserstelle weist eine Durchflussrate von

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	weniger als 7 l/min auf Wasserversorgung durch Tröge: Summe der Volumina aller Tröge kann nicht die Wasseraufnahme von 15 l/Schaf und Tag* gewährleisten
	* da bei hochlaktierenden Tieren und klimatischen Extrembedingungen der Wasserbedarf bis zu 15 l/Schaf und Tag (in Abhängigkeit des Futters) betragen kann. Bei einer Versorgung mit Trögen sollte das gesamte Wasservolumen, wenn möglich, auf mehrere Tröge aufgeteilt sein.
Interpretation	Grundsätzlich gilt, dass die Bewertung 0 erstrebenswert ist; für eine ausreichende Wasserversorgung müssen allerdings auch die anderen Parameter des Moduls 7 berücksichtigt werden.
Anmerkungen	–

7.2 Sauberkeit der Wasserstellen	
Relevanz	Da Schafe sehr empfindlich auf verschmutztes Wasser reagieren, spielt die Sauberkeit der Wasserstellen in der Beurteilung der Wasserversorgung eine wesentliche Rolle.
Vorgehensweise	Jede Wasserstelle muss genau betrachtet werden und auf ihre Sauberkeit hin beurteilt werden.
Definition	**0 – „sauber“**: die Wasserstelle weist klares geruchfreies Trinkwasser auf; sie ist frei von Kot, Harn, Futterresten und Algen; ein geringfügiger Anteil an sauberem Stroh/Heu im Wasser ist zulässig **1 – „verschmutzt“**: das Wasser ist nicht klar und/oder nicht geruchfrei; die Wasserstelle ist durch Kot und/oder Harn und/oder Futterreste und/oder Algen sowie einem hohen Anteil an Stroh/Heu verunreinigt (modifiziert nach Welfare Quality ®, 2009)
Interpretation	Grundsätzlich gilt, dass die Bewertung 0 erstrebenswert ist; für eine ausreichende Wasserversorgung müssen allerdings auch die anderen Parameter des Moduls 7 berücksichtigt werden.
Anmerkungen	–

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Abb. 2: Sauberkeit der Wasserstellen; 0 – „sauber“ (Schalentränke)

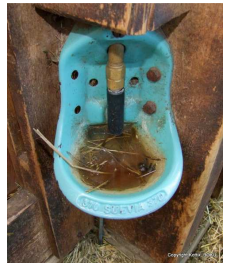

Abb. 3: Sauberkeit der Wasserstellen; 1 – „verschmutzt“ (Schalentränke)

7.3 Mechanische Betriebstauglichkeit	
Relevanz	In der Beurteilung der Wasserstellen (v.a. Selbsttränken) ist es wesentlich, deren mechanische Betriebstauglichkeit und ihre (unter anderem damit verbundene) Nutzbarkeit für die Schafe zu überprüfen.
Vorgehensweise	Jede Wasserstelle muss auf ihre mechanische Betriebstauglichkeit hin (z.B. gute Beweglichkeit des Tränkehebels) beurteilt werden.
Definition	**0 – „gut“**: mechanische Wasserstellen sind von den Tieren ohne Probleme zu bedienen **1 – „schlecht“**: Tiere können aufgrund mechanischer Mängel die Wasserstellen nicht oder nur eingeschränkt bedienen (modifiziert nach Welfare Quality ®, 2009)
Interpretation	Grundsätzlich gilt, dass die Bewertung 0 erstrebenswert ist; für eine ausreichende Wasserversorgung müssen allerdings auch die anderen Parameter des Moduls 7 berücksichtigt werden.
Anmerkungen	–

7.4 Zugänglichkeit	
Relevanz	Die richtige Positionierung von Wasserstellen ist von besonderer Bedeutung, da sonst einige (meist rangniedrigere oder kleinere) oder alle Tiere keinen Zugang zu den Wasserstellen haben und ihren Wasserbedarf nicht oder nicht ausreichend decken können.
Vorgehensweise	Für jede Wasserstelle muss erhoben werden, ob sie so angebracht ist, dass sie für alle Schafe der Gruppe gut erreichbar ist. So sollten sich bspw. keine erhöhten Sockel unterhalb von Tränken befinden, die eigens erklommen werden müssen, oder die Tränken an Engstellen positioniert

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	sein. Auch muss auf eine entsprechende Höhe der Tränke/des Troges (Höhenverstellbarkeit bei Systemen mit anwachsender Tiefstreu) geachtet werden, sodass auch die kleinsten Schafe Zugang haben.
Definition	**0 – „gut zugänglich“**: die Wasserstellen können von den Tieren mühelos erreicht werden die Wasserstellen sind so positioniert , dass allen Tieren freier Zugang ohne die Gefahr zwangsläufiger Auseinandersetzungen gewährt ist die Wasserstellen ermöglichen eine artgerechte Wasseraufnahme **1 – „schwer/nicht zugänglich“**: die Wasserstellen können von den Tieren nur erschwert oder gar nicht erreicht werden die Wasserstellen sind so positioniert , dass Tiere Gefahr laufen, aufgrund von Auseinandersetzungen keinen Zugang zu haben die Wasserstellen ermöglichen aufgrund ihrer Anbringung keine artgerechte Wasseraufnahme
Interpretation	Grundsätzlich gilt, dass die Bewertung 0 erstrebenswert ist; für eine ausreichende Wasserversorgung müssen allerdings auch die anderen Parameter des Moduls 7 berücksichtigt werden.
Anmerkungen	–

Achtung: Es werden nur jene Wasserstellen als funktionstüchtig gewertet, die bei **allen Parametern** von Modul 7 (7.1 bis 7.4) die Bewertung 0 erhalten haben. Erfüllt eine Wasserstelle alle Kriterien, wird in der letzten Tabellenspalte von Modul 7 in der entsprechenden Zeile ein Häkchen eingetragen.

Nur jene Wasserstellen, die ein Häkchen erhalten haben, gelten als funktionstüchtig und tatsächlich verfügbar. Eine ausreichende Wasserversorgung ist dann gewährleistet, wenn pro 20 Schafe 1 funktionstüchtige Tränke, pro Gruppe jedoch mindestens 2 Tränken vorhanden sind. Für Volumenangaben bei der Versorgung mit Trögen siehe 7.1.

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8.1 Anzahl der lahmenden Tiere	
Relevanz	Sind Schafe aufgrund von Krankheit oder Verletzung in ihrer Bewegungsfreiheit eingeschränkt, so ist ihr Wohlergehen maßgeblich beeinträchtigt.
Vorgehensweise	Das Gangbild der Milchschafe wird beurteilt, während diese in den Melkstand getrieben werden bzw. den Melkstand verlassen. Es werden alle Tiere der Melkpartie betrachtet und die Anzahl der lahmenden Tiere in Form einer Strichliste notiert. Anschließend wird die Anzahl der lahmenden Tiere in Prozent angegeben.
Definition	Ein Tier ist dann **lahm**, wenn es eine Abnormität im Gangbild zeigt. Diese kann sich in unregelmäßigen Tritten und/oder einer ungleichmäßigen Belastung aller vier Füße und/oder verkürzten Schritten und/oder starkem Hinken und/oder einer auffälligen Haltung und/oder eventuellem Nicken des Kopfes beim Gehen äußern. Der Grad der Lahmheit ist von untergeordneter Bedeutung, kann aber bei besonderen Auffälligkeiten als Anmerkung notiert werden.
Interpretation	Je geringer die Anzahl an lahmenden Tieren, desto besser.
Anmerkungen	Wichtig zu beachten ist hierbei, dass für das Modul 8 jeweils eine Melkpartie betrachtet wird – diese ist nicht gleichzusetzen mit der Gruppe der Tiere. Für gewöhnlich wird eine Gruppe von Tieren in mehrere Melkpartien unterteilt. Es ist daher wesentlich, dass die Nummer der Melkpartie angegeben wird. Es kann aber dennoch bei den Notizen vermerkt werden, zu welcher Gruppe die Tiere der beobachteten Melkpartie gehören, um ein besseres Gesamtbild der kompletten Schafherde zu erhalten. Weiters muss die Anzahl der Tiere der jeweils betrachteten Melkpartie angegeben werden.

8.2 Anzahl des Ereignisses „Treten“ und Anzahl des Ereignisses „Koten“ und Anzahl des Ereignisses „Urinieren“	
Relevanz	Empfinden Milchschafen aus verschiedensten Gründen Stress während des Melkens, ist ihr Wohlergehen stark beeinträchtigt, was sich in Angst- oder Abwehrreaktionen, wie „Treten“, „Koten“ oder „Urinieren“, äußern kann.
Vorgehensweise	Der/die Beobachter/Beobachterin positioniert sich in einigem Abstand hinter den Schafen im Melkstand, am besten am Arbeitsgang, von wo aus der/die Melker/Melkerin in gewohnter Weise das Melkzeug ansetzt bzw. zum Handmelken an die Tiere herantritt. Die Beobachtungszeit dauert von Melkbeginn bis zum Entlassen der Partie aus dem Melkstand, wobei die gesamte Beobachtungszeit hindurch ein guter Überblick über

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	die ganze Melkpartie gewährleistet sein muss. Jedes Ereignis von „Treten“, „Koten“ oder „Urinieren“ wird notiert, ungeachtet dessen, ob das Verhalten in erster Linie von einem oder von mehreren Tieren gezeigt wird. Die entsprechende Anzahl von Ereignissen wird in Form von Strichlisten notiert. Anschließend wird die durchschnittliche Anzahl an Ereignissen pro Tier errechnet.
Definition	Als **Treten** wird das eindeutige Heben eines oder beider Hinterbeine über 10 cm und ruckartiges Strecken/Absetzen, das nicht als Schritt erkennbar ist, bezeichnet. Es kann – muss aber nicht – gegen den/die Melker/Melkerin oder das Melkzeug gerichtet sein. Als **Koten** wird jener Vorgang bezeichnet, bei dem das Milchschaf, während es am Melkstand steht, Kot absetzt. Als **Urinieren** wird verzeichnet, wenn das Milchschaf, während es sich am Melkstand befindet, Harn absetzt.
Interpretation	Je geringer die Anzahl der Ereignisse „Treten“, „Koten“, „Urinieren“ ist, desto höher ist das Wohlergehen der Tiere (während des Melkens) einzustufen.
Anmerkungen	Siehe 8.1

Modul 9 – Einzeltierbeurteilung

Grundsätzlich ist vorgesehen, dass der/die Beobachter/Beobachterin für die Beurteilung der Parameter 9.1 bis 9.11 von hinten an das im Melkstand stehende Tier herantritt. Die Parameter 9.12 bis 9.18 hingegen erfordern das Herantreten an das Milchschaf während des Melkens von vorne.

Achtung: Sollte es aufgrund der Bauweise des Melkstandes nicht möglich sein, von vorne an das Tier heranzutreten, so können die Parameter 9.12 bis 9.18 auch erhoben werden, während die Tiere „im Gänsemarsch“ zum Melkstand kommen. Wenn es die baulichen Gegebenheiten nicht zulassen, die Parameter 9.1 und 9.2 zu beurteilen, während das Tier im Melkstand ist (z.B. Melkstand sehr hoch gebaut), so können eventuell in diesen seltenen Ausnahmefällen die beiden Parameter auch beurteilt werden, während die Tiere den Melkstand betreten.

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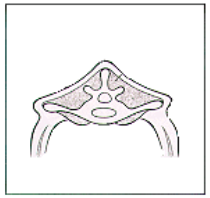
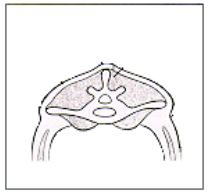
9.1 Körperkondition	
Relevanz	Eine ausgewogene ausreichende Fütterung ist wesentlich für Schafe, vor allem wenn hohe Ansprüche an die Produktionsleistung gestellt werden. Die Futterversorgung kann am einfachsten mit einer Bewertung ihrer Körperkondition beurteilt werden. Nur wenn Schafe ihren Bedarf entsprechend decken können, können Gesundheit und Wohlergehen der Tiere gewährleistet werden.
Vorgehensweise	Während des Melkens kann die Ermittlung der Körperkondition durch Herantreten an das Tier durchgeführt werden. Es werden Muskel- und Fettauflage der Wirbel in der Lendenregion, also etwa in der Mitte des Rückens hinter der letzten Rippe vor dem Hüftknochen, ertastet. Die Wirbel der Lendenregion zeigen sowohl Quer- als auch Dornfortsätze. Zur Bestimmung der Körperkondition wird der Daumen hinter der letzten Rippe auf die Wirbelsäule (Dornfortsätze) gelegt. Die Spitzen der anderen Finger werden gegen die Enden der Querfortsätze gedrückt. Das Schaf sollte dabei in einer möglichst entspannten Haltung sein, da das Ertasten der Wirbel sonst erschwert ist. Je nach Körperzustand wird jedem Tier eine Bewertungszahl zugeteilt. Anschließend wird die Anzahl der Tiere jeder Bewertungszahl in Prozent angegeben.
Definition	

1 – „kachektisch“ 	Dornfortsätze einzeln spürbar Dornfortsätze sind scharf abgesetzt (beim Abtasten sägeblattartig) Querfortsätze klar spürbar die Finger können ohne Probleme unter die Querfortsätze geschoben werden keine Fettabdeckung wenig Muskulatur
2 – „mager“ 	Dornfortsätze gut spürbar einzelne Querfortsätze nicht mehr gut abgrenzbar, etwas bedeckt die Finger können mit etwas Druck unter die Querfortsätze geschoben werden geringe bis keine Fettabdeckung Muskulatur gut entwickelt Querfortsätze mit etwas Druck spürbar

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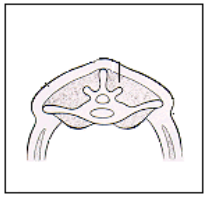
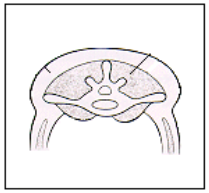
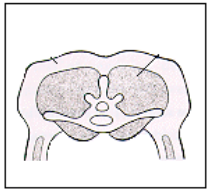
	3 – „durchschnittlich“ 	Dornfortsätze noch gut spürbar, einzeln jedoch nicht mehr klar abgrenzbar Querfortsätze gut abgedeckt, sehr starker Druck notwendig, um sie zu spüren erheblicher Druck nötig, um die Finger unter die Querfortsätze zu schieben gute Muskel- und Fettabdeckung
	4 – „fett“ 	Dornfortsätze nur mit starkem Druck als harte Linie spürbar Querfortsätze nicht fühlbar dicke Fettschicht über gut entwickelter Muskulatur
	5 – „adipös“ 	keine knöchernen Strukturen mehr fühlbar Dornfortsätze nicht fühlbar, von Fett bedeckt sehr dicke Fettschicht
	(modifiziert nach Braunreiter, 2012 und DEFRA, 1997)	
Interpretation	Die Körperkondition eines gesunden Schafes sollte etwa bei 3 liegen. In Abhängigkeit des Produktionszyklus treten allerdings natürliche Schwankungen auf (z.B. etwas niedrigere Körperkondition bei Schafen unmittelbar nach dem Ablammen), die bei der Erhebung berücksichtigt werden müssen. Generell gilt, dass sich zu keinem Zeitpunkt der Produktion Schafe mit Körperkonditionswerten von 1 oder 5 in einer Herde befinden sollten.	
Anmerkungen	–	

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9.2 Wollbild		
Relevanz	Das Wollbild eines Schafes kann guten Einblick in die Pflege und den Gesundheitszustand der Tiere geben. Verschmutzte, feuchte, lückige Wolle kann Zeichen für unzureichende Haltungsbedingungen, Ektoparasitenbefall sowie Krankheit sein und weist somit auf eine Beeinträchtigung des Wohlergehens der Tiere hin.	
Vorgehensweise	Während die Schafe im Melkstand stehen, kann der Zustand des Wollbildes betrachtet und mit einer Zahl bewertet werden. Folgende **bewollte Stellen** des Schafes werden zur Beurteilung herangezogen: hintere bewollte Partien rund um den Schwanzansatz, eine Körperseite (pro Schaf wird jeweils nur eine Körperseite betrachtet; von Schaf zu Schaf abwechselnd links oder rechts) und der Rücken. Je nach Wollbild wird dann jedem Tier eine Bewertungszahl zugeteilt. Anschließend wird die Anzahl der Tiere mit den Bewertungszahlen 1 und 2 in Prozent angegeben.	
Definition	**0 – „gut“**	sauberer Gesamteindruck keine bzw. lediglich vereinzelte Schmutzplaques* eventuell vereinzelt vorhandene Strohhalme oder saubere Einstreureste lassen sich leicht aus der Wolle abstreifen keine Stellen verfilzter, feuchter oder struppiger Wolle authentische Farbe der Wolle keine Stellen ausgedünnter oder ausgerissener Wolle keine Lücken im Wollkleid entsprechende Wolllänge (in Abhängigkeit von Rasse und Schurzeitpunkt)
	1 – „beeinträchtigt“	unsauberer Gesamteindruck mehrere Schmutzplaques* vermehrt Strohhalme und Einstreureste in der Wolle authentische Farbe der Wolle nur eingeschränkt erkennbar an vereinzelten Stellen leicht verfilzte,

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			feuchte oder struppige Wolle keine Stellen ausgedünnter oder ausgerissener Wolle keine Lücken im Wollkleid entsprechende Wolllänge (in Abhängigkeit von Rasse und Schurzeitpunkt)
		2 – „schlecht“	schmutziger Gesamteindruck viele/durchgehende Schmutzplaques* Wolle stark mit Strohhalmen und feuchter Einstreu durchsetzt, welche sich nur mit einigem Aufwand entfernen lassen vermehrt Stellen verfilzter und/oder feuchter und/oder struppiger Wolle matte Farbe Stellen mit ausgedünnter oder ausgerissener Wolle gänzlich wolllose Stellen überlange Wolle (in Abhängigkeit von Rasse und Schurzeitpunkt)
	* als Schmutzplaques werden dreidimensionale Schmutzablagerungen ab Handtellergröße bezeichnet		
Interpretation	Das Wollbild eines Schafes sollte immer sauber sein, um Gesundheit und Wohlergehen langfristig zu gewährleisten.		
Anmerkungen	–		

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Abb. 4: Wollbild; 0 – „gut“

Abb. 5: Wollbild; 1 – „beeinträchtigt“

Abb. 6: Wollbild; 2 – „schlecht“

9.3 Länge des Schwanzes		
Relevanz	Des Öfteren werden in der Praxis Milchschafen die Schwänze gekürzt, um vor allem das Ablammen, den Deckakt und das regelmäßige Melken zu erleichtern. Der Vorgang des Kürzens stellt jedoch einen vehementen Eingriff dar (zumal meist ohne entsprechende Anästhesie oder Schmerzmittelverabreichung durchgeführt) und beeinträchtigt somit das Wohlergehen der Tiere maßgeblich – unter Umständen langfristig.	
Vorgehensweise	Es wird betrachtet, ob der Schwanz eines Tieres die normale natürliche Länge hat oder der Schwanz unnatürlich gekürzt erscheint und somit vermutlich kupiert wurde. Je nach vorhandener Länge des Schwanzes wird die entsprechende Bewertungszahl vergeben. Anschließend wird die Anzahl der Tiere mit den Bewertungszahlen 1 und 2 in Prozent angegeben.	
Definition	**0 – „natürliche Länge“**	Schwanz ist von natürlicher Länge; keinerlei Anzeichen einer künstlichen Verkürzung (in Abhängigkeit der Rasse reicht er bis zum Sprunggelenk oder darunter)

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		1 – „gekürzt“	Schwanz ist um etwa ein Drittel oder die Hälfte kürzer als bei der jeweiligen Rasse natürlich
		2 – „nahezu nicht vorhanden“	Schwanz ist drastisch gekürzt; nur noch als Stummelansatz erkennbar After und Vulva entweder gerade noch oder nicht mehr durch den Schwanz bedeckt
Interpretation	Grundsätzlich sollte im Sinne des Wohlergehens ein Schaf einen natürlich langen Schwanz aufweisen (Beurteilung 0) und nur in begründeten Ausnahmefällen der Schwanz um maximal zwei Drittel (Beurteilung 1) gekürzt sein. Wird dennoch Schwanzkürzen durchgeführt, so hat es im Hinblick auf das Wohlergehen unter Betäubung zu erfolgen und ist eine anschließende Schmerzbehandlung zu gewährleisten.		
Anmerkungen	In seltenen Fällen kann auch ein Unfall die Ursache für einen verkürzten Schwanz sein.		

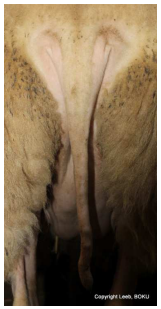

Abb. 7: Länge des Schwanzes; 0 – „natürliche Länge“

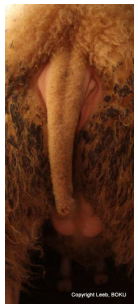

Abb. 8: Länge des Schwanzes; 1 – „gekürzt“

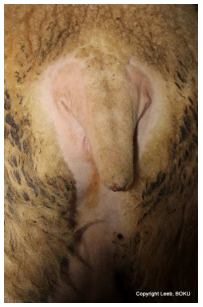

Abb. 9: Länge des Schwanzes; 2 – „nahezu nicht vorhanden“

9.4 Anzahl Läsionen am Euter	
Relevanz	Unversehrtheit der Haut des Euters ist von grundlegender Bedeutung für Gesundheit und Wohlergehen eines Milchschafes.
Vorgehensweise	Das Euter des Tieres wird von hinten betrachtet. Die Anzahl der entsprechenden Stellen wird notiert. Anschließend wird die durchschnittliche Anzahl an entsprechenden Stellen pro Tier errechnet.

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Definition	Als **Läsion** wird eine Stelle verletzter Haut, welche als frische oder verkrustete Wunde (entweder mit einer Länge von mehr als 3 cm oder einem Durchmesser von mindestens 1 cm) erkennbar ist, bezeichnet (modifiziert nach Welfare Quality ®, 2009).
Interpretation	Läsionen am Euter können nicht nur schmerzhafte Veränderungen der Haut darstellen, sondern können auch weitere Erkrankungen (z.B. durch das Eindringen von Bakterien) zur Folge haben. Im Sinne des Tierwohlergehens und der -gesundheit ist auf Unversehrtheit des Euters zu achten.
Anmerkungen	–

9.5 Anzahl Schwellungen am Euter	
Relevanz	Im Bereich des Euters sind Schwellungen im Hinblick auf das Wohlergehen und die Gesundheit von Milchschafen von besonderer Bedeutung und können auch Auswirkungen auf die Produktionsfähigkeit eines Tieres und die Milchqualität haben.
Vorgehensweise	Siehe 9.4 Zusätzlich wird das Euter abgetastet.
Definition	Als **Schwellung** wird eine Stelle, welche eine eindeutige Umfangsvermehrung im Vergleich zum Normalzustand und eventuell auch eine erhöhte Temperatur aufweist, bezeichnet (modifiziert nach Welfare Quality ®, 2009).
Interpretation	Vor allem bei laktierenden Tieren ist das Euter regelmäßigen Belastungen ausgesetzt, welche zu Veränderungen des Gewebes und damit verbundenen Schmerzen führen können. Schwellungen können Anzeichen einer Mastitis sein.
Anmerkungen	–

9.6 Sauberkeit der Hinterbeine		
Relevanz	Die Kontrolle der Sauberkeit der Hinterbeine eines Schafes ist wesentlich, da Verschmutzung auf schlechte Haltungsbedingungen hinweisen kann und außerdem ein erhöhtes Krankheitsrisiko (bspw. durch vermehrtes Auftreten von Bakterien) darstellen kann. Beides stellt eine Gefährdung des Wohlergehens der Tiere dar.	
Vorgehensweise	Beide Hinterbeine (inkl. Innen- und Außenseite) werden von hinten betrachtet. Die Sauberkeit kann dann mit der entsprechenden Bewertungszahl beurteilt werden. Anschließend wird die Anzahl der Tiere mit der Bewertungszahl 1 in Prozent angegeben.	
Definition		
	0 – „sauber“	keine/lediglich vereinzelte Schmutzspritzer* keine Schmutzplaques*

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	1 – „verschmutzt“	zahlreiche Schmutzspritzer* und/oder vereinzelte/durchgängige Schmutzplaques*
	* als Schmutzplaques werden dreidimensionale Schmutzablagerungen (inkl. Kot) ab Handtellergröße bezeichnet; als Schmutzspritzer werden Schmutzspuren (inkl. Kot) ab einer Länge von 5 cm bezeichnet (modifiziert nach Welfare Quality ®, 2009)	
Interpretation	Im Sinne des Wohlergehens sollten Schafe saubere Hinterbeine (Bewertung 0) aufweisen.	
Anmerkungen	–	

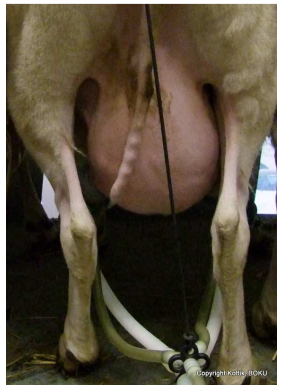

Abb. 10: Sauberkeit der Hinterbeine; 0 – „sauber“

Abb. 11: Sauberkeit der Hinterbeine; 1 – „verschmutzt“

9.7 Sauberkeit des Euters	
Relevanz	Verschmutzungen am Euter können Anzeichen unsauberer, minderer Haltungsbedingungen sein und stellen ein erhöhtes Infektionsrisiko der Tiere dar, was in weiterer Folge vermindertes Wohlergehen für die Schafe bedeuten kann. Außerdem können sich Verschmutzungen des Euters negativ auf die Milchqualität auswirken.
Vorgehensweise	Um die Sauberkeit des Euters und der Zitzen festzustellen, wird das Euter von hinten betrachtet und mit der entsprechenden Zahl bewertet. Anschließend wird die Anzahl der Tiere mit der Bewertungszahl 1 in Prozent angegeben.

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Definition	Siehe 9.6
Interpretation	Milchschafe sollten unbedingt ein sauberes Euter aufweisen (Bewertung 0), um Wohlergehen der Tiere und Hygiene der Milchproduktion zu gewährleisten.
Anmerkungen	–

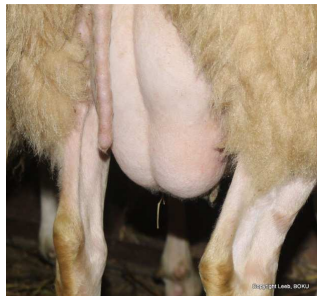

Abb. 12: Sauberkeit des Euters; 0 – „sauber"

Abb. 13: Sauberkeit des Euters; 1 – „verschmutzt“

9.8 Anzahl haarloser Stellen an den Hinterbeinen	
Relevanz	Haarlose Stellen können das Wohlergehen von Milchschafen beeinträchtigen und stehen zumeist in engem Zusammenhang mit dem Haltungssystem. Vor allem zu geringes Platzangebot, inadäquate Einstreu etc. können das Auftreten von haarlosen Stellen begünstigen.
Vorgehensweise	Um das Vorhandensein von haarlosen Stellen an den Hinterbeinen eines Schafes feststellen zu können, werden sowohl die Hinteransicht als auch die Innen- und Außenseite der beiden Hinterbeine eines Tieres betrachtet. Die Anzahl der entsprechenden Stellen wird notiert. Anschließend wird die durchschnittliche Anzahl an entsprechenden Stellen pro Tier errechnet.
Definition	Als **haarlose Stellen** werden Bereiche von über 2 cm Durchmesser bezeichnet, die durch Haarausfall gekennzeichnet sind (keine Hautverletzungen) oder durch extremes Ausdünnen des Haarkleides auffallen (modifiziert nach Welfare Quality ®, 2009).
Interpretation	Haarlose Stellen sind in Hinblick auf Tierwohlergehen und -gesundheit negativ zu bewerten, da sie z.B. auf mangelhafte Haltungsbedingungen oder auf das Vorhandensein von Parasiten hinweisen können und weitere Gesundheitsprobleme nach sich ziehen können.
Anmerkungen	An den Hinterbeinen werden auch Anzeichen einer Hyperkeratose als haarlose Stellen gewertet.

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9.9 Anzahl der Läsionen an den Hinterbeinen	
Relevanz	Unversehrtheit der Haut ist Teil einer intakten Physiologie und damit Voraussetzung für ein gesundes Tier.
Vorgehensweise	Siehe 9.8
Definition	Siehe 9.4
Interpretation	Etwaige Verletzungen der Hinterbeine haben negative Auswirkungen auf die Gesundheit der Tiere, da sie nicht nur Schmerzen verursachen, sondern auch Infektionen begünstigen können. Dies kann darüber hinaus das Milchschaf in seinen täglichen Aktivitäten einschränken und somit sein Wohlergehen beeinträchtigen.
Anmerkungen	–

9.10 Anzahl Schwellungen an den Hinterbeinen	
Relevanz	Uneingeschränktes Fortbewegungsvermögen ist wichtig, dass ein Tier seine artspezifischen Verhaltensweisen ausüben kann.
Vorgehensweise	Siehe 9.8 Zusätzlich werden die Hinterbeine (besonders die Gelenke!) auf Schwellungen abgetastet.
Definition	Siehe 9.5
Interpretation	Da Schwellungen sowohl zu Schmerzen als auch zu Bewegungseinschränkungen führen können, ist jegliches Vorhandensein solcher Auffälligkeiten negativ zu werten.
Anmerkungen	–

9.11 Zustand der Klauen		
Relevanz	Der Zustand der Klauen spielt eine wesentliche Rolle für Gesundheit und Wohlergehen der Tiere. Sind die Klauen beeinträchtigt, so kann das nicht nur Schwierigkeiten in der Bewegung, sondern auch Schmerzen und schwere Krankheiten zur Folge haben.	
Vorgehensweise	Um einen Eindruck des Zustandes der Klauen zu erlangen, werden die beiden hinteren Klauenpaare des im Melkstand stehenden Schafes betrachtet und mit der entsprechenden Bewertungszahl versehen. Anschließend wird die Anzahl der Tiere mit den Bewertungszahlen 1 und 2 in Prozent angegeben.	
Definition	**0 – „gut“**	beide hinteren Klauenpaare haben eine normale Länge und beide hinteren Klauenpaare zeigen eine normale Stellung der einzelnen Zehen

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		1 – „beeinträchtigt“	ein oder beide hinteren Klauenpaare sind zu lang und/oder ein oder beide hinteren Klauenpaare zeigen (eventuell auf Grund zu langen Wachstums) Fehlstellungen (z.B. eine Zehe dreht sich nach außen,...) bzw. sind verformt
		2 – „schlecht“ (Zutreffen von mindestens einem Kriterium erforderlich)	ein oder beide hinteren Klauenpaare sind massiv überlang ein oder beide hinteren Klauenpaare zeigen (eventuell auf Grund zu langen Wachstums) massive Fehlstellungen (z.B. eine Zehe dreht sich nach außen,...) bzw. sind verformt ein oder beide hinteren Klauenpaare zeigen eindeutig sichtbare Abnormitäten (z.B. Risse im Klauenhorn, Eiteraustritt, Ablösung des Klauenhorns von tieferen Strukturen,...) ein oder beide hinteren Klauenpaare zeigen Rötungen und/oder lokale Umfangsvermehrungen oberhalb des/der Klauenpaare beim Herantreten an das Tier wird ein fauliger Geruch von den Klauen her wahrgenommen
Interpretation	Gesunde Schafe weisen einen guten Klauenzustand (Bewertung 0) auf.		
Anmerkungen	–		

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Abb. 14: Zustand der Klauen; 0 – „gut“

Abb. 15: Zustand der Klauen; 1 – „beeinträchtigt“

Abb. 16: Zustand der Klauen; 2 – „schlecht“

9.12 Anzahl haarloser Stellen am Kopf	
Relevanz	Eine intakte Hautoberfläche ist für die Gesundheit eines Tieres und in weiterer Folge auch für sein Wohlergehen wesentlich, kann aber bspw. durch schlechte Haltungsbedingungen geschädigt sein.
Vorgehensweise	Der Kopf des Tieres wird betrachtet. Die Anzahl der entsprechenden Stellen wird notiert. Anschließend wird die durchschnittliche Anzahl an entsprechenden Stellen pro Tier errechnet.
Definition	Siehe 9.8
Interpretation	Es sollten keinerlei Anzeichen von haarlosen Stellen am Kopf zu erkennen sein.
Anmerkungen	Bei der Betrachtung des Kopfes ist es wesentlich, auch die Ohren des Tieres miteinzubeziehen.

9.13 Anzahl Läsionen am Kopf	
Relevanz	Läsionen am Kopf können sowohl Schmerzen verursachen als auch die Anfälligkeit für verschiedene Krankheiten erhöhen. Sie können entweder durch die Haltungsumwelt (z.B. Anwesenheit eines schlecht ausgebildeten Hütehundes) hervorgerufen werden oder aber auch Anzeichen verschiedener Erkrankungen sein.
Vorgehensweise	Siehe 9.12
Definition	Siehe 9.4
Interpretation	Da Läsionen am Kopf sowohl zu Erkrankungen führen können als auch Symptome einer bereits vorhandenen Krankheit darstellen können, ist auf solche Irritationen besonderes Augenmerk zu legen. Ihr Vorhandensein ist als Beeinträchtigung des Wohlergehens des Tieres einzustufen.
Anmerkungen	Bei der Betrachtung des Kopfes ist es wesentlich, auch die Ohren des Tieres miteinzubeziehen. Kreisrunde Löcher in den Ohren, welche durch das Einziehen der Ohrmarke entstanden sind und keinerlei Anzeichen

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	einer frischen Verletzung oder Entzündung aufzeigen, werden nicht als Läsion gewertet. Ihnen liegt vermutlich das Zerbrechen einer Ohrmarke zu Grunde. Besonderes Augenmerk ist auch auf die Maul- und Lippenregion zu legen.

Abb. 17: Haarlose Stelle am Kopf

Abb. 18: Läsion am Kopf (Ohrbereich)

9.14 Anzahl Schwellungen am Kopf	
Relevanz	Schwellungen am Kopf schränken das Wohlergehen und die Gesundheit eines Milchschafes ein, da sie unnatürliche Veränderungen des Körpers darstellen, die zu Schmerzen oder Einschränkungen des Verhaltens führen können. Außerdem können sie auf das Vorhandensein von Erkrankungen hinweisen.
Vorgehensweise	Siehe 9.12
Definition	Siehe 9.5
Interpretation	Da Schwellungen das Wohlergehen eines Tieres reduzieren, sollten sie nicht vorhanden sein.
Anmerkungen	Bei der Betrachtung des Kopfes ist es wesentlich, auch die Ohren des Tieres miteinzubeziehen. Besonderes Augenmerk ist auch auf die Maul- und Lippenregion zu legen.

9.15 Ohrtemperatur	
Relevanz	Wenn Schafe Stress empfinden, der unter anderem durch bestimmte Situationen oder Krankheit hervorgerufen ist, kann sich dies in einer stark erniedrigten oder stark erhöhten Ohrtemperatur äußern. Die Ohrtemperatur kann also Anzeichen eines schlechten Wohlergehens sein.
Vorgehensweise	Durch Angreifen der Ohren kann die Ohrtemperatur erfühlt werden. Es werden hierbei beide Ohren eines Schafes kurz mit der Hand umfasst, um festzustellen, ob die Ohrtemperatur eines oder beider Ohren stark erniedrigt oder stark erhöht ist. Für jedes Schaf wird dann die entsprechende Bewertungszahl notiert. (Im Raum für Notizen kann

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	vermerkt werden, ob es sich um eine erhöht oder erniedrigt empfundene Temperatur handelt.) Anschließend wird die Anzahl der Tiere mit der Bewertungszahl 1 in Prozent angegeben.
Definition	**0 – „unauffällig“**: die erfühlte Ohrtemperatur beider Ohren ist unauffällig **1 – „auffällig“**: die erfühlte Ohrtemperatur eines oder beider Ohren erscheint „kalt“ oder „heiß“
Interpretation	Gesunde Schafe mit gutem Wohlergehen weisen eine unauffällige Ohrtemperatur auf (Bewertung 0).
Anmerkungen	–

9.16 Augenausfluss	
Relevanz	Wenn Schafe Augenausfluss haben, so kann dies auf ein schlechtes Stallklima oder auf das Vorhandensein von Krankheiten oder Augenverletzungen hinweisen. All diese Faktoren beeinflussen das Wohlergehen der Tiere negativ.
Vorgehensweise	Um das Vorhandensein von Augenausfluss feststellen zu können, werden beide Augen des Tieres genau betrachtet und mit der entsprechenden Bewertungszahl beurteilt. Anschließend wird die Anzahl der Tiere mit der Bewertungszahl 1 in Prozent angegeben.
Definition	**0 – „kein Augenausfluss“**: kein Augenausfluss* vorhanden **1 – „Augenausfluss“**: Augenausfluss* vorhanden * eindeutig sichtbarer Austritt von Sekret (trocken oder feucht) aus einem oder beiden Augen von mindestens 3 cm Länge (modifiziert nach Welfare Quality ®, 2009)
Interpretation	Für ein gutes Wohlergehen und eine intakte Gesundheit dürfen die Schafe keinen Augenausfluss aufweisen (Bewertung 0).
Anmerkungen	–

9. 17 Nasenausfluss	
Relevanz	Nasenausfluss kann auf Krankheiten oder schlechtes Stallklima hindeuten und ist somit Merkmal eines beeinträchtigen Wohlergehens.
Vorgehensweise	Um das Vorhandensein von Nasenausfluss feststellen zu können, wird der Nasenspiegel des Tieres genau betrachtet und mit der entsprechenden Bewertungszahl beurteilt. Anschließend wird die Anzahl der Tiere mit der Bewertungszahl 1 in Prozent angegeben.
Definition	**0 – „kein Nasenausfluss“**: kein Nasenausfluss* vorhanden

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	1 – „Nasenausfluss“: Nasenausfluss* vorhanden * eindeutig sichtbarer Ausfluss von Flüssigkeit aus den Nasenöffnungen, welcher durchsichtig bis gelblich/grün sein kann und des Öfteren eine dickere Konsistenz hat (modifiziert nach Welfare Quality ®, 2009)
Interpretation	Schafe sollen keinen Nasenausfluss (Bewertung 0) aufweisen.
Anmerkungen	Wichtig zu beachten ist hierbei, dass eine feuchte Nase bzw. kleine Wassertröpfchen am Nasenspiegel bei Schafen normal ist und somit nicht als Nasenausfluss zu werten ist.

9.18 Zustand der Zähne	
Relevanz	Um ausreichend artgerechte Nahrung aufnehmen und sowohl den täglichen Bedarf decken als auch gute Leistungen erbringen zu können, muss ein Schaf ein funktionsfähiges Gebiss haben.
Vorgehensweise	Um den Zustand der Schneidezähne eines Schafes zu bewerten, wird bei geschlossenem Maul mit dem Zeigefinger entlang der Dentalplatte und der Schneidezähne gefahren und die entsprechende Bewertungszahl vergeben. Anschließend wird die Anzahl der Tiere mit den Bewertungszahlen 1 und 2 in Prozent angegeben.
Definition	**0 – „gut“**: die Schneidezähne schließen gleichmäßig mit der Dentalplatte ab und keiner der Zähne ist abgebrochen bzw. sie stehen ohne eindeutig ersichtliche Lücken gerade nebeneinander und kein Zahn wirkt locker und kein Zahn macht einen stark verlängerten Eindruck (aufgrund von Zahnfleischrückbildung) **1 – „beeinträchtigt“** (sobald hier mehr als zwei Kriterien zutreffen, handelt es sich um Bewertung 2): die Schneidezähne schließen nicht gleichmäßig mit der Dentalplatte ab (Über- oder Unterbiss) oder ein bis zwei Zähne sind abgebrochen bzw. es sind ein bis zwei Zahnlücken vorhanden

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			oder ein bis zwei Zähne wirken locker oder ein bis zwei Zähne machen einen stark verlängerten Eindruck (aufgrund von Zahnfleischrückbildung)
		2 – „schlecht“ (Zutreffen von mindestens zwei Kriterien erforderlich)	die Schneidezähne schließen nicht gleichmäßig mit der Dentalplatte ab (Über- oder Unterbiss) und/oder mehr als zwei Zähne sind abgebrochen bzw. es sind ein bis zwei Zahnlücken vorhanden und/oder mehr als zwei Zähne wirken locker und/oder mehr als zwei Zähne machen einen stark verlängerten Eindruck (aufgrund von Zahnfleischrückbildung)
Interpretation	Schafe sollen einen guten Zustand der Zähne (Bewertung 0) haben. Ist der Zustand der Zähne nicht in Ordnung, so hat dies negative Auswirkungen auf seine Ernährung und sein Wohlergehen.		
Anmerkungen	–		

In der letzten Spalte des Erhebungsblattes des Modul 9 kann in Abhängigkeit des Parameters der durchschnittliche Score bzw. die durchschnittliche Anzahl, bezogen auf die betrachteten 10 Tiere, berechnet werden.

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Schlusswort

Wurden mithilfe der Checkliste alle erforderlichen Daten gewissenhaft erhoben, können die Daten sowohl innerbetrieblich als auch überbetrieblich verglichen werden.

Während bei Modul 2, (ggfls. Modul 3,) Modul 4 und Modul 6 eine inhaltliche Betrachtung der Ergebnisse ausreicht, so ist es bei Modul 5, Modul 7, Modul 8 und Modul 9 erforderlich, rechnerisch (wie bei den Modulbeschreibungen angegeben) vergleichbare Werte zu ermitteln. Dies soll helfen Bereiche guten Wohlergehens zu kennzeichnen sowie Problembereiche eines Betriebes hervorzuheben.

Die Checkliste ermöglicht es somit, einen guten Einblick in die Praxis eines Betriebes zu gewinnen und darauf aufbauend das Wohlergehen der Milchschafe langfristig zu verbessern.

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