

A welfare assessment system for dairy cows on grassland

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Abstract

Animal welfare is an important topic worldwide. For cows kept in cubicles, Van Eerdenburg et al. developed and validated a welfare scoring system for cows in cubicles. However, in countries with a warm climate cows are held on pasture all year long. To score the welfare of the cows on pasture in countries such as Uruguay, a barn-based cow comfort scoring system (Verschuuren, 2010; Wolf, 2010) was modified to enable welfare assessment of cows on pasture. The system is based on 13 chapters: general, waiting area, milking parlour, exit milking parlour, water, feeding sites, walkways, loading site, pastures, farmer and staff, environmental management and animal health. In this study the pasture based system is refined. This qualitative study is done during 4 weeks, by visiting 40 dairy farms in Uruguay with Holstein Friesian cows. All parameters were evaluated to establish whether they are required and are useful to determine a good perception of the welfare of the cows. Missing parameters were added to get a correct perception of the welfare of the cows. This results in a new system containing the chapters: general, milking parlour and pre milking yard, exit milking parlour, water, feeding sites, walkways, loading site, pastures, farmer and staff, environmental management, animal health and youngstock. With the suggested changes it is probably possible to achieve a useful and effective scoring system. This new system needs to be validated in future.

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Introduction

Animal welfare is a growing issue in the world. Consumers of eggs, milk and meat care more and more about the origin of their 'food'. The consumer wants animal-friendly produced meat, milk and eggs. Animal rights are reflected in the laws of many countries and states. Good animal welfare is important for the dairy farmer too: he has to keep animals under the best conditions possible, because the better the welfare of the cow, the higher the milk yield will be (van Eerdenburg, F.J.C.M., et al., 2013). But how is welfare defined? There are numerous definitions. One of the most widely adopted definitions of animal welfare are the Five Freedoms from the Brambell Committee. They comprise (Rogers Brambell, 1965):

1. Freedom from hunger and thirst, by ready access to water and a diet to maintain health and vigor.
2. Freedom from discomfort, by providing an appropriate environment.
3. Freedom from pain, injury and disease, by prevention or rapid diagnosis and treatment.
4. Freedom to express normal behavior, by providing sufficient space, proper facilities and appropriate company of the animals' own kind; and
5. Freedom from fear and distress, by ensuring conditions and treatment that avoid mental suffering.

The Brambell Committee's report (1965) said: *"Welfare is a wide term that embraces both the physical and mental well-being of the animal. Any attempt to evaluate welfare, therefore, must take into account the scientific evidence available concerning the feelings of animals that can be derived from their structure and functions and also from their behavior"*

Because of the scale of enlargement, specialization, and mechanization of production, animal welfare is becoming more and more important. Proper monitoring can provide assistance in assuring this. There are systems to check the welfare of cows on a farm. Van Eerdenburg and colleagues (van Eerdenburg, F.J.C.M., et al., 2013) developed a scoring system for the level of comfort of barn-based dairy cows. In the Netherlands, there is another system called Cow compass (Koe Kompas, 2012). Welfare Quality® is a project funded by the European Commission and is intended to become the European standard for animal welfare. These three instruments measure the welfare of the dairy cows in cubicles.

Around the world many cows live the whole year on pasture due to favorable climatic conditions. There are several differences between cows living in cubicles and cows living on pasture. The grazing of cattle is generally thought to have a better 'image' than intensive, zero grazing, housing systems. Indeed, it has been found that cows on pasture have fewer cases of illness such as mastitis and lameness (Washburn, et al., 2002) and are able to exhibit more natural behavior (Hernandez-Mendo, et al., 2007). There are many studies (Washburn, et al., 2002; Hernandez-Mendo, et al., 2007) that show that cows exhibit more lying-down movements on pasture, which suggests that the level of comfort of indoor housing is not ideal. Physiological effects of grazing have also been reported, such as the finding that stress hormones increased after cattle were moved to a cubicle from pasture (Redbo, 1993; Higashiyama et al., 2007). Of course, there are also some disadvantages when the cows live outside. The weather has more impact. It can be quite hot, with potential sunburn (Mayer, 1992; Rowe, 1989). Rain is good for grass growth, but too much rain can disturb such growth and cause muddy conditions (Borderas, et al., 2004). Long walking distances to the milking parlour or the water buckets can be a disadvantage too.

To score the welfare of the cows living on pasture, it is necessary to convert the current system for cows in cubicles. For this reason two researchers from the University of Utrecht extended the scoring system of (van Eerdenburg, F.J.C.M., et al., 2013), for pasture based cattle (Verschuuren, 2010; Wolf, 2010). In the system for the pasture kept cows, some of the parameters were changed or skipped. Both systems yield a sum score ranging from -500 to 500 points.

The present study was intended to validate the modified scoring system by Verschuuren (2010) and Wolf (2010) (Verschuuren, 2010; Wolf, 2010). Forty pasture-based dairy farms were checked on all parameters of their scoring system. All parameters were evaluated to establish whether they are required and are useful to establish a good perception of the welfare of the cows. The practicality and effectiveness of the system was tested: are all parameters 'easy' to score and objective? Where considered necessary, the scoring system was modified (by adding, changing and/or removing parameters). It is expected that these modifications yield a scoring system that is better suited to evaluate the welfare of cows on pasture. The proposed new system needs to be validated in future.

Material and methods

40 dairy farms with a pasture based system were visited with the aim to validate the scoring system by Verschuuren (2010) and Wolf (2010). However, during the visits to the farms we noticed that the system did not cover all relevant aspects of welfare of pasture kept cattle. Therefore, the focus of the research shifted to the question whether all parameters are required and useful to establish a good perception of the welfare of the cows and to modify and extend the system were necessary. Where considered necessary, the scoring system was modified (by adding, changing and/or removing parameters) after the visits to all farms.

During the visits to the farms some missing parts were noticed. To define the scoring system created for the assessment of cow comfort of pasture-based dairy cow's chapters or points were added. Where considered necessary, the scoring system was modified (by adding, changing and/or removing parameters) after the visits to all farms. It is expected that these modifications yield a scoring system that is better suited to evaluate the welfare of cows on pasture

These modifications and extension yielded a new scoring system with modifications in the existing chapters, and a new chapter 'Youngstock'. The complete modified scoring system for dairy cows on pasture is shown in appendix 1. The questionnaire is adapted too, and is listed in appendix 2.

Animals and housing

In Uruguay, a country with pasture based dairy farming, 40 dairy farms with lactating Holstein cows were visited. Every farm had different management; thus hours of milking, feeding, feeding time etc. were different. The smallest farm had 39 cows and the largest 1100, the average was 345 cows.

Data collection

All 40 farms were visited and checked according to the scoring system (Verschuuren, 2010; Wolf, 2010). The visits took place from the 30th of October until the 2nd of December 2012. Data was collected by two investigators (both students of the University of Utrecht, dept. of Farm Animal Health). The two investigators had a supervisor, a mastitis expert. The supervisor has been living in Uruguay for 18 years and also helped with communication in Spanish. The environment, the cows, the waiting room and the milking parlour were documented by taking pictures and making notes. The distribution of the time to determine how long the cows are in the pasture and how long the whole milking process takes were recorded, this includes getting the cows out of the pasture until bringing them back.

Scoring system

The scoring system (Verschuuren, 2010; Wolf, 2010) consisted of two parts: a questionnaire and a checklist¹. The questionnaire was used to gather information about hours of milking, percentage of cows with a disease, percentage of dead cows and education of farmer and staff.

The checklist consisted of 9 main chapters: general, milking parlour and waiting area, water, feeding sites, walkways, loading site, pastures, farmer and staff, and animal health. Each of the parameters was checked during the visit or was obtained through the answers of the questionnaire. Guidelines for the scoring of locomotion, body condition score and hygiene were provided and added in appendix 6 till 10. Each number of points in between could be given as well. The points must be summed up per chapter, and counted for the entire farm. If the minimum score for a chapter is not reached, the difference between the score and the minimum needs to be subtracted from the total score (van Eerdenburg, F.J.C.M., et al., 2013).

Data analysis

While scoring the farms the investigators noticed that parameters to fully evaluate the cow welfare under the usual housing conditions in Uruguay were missing in the scoring material used. The parameters or chapters which were missing in the system were added to the new system during the course of the study. Parameters which were less important were defined and merged with another parameter. To make the system usable for an untrained observer, some sheets were added. These sheets are used in the existing scoring systems and were added in appendices 6 till 10.

Results

Practical applicability

The time it took to do the checklist depended on the number of cows present at the farm. Questioning the farmer lasted approximately in 45 minutes. Most parameters are easy to score. The chapters where the cows were examined (e.g. locomotion score and cleanliness), took more time. Also the chapters measured with an instrument (e.g. water temperature, size of the premilking yard) took more time to score. To make it more easy for the investigator there is an checklist added. This checklist, displayed in appendix 3, consists of a list of objects that the researcher needs to do a proper welfare check. The method table is displayed in appendix 5. This gives a proper indication of which chapter needs an instrument to measure, and which information is collected from the questionnaire.

The time all chapters take to score depends mainly on the number of cows at a farm. The number of cows that needs to be scored is not noticed yet. A table with the numbers is added in appendix 4 'number of cows to score', for the new system. That makes it more clear for the investigator and gives a good indication of the farm. The parameters for which several cows needs to be scored are displayed in the method table too.

Changing in chapters

In the chapters general, milking parlour and premilking yard, milking parlour, farmer and staff and animal health some changes were made. All changes will be explained in the next paragraphs. Some changes in the number of points awarded were necessary to keep the maximum score of 500 points, following the extended the scoring system of Eerdenburg and colleagues (van Eerdenburg, F.J.C.M., et al., 2013) for pasture based cattle.

¹ The complete checklist and questionnaire can be found in the reports by (Verschuuren, 2010; Wolf, 2010) and are online available via the repository Igitur of the Library of the University Utrecht: <http://dspace.library.uu.nl/handle/1874/44627> and <http://dspace.library.uu.nl/handle/1874/44655>.

General

The chapter 'general' includes all matters that are not specific to a particular topic. However, these items are just as important. These are the parameters that reflect the cows natural behavior. Cows that do not suffer from stress are not agitated, have their tails hanging straight down and are relaxed. Excited animals may keep their tails straight up. When a cow is bothered by flies or other insects, she will swing her tail to keep the insects away. If cows have the space to stand up and if they are without stress, they will stretch. Stretching does not happen when there is a stressor and the cows have to rush up. However, a single, short lasting, stressor is not a serious problem. Bellowing was not heard at any farm. Nevertheless, this is an indicator that clearly indicates the welfare of the cows. When a cow produces a sound, this can be an expression of pain or stress (FASS, 1999).

The cleanliness score is included in this chapter too and is also a very important one. Evaluation of cow cleanliness can be used as a tool to monitor and control bacterial exposure levels (Bartlett, et al., 1992; Reneau et al., 2005; Ward et al., 2002). Previous field studies have established a significant association between udder and hind limb cleanliness scores of lactating dairy cattle, and measures of subclinical mastitis (Reneau, et al., 2005; Schreiner and Ruegg, 2003); meaning this is an important factor for cow comfort. It is very important that cows are clean to decrease the risk of infections. Every infection compromises welfare. It is therefore logical that this chapter is of great influence on the total cow welfare and thus the final score. It should not have, however, the largest influence, more than for instance 'animal health'.

During the visits, it was found that tail docking is not applied anymore. None of the cows on the visited farms had a docked tail. Tail docking was, in the past, something that was usually done to protect the tails before they were eaten by fly larvae etc. In modern farming, in Uruguay, is it not common anymore. It is possible that one of the animals is docked for a clinical reason. In that case, the well-being of that individual animal will be improved by the necessary medical intervention. Consequently, this parameter can be deleted. The docked tails can be scored by the point broken tails, also in the chapter 'general'.

Milking parlour and premilking yard

All topics of the premilking yard, milking parlour and exit of the milking parlour are included in this chapter. The 'waiting area' is an important chapter because the cows have to wait there before milking. Unfortunately, the literature study the investigator didn't yield any information about the waiting area. Waiting area is not the right word for the place where the cows wait before milking. It is called premilking yard. That's why it will be referred to as premilking yard in the rest of the report.

On all farms visited, all cows were milked twice a day. So waiting for the parlour happened twice every day, for a period of 1 hour to more than 3 hours. Being among the first cows to be milked gave the cows certain advantages: in addition to spending less standing time while waiting, they returned to an empty field and access to the feeding barrier was freely available. Cows waiting to be milked did not have the opportunity to lie down, drink or eat. The researchers observed that when a drinking trough was present in the premilking yard, this decreased the cow welfare, because under this condition, the cows were not willing to get milked. This increased the waiting period and the farmer and staff got angry and chased the cows more frequently. Therefore, a place to drink in the premilking yard doesn't yield extra points. It is known that providing a small edible reward during milking can reduce the time cows spend in the premilking yard, leading to a potential reduction in risk of congestions at the dairy, particularly during times of high demand, as well as a reduction in unnecessary time spent off pasture by cows in the milking herd, promoting cow welfare through reducing the risk of lameness and enhancing productivity (Scott, et al., 2014). Limited space per cow (at the beginning of milking a maximum of 3 m²) inhibited locomotion and social activity (Dijkstra, et al., 2012). Dijkstra et al (2012) noted that a low proportion of cows ruminating during waiting might indicate a stressful environment. The

percentage of cows ruminating increased as milking proceeded (Dijkstra, et al., 2007). As the waiting group decreased in size over time, the social environment changed, and it might therefore be the case that as the group becomes smaller, there are fewer stressors (other cows) and the remaining animals become less stressed. Indeed, a reduced number of events of aggression over time (Dijkstra, et al., 2012) supports this notion. Nevertheless, rumination remained suboptimal, and having an extended period of time in which the cows remain in the constricting and restrictive environment of the premilking yard remains a welfare concern. Cows that spend more time in the premilking yard have less opportunities for normal behavior; therefore, the welfare of these cows is poor. The percentage of cows ruminating in the premilking yard increased in all cow sheds as milking proceeded. The cows in the last waiting group demonstrated more curiosity and grooming activities. Mounting and vocalization activities had a tendency to decrease with time in the premilking yard (Dijkstra, et al., 2012).

The size of the premilking yard must also be added to the system. For a normal sized cow an area of 1.4 m² per animal is sufficient. In Uruguay, the cows are smaller, meaning 1.2 m² may be sufficient (Niel Chesterton, pers comm.). These minimal measures are necessary to prevent overcrowding. Under overcrowding conditions, the cows twist in strange angles, leading to white line defects and lameness (Niel Chesterton, pers. comm.).

Surface of the premilking yard

1,2 – 1,5 m ² or more	5 points
1,2 m ² per cow	0 points
Less than 1,2 m ² per cow	- 10 points

At this point, the number of frightened animals can be added. When a cow is not comfortable in the herd, it will raise its head in the air. This leads to an uncomfortable position. The risk of developing white line defects and sole damage is increased. Therefore, counting the number of animals with their head in the air during the time in the premilking yard may be a good indicator for welfare.

There are milking systems in which cows choose themselves the timing and the frequency of milking. In this way, the size of the area should not matter. Offering a small feed reward upon entry onto the milking parlour reduced the voluntary waiting time in the premilking yard and may be a viable management strategy to encourage cows queuing in the premilking yard to volunteer for milking.

Frightened animals during waiting

0% frightened	0 points
5% frightened	-5 points
>5% frightened	-10 points

Milking parlour

At the 'milking parlour' two points should be added: noise in the milking parlour and milking methods.

Noise in the milking parlour

The method of milking was also added to get a better impression of well-being during milking. It is not pleasant for the cows (Pajor, et al., 2000) when the milking machine produces a lot of noise, that is clearly audible in the milking parlour. This could result in cows not wanting to go into the milking parlour, because of the noise. When the cows do not voluntarily enter the milking parlour, tools will be used to get them in the parlour. These tools are detrimental to the welfare of the cows. A radio produces noise too, so can have the same effect on the cows. There is a stimulatory effect of music on the voluntary approach of cows to an automatic milking system (Uetake, et al., 1997). But too much noise has a negative effect on the cows' welfare

(Pajor, et al., 2000). The normal background noise is 35 decibels. The limit of being pleasant for the human being is between 20 and 50 decibels (ARBO SZW, 2013).

The sound in the milking parlour must be measured with a decibel meter.

20 – 50 dB	5 points
50 – 70 dB	-5 points
>70 dB	-10 points

Milking methods

There are ways of minimizing the risks of mastitis infections. It is wise to reduce the risk of mastitis, because of the effects on cow comfort. Proper milking procedures have a consistent association with lower contagious mastitis risk (Dufour, et al., 2011). Among the most reliable predictors were annual milking system checks, having an established milking order, wearing gloves during milking, using automatic take-offs, and using post-milking teat disinfection (Dufour, et al., 2011; Keefe, 2012). Gloves should be worn during milking. Previous reports indicate that bacterial load on milkers' hands is reduced when gloves are worn and elimination of existing infection is higher for herds where milkers wore gloves (Dufour, et al., 2011). A pre-treatment with paper and post-treatment with dip or spray have a negative effect on an infection (Dufour, et al., 2011; Elmoslemany et al., 2010). If an elevated incidence rate of clinical mastitis caused by environmental pathogens is the herd problem and if the prevalence of mastitis caused by contagious pathogens is low, aspects of the classic mastitis control program that proved to be risk indicators for clinical mastitis caused by environmental pathogens should be reconsidered (Barkema et al., 1999). Farms where milkers washed their hands during milking time yielded lower PPC (approximately 0.6 log CFU/ml) than those where this practice was not carried out. This supports the notion that milkers' hands can be a significant source of milk contamination. In conclusion, several factors related to milking equipment and milking time hygiene (i.e. the frequent cleaning of cooling tanks), were associated with high psychotropic counts in milk (DeVries, et al., 2012). Therefore, the use of aprons during milking is desirable.

Aprons	5 points
Gloves	5 points
Pretreatment with paper	5 points
Posttreatment with dip or spray	5 points

Farmer and staff

This chapter consists of the education of the farmer and staff and how the cows are treated. It could cause discomfort, pain, fear and distress when a person handles a cow incorrectly. The expression of normal behavior may be hampered.

Reducing stress during routine husbandry procedures is likely to improve animal welfare. The effects of handling may have been overshadowed by the degree of pain and/or stress associated with the procedures (Steward, 2002). Cows remember positive handling and this has a long-term effect on their behavior toward humans. Cows tend to develop fear memories that are linked to either bad places or a person wearing a certain type of clothing, or prominent objects. If a cow becomes fearful of the milking parlour this would be very detrimental for milk production. Animals can associate humans with negative experiences and show reactions of fear and stress. Negative handling of heifers resulted in greater flight distances and higher cortisol concentrations, indicating stress (Breuer et al., 2003). The behaviour of the stockperson can not only cause, but also reduce stress in animals. Hemsworth et al. (1989) reported that the stockperson's presence and their positive handling during calving of heifers led to faster approach to an experimenter in a test situation, lower cortisol concentrations, and less stepping and kicking during milking. An additional measure may be the behaviour of dairy cows during milking (stepping, kicking) as a response to actual human handling (Waiblinger et al., 2006). In several studies, the behavior of cows during milking has been found to correlate to human

handling and behavior, and to the level of fear cows have of humans (Rushen et al., 1999; Munksgaard et al., 2001; Waiblinger et al., 2002).

The current scoring system does not contain management assistance. Even though, also in Uruguay, this is becoming increasingly important. Herd guidance is a monthly check by the vet of the farm. This is a preventative measure that will lower the risk of disease in the cows. Lower disease risk is beneficial for the well-being, which makes it a point in the system. It is important to report the frequency of the vet visits too. High quality of knowledge and experience of veterinarians in legal regulations and their implementation in the protection of animals against cruelty is a necessary precondition for inspections. The existence of a separate course on the protection and welfare of animals in study programs of veterinary faculties and high quality of instruction are basic prerequisites for improvement in the protection of farm companion animals (Vecerek and Voslarova, 2013).

Guidance by a veterinarian will improve the welfare on a farm, because it will prevent illness and thereby improve the welfare of the cows.

Monthly management assistance	10 points
Once every two months	5 points
less frequent or no assistance	0 points

Animal health

This is the chapter that contains the most sub-topics and is really important for a good indication of welfare. In Welfare Quality® and the barn system of Eerdenburg et al (van Eerdenburg, F.J.C.M., et al., 2013) animal health is a very important parameter. All the freedoms of Brambell (1965) affect, directly or indirectly, the animal health. The third freedom is specific to health: freedom from pain, injury or disease by prevention or rapid diagnosis and treatment.

During all visits no thick hocks and carpi were seen. Cases of thick hocks and thick carpi do not occur as a problem, just as an incident. Because the cows are grazing outdoors, they do not damage their feet that occurs frequently in cubicle based housing. In the welfare system for the cows on grassland these items can be taken together. The item is not deleted, because there must be a focus on it.

At some farms cows with sunburn were observed. Sunburn develops when the animals are in the bright sun. In the health chapter this parameter is missing. It has been shown that sunburn has a negative impact on animal welfare (Mayer 1992). Sunburn is painful (Mayer 1992; Rowe 1989), and therefore it impairs the welfare of the cows. It is relevant to include the percentage of animals with sunburn in the scoring system.

Percentage of animals with sunburn

0%	0 points
0-5%	-2 points
6-10%	5 points
10-15%	10 points
> 15%	15 points

Youngstock

On most farms the youngstock is reared on the premises. In this way it is easy to score the welfare during the rearing period. The rearing period is important for the welfare of the animals. Most farms rear the majority of their own replacements and the ability to ensure their entry to the adult herd at the most cost-effective time is dependent on ensuring well controlled growth rates and welfare (Logue and Mayne, 2014). Therefore, youngstock is an item that has to be added to the scoring system in order to determine the welfare status of the cows on a pasture based farm. The youngstock component is also added in a later version of the cow compass system. This confirms that it is an important item. Other reports confirm this too (De Paula

Vieira, et al., 2012; Montoro, et al., 2013). Providing young animals with the opportunity to engage in more complex social interactions is hypothesized to improve their capacity to cope with changing environments (De Paula Vieira, et al., 2012). In this way one could say that it is important for the whole life of a cow. Learning how to cope with changes in life makes new events less stressful. Therefore, this point will be added to the system with a focus on the points: water and feed, providing shade, in group or alone and the health status of the calves.

Colostrum

Colostrum is very important because newborn calves don't yet have antibodies in their blood. They must get colostrum of their mother with antibodies immediately after birth to establish a sufficient level of serum immunoglobulin concentration. Calves with low serum immunoglobulin concentration have an increased risk of disease and death. Several factors of colostrum management are of influence on the serum immunoglobulin concentration. Therefore an adequate supply of colostrum is important for good passive immunity (Logue and Mayne, 2014).

Immediately after birth minimum 2 litres	10 points
> 2 litres before 6 hours after birth	5 points
lower amounts of colostrum	0 points
None	-10 points

Water and feed

It is recommended to feed dairy calves milk twice daily with an amount equivalent to 10% of their body weight, until weaning at about an age of 6 weeks. Normal oral and ingestive behavior pattern is prohibited by separation of newborn calves from their mothers. The segregation eliminates the maternal care and the influence of adults on calf behavior, and the cords at pins in the ground restricts movements and social interference with other calves (Grøndahl, et al., 2007).

Untill weaning

Good: Colostrum, milk replacer, water, concentrate and hay.

Bad: Separated milk, high cell count milk and after weaning only hay and no concentrates

Good	10 points
Bad	0 points

After weaning

Good: Sufficient good quality roughage (grass sufficient to grazing), no mould or heating and fresh drinking water in sufficient quantity

Bad: Rest feed or lower quality silage, mould or dirty feed and dirty or too little water.

Good	10 points
Bad	0 points

Lodging

In Uruguay there are different ways to lodge the calves and youngstock. Some calves were housed individually in a calf box made of wood or plastic. Others are kept with a pin in the ground, sometimes with more calves in a group. But when the calves are with a pin in the ground held by a string they cannot play with each other. Another option to keep the youngstock is to keep them in groups together, with the possibility to play with each other.

Group housing may reduce chronic stress. Plasma cortisol levels have been used in cattle to detect activation of the hypothalamo-pituitary-adrenocortical axis due to external stressors. Group size did not alter circulating cortisol concentrations. Calves housed in groups had higher basal cortisol concentrations and those calves were more reactive to weighing than calves housed individually. The increased plasma cortisol level with advancing age may be attributed to normal changes associated with increased growth. Social contact facilitates the development of normal species-specific social behaviour in calves. Dairy cattle housed in groups need to learn

certain social skills to successfully interact with group mates. Individually penned calves are shown to have low social rank within the group, and lower milk production level (Grøndahl, et al., 2007)

Group with shade	20 points
Group without shade	0 points
Single with shade	0 points
Single in sun	-10 points

****Group means that the calves can play with each other, not when they are together, but kept on a cord with a pin in the ground.**

Diseases

The risk of respiratory disease is greater in calves housed in large groups than in individual pens (Abdelfattah, et al., 2013). Group housing of young calves does not inevitably lead to increased health problems. The incidence of diarrhea was similar among treatments. There is no difference in diarrhea between calves kept in the small- vs. large-sized groups (Abdelfattah, et al., 2013).

Diarrhea

Percentage of diarrhea over the last year

0%	0 points
0-5 %	- 5 points
6-10%	-10 points
>10	-15 points

Pneumonia

Percentage of pneumonia over the last year

0%	0 points
0-5 %	- 5 points
6-10%	-10 points
>10	-15 points

Calf mortality

There are many reasons for calf mortality. Poorer quality colostrum leads to all kinds of diseases and later on eventually to mortality. Roughly 20% of calves fail to absorb sufficient colostrum antibodies leading to increased mortality and to reduced lifespan. There is a considerable variation in the IgG fractions of dairy cow colostrum influenced by breed and/or yield component, season/housing, and mastitis (Logue and Mayne, 2014).

% Subtract 5 per % of mortality.

% of cases in which a calf dies at the farm. Mortality rates in South-America tend to be much higher than in Europe. Subtract 5 points per % of mortality. For example, in case of 10% calf mortality, give minus 50 points.

Discussion

Some critical notes need to be made about the pasture-based welfare scoring system for dairy cows. The used system was based on the system of a barn based welfare scorings system made by (van Eerdenburg, F.J.C.M., et al., 2013) and was not complete yet. No other cow-comfort scoring system for pasture-based dairy cows exists, and consequently, there was no comparison material for the present welfare scoring system. Without an established and validated welfare scoring system that can serve as gold standard, validation of this system not easy. The validation of the modified scoring system by Verschuuren (2010) and Wolf (2010) has not yet been validated, because some missing parts were noticed during visiting the farms. Changes were made in the pasture-based system after collecting the data in Uruguay. Validation of the

system so far is not possible, because some parameters were scored only a few times or not at all.

During the visits on the farms the investigators recognized that some items were still missing in the welfare scoring system. Items such as sunburn, surface of the waiting area and frightened animals in the waiting area were added to the modified welfare scoring system. The current scoring system does not contain management assistance, a topic that is becoming increasingly important, also in Uruguay.

Objectivity

The situation in Uruguay is very different from the situation in the Netherlands. Uruguay is not as developed as the Netherlands and some farmers are poor and not educated. Training on how to work with the cows and development of their knowledge would make a very big difference in the treatment of the animals and thus in the welfare of the cows. This is not an excuse for the bad welfare, but a point where improvement can be made. Also poor knowledge may affect the quality of the responses of the farmer to questions from the questionnaire.

It is not possible for the system to be entirely objective. For example, some parameters are divided into several options from which the investigator can choose. He or she has very good guidelines to make an informed choice. Even though, it is possible that in some situations it is not entirely clear which option to choose. Different investigators will not always choose the same option. To avoid this, the scoring was always performed by the same two investigators, both with the same instructions.

It is very difficult to get a good estimate of the animal health in Uruguay, because most of the farmers don't keep records to calculate year indices. They don't document the history of each individual cow as is done in the Netherlands. Also, the veterinarians don't keep track of these figures. Furthermore, even if farms had an administration system, not all data could be considered as reliable. A welfare indication would be more based on the reliable information, if the history of cows and farms were documented. Now the investigators were depending on the memory of the farmers to get the figures. This is not an accurate method.

Because the researchers travelled along with a mastitis expert, most of the farms that were visited had a mastitis problem. This could have biased the modifications and extensions of the welfare scoring system that we used during our visits. However, because the veterinarian did also periodical controls of the milking equipment, some of the farms visited had not mastitis problems. It is important that in the future, the pasture-based system will be tested at farms that were selected randomly.

During the study the weather conditions were extremely warm, except the first two days when it rained most of the time. Weather conditions influence the outcome of the score. Pastures can be green and grassy, or yellow and dry, just like the walkways and outlets which may be muddy or dry with stones. This can affect the outcome of the welfare evaluation and may yield more positive or negative outcomes.

The researchers did not speak Spanish very well, so there was a language barrier between them and the farmers. Eventually much more information could have been collected if the investigators had been well trained in the language.

Practical knowledge is needed by the researcher(s), e.g. to score the body condition, locomotion score, cleanliness score and the filling of the rumen. Scoring these parameters should be done by someone who is well trained and experienced.

In order to measure the anxiety in cows a test should be performed using the Dodge test (Koe kompas, 2012):

Measure at how much distance the cows dodge.

1. Shy: Cows dodge at the distance of approximate 10 meters or more
2. Restless: Cows dodge at the approximate distance between 5 and 10 meters
3. Average: Cows dodge at the approximate distance between 1 and 5 meter
4. Quiet: Cows dodge at the approximate distance of less than one meter
5. Tame: Cows do not dodge

To check the temperature of the drinking water it is relevant to use a calibrated thermometer. In order to examine the water for residues it is necessary to use a glass. In appendix 10 an explanation is present of how to score the water quality.

Questionnaire

Some elements have to be added to the questionnaire and there are some redundancies. To get a clear representation of the farm it is also useful determine the number of cows in lactation. Concerning the hectares of land a farmer has it is wise to differentiate between the amount of hectares in general and the number of hectares of land that is available for the cows. Besides veterinary assistance during calving, it is good to ask the farmer about his assistance at calving with problem cows. In fact, it turned out that the veterinarian is rarely engaged. Number of dead cows and the number of cases explicable and inexplicable need to be registered. When asked about the quality of food, individual diets per animal or group of animals should also be investigated. This allows a better scoring for the forage quality.

Many farms occupy several employees. This possibility needs to be asked as well. Also, the training of employees and any further training and retraining should be a question in the questionnaire. The training of the farmer has to be verified.

The checks must be done around the time of milking. It is best to start half an hour before milking to tick off the list. Milking is an important item as well, meaning it must be observed too. By starting prior to milking, the behavior of the cows 'at rest' can be observed in addition to the behavior of the cows during and after milking. After checking the cow parameters, the other parameters can be checked.

The questionnaire takes time. Of course, the time the survey takes depends on the farmer's way of talking. During the questionnaire there is a possibility to explain the reason of the research. Some questions were so brief it was not clear to the farmer what was meant by the question. This is one of the reasons why the questionnaire has been improved in the new system. The modified questionnaire is added to appendix 2.

Unresolved items and recommendations

To the scoring system developed for the assessment of cow comfort of pasture-based dairy cows, chapters and points were added. Where considered necessary, the scoring system was modified (by adding, changing and/or removing parameters). It is expected that these modifications yield a scoring system that is better suited to evaluate the welfare of cows on pasture. All added chapters and changing in chapters were based on observations during the visit to 40 dairy farms in Uruguay. The noticed parameters were compared with literature. Unfortunately for some of the points, the literature does not provide relevant information

The researchers observed that, if a drinking trough was present in the waiting area, this decreased the cow welfare. It decreases because the cows are not willing to get milked while they want to drink. Consequently the cows stayed longer in the waiting area and the farmer and staff got angry and chased the cows more physically. It therefore is a point of discussion whether the presence of a place to drink in the waiting area should yield extra points. Of course the cows need water ad libitum, especially when the temperature is high, like in Uruguay. Drinking water is not the only point in the waiting area. Dairy cows preferred to use shade or

sprinklers and ambient conditions (no cooling) after walking. The preference for shade increases in warm weather (Schütz, et al., 2011).

Further investigation is needed to determine whether there is sufficient water available at the pasture and whether there is water available immediately after the milking. Will the cows still drink and don't want to go in the milking parlour?

These are not the only points where further research is needed. Also added is 'noise in the milking parlour'. The highest points were given based on the Dutch law, which defines a maximum level of decibels for employees. Research must be performed to address the question what the threshold is above which the noise level becomes adverse to cows. In this research a distinction can be made between constant sounds (of a milking machine) or different sound heights from the radio.

Most farms rear their own youngstock. In this way it is easy to score the welfare during the rearing period of the cows. Furthermore, the rearing period is an important factor for welfare (De Paula Vieira, et al., 2012; Montoro, et al., 2013). That's why it is added in the system. At this point a maximum of 50 points is awarded to this part of the scoring system. It is however unclear whether this is sufficient for an obvious indication of welfare. It should be considered if the factors that cause a decrease in points are important enough, or if they have, on the other hand, too much impact on the final score yielded by the scoring system. For a clear representation of the impact of calf welfare on the welfare of grown dairy cows further research is necessary, investigating the whole life cycle of a dairy cow. In this way the impact of all phases in a life cycle can be compared and the significance of different phases can be determined.

Conclusion

Validating the welfare system for dairy cows on grassland was not possible yet, because there were missing several chapters and sub-topics. These chapters identified during a series of 40 visits to dairy farms in Uruguay, with the intention to validate a modified welfare scoring system. These chapters must be added to derive correct perception of the welfare of the cows, and have consequently been added to the new system. With the changes it is probably possible to achieve a useful and effective scoring system. All parameters used are in fact 'easy' to score. The modified and extended system needs to be validated. The correlation between the parameters and the total score for each farm must be recalculated. Because the system used in Uruguay was incomplete, i.e. did not cover the local conditions, it has not been possible yet to compare the existing barn based system with the pasture based system (van Eerdenburg, F.J.C.M., et al., 2013).

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the cow related problems.

Appendix 1 Scorings sheet

This sheet is copied from the sheets of (Verschuuren, 2010; Wolf, 2010), with additions after the investigation at 40 farms in 2012. Each number of points in between may be given as well. The points must be summed per chapter, and counted for the entire farm. If the minimum score for a chapter is not reached, the difference between the score and the minimum needs to be subtracted from the total score (van Eerdenburg, F.J.C.M., et al., 2013). Behind the scoring sheet is a list of numbers of animals that have to be scored by the individual points. This number of animals depends on the size of the farm.

General

Minimum points 8, maximum points 20.

Fear behavior

The points awarded to view the rapprochement of the cow by the investigator. The investigator approaches the cow with a straight arm. Does the cow remain stationary, does it take one step back, two steps back does, does it move more than two steps back or does it run away.

- 5 points Curious animals
- 4 points Not fearful animals, does the cow remain stationary
- 3 points Cow steps backward
- 0 points Fearful animals, cow 'runs' away

Stretching when standing up on the pasture

When a cow lies comfortably in the grasslands and is not forced to stand up quickly, the cow will stretch when standing up.

- 3 points Stretching
- 0 points Otherwise

Tails are hanging straight and relaxed

When a cow is not suffering from any stress or is not agitated, the tail hangs straight down and relaxed. Excited animals can keep their tail straight up. If a cow is bothered by flies or other insects, the tail will be swinging to keep the insects away.

- 3 points If more than 90% of the cows in the pasture have a relaxed, straight tail
- 2 points When 80-90% of the cows have a straight and relaxed hanging tail
- 0 points Otherwise

Broken tails(percentage x -1)

If a cow is handled very roughly the tail might break. For example in a situation when a farmer that uses the tail to move the cow in the right direction. Livestock with mastitis is sometimes marked by a string around the tail. When this string is tied to tight, the tail will die and fall off. The use of tails by cattle is a fly-avoidance behavior. The welfare of cows with shorter tails is reduced because of their inability to repel flies and the disruption of grazing behavior by the use of alternative fly-avoidance. Cows with docked tails should be excluded.

- 0 points If less than 1% of the cows have a broken tail.
- ≥1 points Subtract one point per percentage of broken tails.
(For example, in case of 8% broken tails, subtract 8 points)

Bellowing

A behavioral indicator of discomfort is vocalization. The assessment of stress and discomfort should contain both behavioral and physiological measures. Cows in oestrus or with cystic ovarian follicles or when they have recently calved will bellow often and should be excluded.

- 4 points If there is less than 2 times bellowing per 30 minutes
- 2 points Twice per 30 minutes
- 0 points More bellowing

Environmental noise

Noise in the environment, produced by tractors, cars, airplanes, shouting etc., is not pleasant for the cows.

- 0 points If there is not much noise
- 3 points If there is some noise
- 5 points If there is a lot of noise

Flies

Flies can be irritating for the cows. Cows that suffer from flies wave their tails to drive the flies away; they hit themselves with their tails, throw their head in the flank or kick their own belly. There are certain fly-control methods to keep the flies away.

- 0 points No flies
- 2 points A few
- 4 points Many flies
- 5 points Very many flies

Cleanliness score

If the ground on which the cows have to walk is very muddy or covered with faeces, such as the pasture, the walkways, the feeding and water places or around the milking parlour, the cows will get dirty. For the cows it is unpleasant to walk on muddy paths. They get dirt up to their belly. It increases the chances of sickness, for example a mastitis infection. Mud and faeces contain a lot of bacteria.

To score the cleanliness there is a cleanliness scoring system. See appendix 7.

1	A totally clean cow
2	The heel and the bottom of the legs are slightly covered with mud or faeces
3	The rear legs are covered to about the heel, the rest of the body is clean
4	The upper rear limbs of the cow are dirty and the ventral abdomen and udder of the cow are slightly covered with mud or faeces
5	The cows are covered with dirt all over the body

- 5 points Good, an average between 1 and 2
- 0 points Sufficient, an average between 2 and 3
- 5 points Bad, an average more than 3

Premilking yard

Minimum points 12, maximum points 30.

Behavior

Cows tend to develop fear memories which are linked to either bad places or a person wearing a certain type of clothing or prominent objects. If a cow becomes afraid of the milking parlour this will be very detrimental for the milk production. Cows that do not fear the milking parlour will be waiting quietly and will enter the milking parlour voluntarily. Cows that do not feel comfortable, will be waiting as far as possible in the back with their backside turned to the milking parlour. These cows have to be forced into the milking parlour.

- 3 points If the cows are facing the milking parlour, waiting in the front
- 0 points When cows are facing the milking parlour but are waiting in the back
- 3 points Cows turn their back to the milking parlour and are waiting in the back

Maximum time waiting before entering the milking parlour

For the well-being of the cow it is better to have a short time to wait in the premilking yard before getting milked. The cows are standing on concrete, not being able to lie down or eat, sometimes not being able to drink, and the udder will be swollen and heavy.

2 points	Waiting less than an hour
1 point	Waiting between 1 and 2 hours
0 points	Otherwise

Surface of the premilking yard

For a normal sized cow an area of 1.4 m² per animal is sufficient (Niel Chesterton, pers comm.). In Uruguay, the cows are smaller, suggesting 1.2 m² may be sufficient (Niel Chesterton, pers comm.). These measurements are necessary to prevent overcrowding. When there is overcrowding the cows twist in strange angles, leading to white line defects and lameness (Niel Chesterton, pers. comm.).

5 points	1,2 – 1,5 m ²
0 points	1,2 m ² per cow or more
-10 points	Less than 1,2 m ² per cow

Frightened animals during waiting

When a cow is not comfortable in the herd, it will raise its head in the air. This leads to an uncomfortable position. The risk of developing white line defects and sole damage is increased. Therefore counting the number of animals with their head in the air during the time in the premilking yard is a good indicator for welfare.

0 points	0% frightened
-5 points	5% frightened
-10 points	>5% frightened

Shade

It is important for cows to have access to shade. When it is hot and the cows do not have access to shade they can suffer from heat stress. Heat stress can be significantly reduced if shade is provided.

5 points	If there is ample shade in the premilking yard
0 points	If there is a bit shade in the premilking yard
-5 points	If there is no shade in the premilking yard

Presence of a ventilation system

A ventilation system ensures cows suffer less from the heat. A fan is an example of a ventilation system. Bucklin et al (1991) found that a fan cooling system in combination with shade can improve cow comfort and increase milk production of cows in hot, humid climates.

5 point	If there is a ventilation system present
0 points	If there is no ventilation system present

Presence of sprinklers

Sprinklers spray water, which provides cooling. This prevents suffering from heat stress.

5 point	If there are sprinklers
0 point	If there are no sprinklers

Slipperiness floor

The floor has to provide sufficient grip. Without grip animals can slip or fall down and get injured.

1 point	Sufficient grip present
-5 points	No sufficient grip present

Cleanliness floor

A lot of dirt can make the floor slippery. Dirt is a good environment for bacteria etc. thus it can affect the health of an animal. For example, if a cow has to stand in the dirt for a while this can cause claw problems. Attention to hygiene can reduce the incidence of lameness.

2 points	A clean floor
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0 point	A bit dirty floor
-5	A dirty floor

Flatness floor

Holes or lumps in the floor can make a cow fall down or trip. It is also unpleasant if an animal has to stand unequal because the floor is not flat.

2 points	Flat floor
0 points	Small holes / lumps
-5 points	Big holes / lumps

Milking parlour

Minimum points 15, maximum points 34

Placing of feeding troughs

Feeding troughs need to be placed in a way that the cow can keep her head in a natural position during eating. If the feeding trough is not placed straight in front of the cow she has to keep her head skewed which is very uncomfortable.

3 points	Straight in front of the head
0 points	Oblique in front of the

Space

A cow does not have enough space when she cannot stand straight, when she has to bend her head to fit in or when a bar is pushing against her body. This is very uncomfortable and makes the cow dislike milking.

3 points	If the cow has enough space
0 points	If the cow doesn't have enough space

Slipperiness floor

The floor has to provide sufficient grip. Without grip animals can slip or fall down and get injured.

1 point	Sufficient grip present
0 points	No sufficient grip present

Cleanliness floor

A lot of dirt can make the floor slippery. Dirt is a good environment for bacteria etc. thus it can affect the health of an animal. For example if a cow has to stand in the dirt for a while this can cause claw problems. Attention to hygiene can reduce the incidence of lameness.15, 37

1 point	A clean floor
0 point	A bit dirty floor
-1 point	A dirty floor

Flatness floor

Holes or lumps in the floor can make a cow fall down or trip. It is also unpleasant if an animal has to stand unequal because the floor is not flat.

1 point	Flat floor
0 points	Small holes / lumps
-1 points	Big holes / lumps.

Stairs and slopes

Stairs and slopes constitute a problem for the cow. They can be an obstacle for the animals where they can slip or fall down. Especially when the stairs or slopes get wet it can be dangerous. Animals walk very slowly and act reluctant when passing a slope. They look very scared and try to avoid it.

2 points	No stairs or slopes present
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0 points Stairs or slopes present

Light

The light in the parlour is sufficient when it is possible to read a newspaper anywhere in the barn.

2 points If there is sufficient light in the barn

0 points If there is not enough light in the barn

It smells fresh

The air quality is measured by the smell. It should not smell like gases (NH₃, H₂S or other gases).

1 point If it smells fresh

0 points If it smells like gases

-2 points If it smells very strong

The way of walking of the cows related to the placement of the shafts

Shafts are placed in the milking parlour and at the entrance of the milking parlour. The shafts may not cause any nuisance to the cows. If the shafts are not well placed (too high or too low) or have sharp endings/ends, the cows can hurt themselves. The cows will walk slowly and carefully in the milking parlour.

2 points If the cows walk lofty and correct

1 point If they walk carefully and slowly

% kicking cows

Kicking is a behavioral indicator of discomfort. Cows that kick during the milking process are not comfortable with you touching their udder or with attaching the machine. This can be due to udder problems, such as an infection or when the cow handled without any care. Rousing et al, 2004, found a relation between kicking during milking and teat lesions. Cows with teat lesions were more likely to kick during milking and often kicked more than once. If people yell inside the milking parlour, the cow may become fearful and it may kick.

0 points If 0-5% of the cows kick

-2 points If 5-10% of the cows kick

-5 points If 10-15% of the cows kick

- 8 points Otherwise

Noise in the milking parlour

It is not pleasant for the cows when the milking machine produces a lot of noise (Pajor, et al., 2000), that is audible in the milking parlour. This could result in cows not wanting to go into the milking parlour, because of the noise. When the cows do not voluntarily enter the milking parlour, tools will be used to get them in the parlour. A radio produces noise to, so can have the same effect on the cows. There is a stimulatory effect of music on the voluntary approach of cows to an automatic milking system (Uetake, et al., 1997). But too much noise has a bad effect on the cows' welfare (Pajor, et al., 2000). The normal background noise is 35 decibels. The limit of being pleasant for the human being is between 20 and 50 decibels (Arbo NL, 2013).

The sound in the milking parlour must be measured with a decibel meter.

0 points 20 – 50 dB

-5 points 50 – 70 dB

-10 points >70 dB

Minimizing the risks of mastitis infections

It is wise to reduce the risk of mastitis, because of the effects on the cow comfort.

5 points Aprons

5 points Gloves

- 5 points Pretreatment with paper
- 5 points Post treatment with dip or spray

Exit milking parlour

Minimum points 3, maximum points 6

Floor

Cows prefer a soft floor. A hard floor, like concrete, ensures that the claws wear faster. That is why a floor of grass gets most points assigned. A floor that is made of sand can get holes in it very easily, especially when a lot of cows walk on it a few times a day.

- 1 point Grass
- 0 points Concrete
- 1 point Sand

Mud

A lot of mud can make the floor slippery. Mud is a good environment for bacteria which can affect the health of an animal. Besides this, it makes a claw wet and this can decrease the hardness of the claw. Cows with softer claws are at greater risk for lameness.⁷

- 2 points No mud
- 0 points A little bit of mud
- 2 points Ample mud

Surface

It is very uncomfortable and can be dangerous if the surface is severely convex or has a lot of holes. If the surface is convex all the cows are walking in a line in the middle or on the sides.

The middle and sides are a little bit flat and the rest is not.

- 2 points A flat surface
- 1 point A convex surface
- 0 points Severely convex surface
- 0 points Holes in the floor

Rubbish and obstacles

Rubbish and obstacles are annoying for the cows. They have to walk around it and if they accidentally step on it they can get injured.

- 0 points No rubbish or obstacles
- 1 point A little bit of rubbish or obstacles
- 2 points Lots of rubbish or obstacles

Slopes

A slope is an obstacle for the animals where they can slip or fall down. Especially when the slope is wet it can be dangerous. Animals walk very slowly and act reluctant. They look very scared and try to avoid the obstacle.

- 1 point No slopes present
- 0 points Slopes present

Water

Minimum points 16, maximum points 33

Ad libitum water available

According to the five freedoms water should be available everywhere and every time. This means there have to be drinking places everywhere, meaning at every pasture, in the premilking yard and at the exit of the milking parlour. And the drinking places have to contain water at all times. There need to be a sufficient amount and size of drinking troughs has to be enough for the cows. Troughs exist in different sizes. In order to be a drinking trough, there has to be water in it.

A small drinking trough, minimum 65 centimeters, is suited for one cow. And that place is enough for 10 cows. Cows may consume 30 to 50% of their daily water intake within one hour after milking; this means it is very important that the cows have got enough space to drink between the exit of the milking parlour to the pasture.

- | | |
|-----------|---|
| 18 points | Places to drink filled with water in every pasture, the premilking yard and the outlet and no fighting for the water and all the cows get the chance to drink when they want. |
| 12 points | Drinking place filled with water in the pastures and the premilking yard |
| 0 points | Otherwise |

Type of place to drink

A constructed drinking place contains water from the service pipes. A natural drinking place contains ground water with its natural flora. Natural water can be contaminated with for example a pond snail (*Lymnea trunculata*) which can cause liver problems when ingested by a cow.

- | | |
|----------|-----------------------------|
| 3 points | Constructed drinking places |
| 0 points | Natural drinking places |

Cleanliness

Water troughs are a major source of exposure of cattle to enteric bacteria, including a number of foodborne pathogens. An adequate supply of clean, fresh drinking water is widely considered essential for optimal cow health and maximum milk production. *See appendix for the use of a glass to estimate the quality*

- | | |
|-----------|-----------------------|
| 3 points | Clear and clean water |
| 0 points | A bit dirty |
| -3 points | Muddy or dirty water |

Temperature

A cow prefers water of moderate temperatures (15-25°C) rather than very cold or hot water. A cow drinks around 25 liters at a time (Niel Chesterton, pers comm.) and this all ends up in the rumen. Chilled water will decrease the local temperature substantially and the flora will function on a less efficient level. Furthermore, a lot of cold water in the rumen is not comfortable. On a hot day a cow will prefer a little bit colder water, but not less than 15 degrees. Drinking warm water in a warm environment is even less appreciated. Use a thermometer to check the temperature of the water in a minimum of three of the water buckets.

- | | |
|----------|-------------------------------|
| 5 points | Water is between 15 and 25 °C |
| 2 points | Cold water, < 15°C |
| 0 points | Warm or hot water, >25°C |

Distance from the pasture where the cows are to the place to drink

It is not good for the well-being of the cow if she has to travel a long distance to drink water. This costs a lot of energy and will go at the expense of the production and the welfare. Measure the distance by counting steps. One step is approximately 0.5 meter.

- | | |
|----------|------------------------------|
| 3 points | Distance less than 500 meter |
| 1 point | Between 500 and 1500 meter |
| 0 points | More than 1500 meter |

Safety of the drinking trough

A drinking trough has to be safe so the cow cannot injure itself and cannot accidentally fall in it. The drinking trough must be without sharp edges to protect the cow from trauma and the walls have to be high enough to protect the cow from falling in the water and defecating in it.

- | | |
|----------|---------------------|
| 1 points | Safe drinking place |
| 0 points | Not safe |

Feeding sites

Minimum points 13, maximum points 27

Additional feeding sites in the pasture

Additional feeding sites in the pasture are required at times of scarcity and drought to avoid malnutrition.

- 10 points Additional feeding sites are present
- 0 points No additional feeding sites

Surface

It is good for the well-being of the cow to stand on a firm surface while eating.

- 3 points Concrete surface
- 1 point Grass
- 0 points Sand

Cleanliness of the surface

The surface on which the cow is standing while eating has to be clean. Keeping cows out of the mud increases their productivity and reduces endoparasitic infection and foot problems.

- 3 points Clean
- 0 points Small layer of faces or mud
- 3 points Big layer of faces or mud

Feeding place per cow

Every cow should have its own feeding place, with a minimum of 65 cm, to ensure that cows lower in rank get enough food.

- 3 points One feeding site (> 65cm) per cow
- 1 point In case of 58,5-65 cm per cow
- 0 points In case of < 58,5 cm per cow

Contamination of the feeding site

The feeding site is supposed to be clean. There may be no undesirable debris that may affect the cow's health and comfort (wires, plastic containers, etc.); the troughs must be free of any (in)organic material and look suitable for cows. A feeding site on the ground has a higher risk of getting contaminated than one above the ground.

- 0 points No contamination of the feeding site
- 3 points Contamination of the feeding site

Distance from the pasture to the feeding site

It costs a cow a lot of energy to walk long distances. This affects the welfare and the production.

- 3 points If the distance is <1 km
- 1 point In case of a distance between 1 and 3 kilometers
- 0 points Otherwise

Quality

The quality of the food provided for the cows has to be good. Dairy cows need special nutrition because they have to produce milk. Important are the rates of proteins, minerals and vitamins in the food. The mixture should also provide enough energy. Food must be free of undesirable organic materials (for example mould) and look suitable for cows. The food also may not contain any other debris that may affect the cow's health and comfort (wires, strings, plastic containers etc.).

- 5 points Food for dairy cows, without mould and other debris, adjusted to the cows personal needs
- 4 points Food for dairy cows, without mould and other debris, adjusted to a group of cows (in the same lactation stadium)

3 points	Food for dairy cows, without mould and other debris, all the cows get the same amount
2 points	Food not for dairy cows, without mould and other debris, all the cows get the same amount
1 point	Food for dairy cows, with mould and/or other debris, all the cows get the same amount
0 points	Food not for dairy cows, with mould and/or other debris, all the cows get the same amount

Walkways

Minimum points 9, maximum points 18

Floor

Cows prefer a soft floor. A hard floor, like concrete, ensures that the claws wear faster. That is why a floor of grass gets most points assigned. A floor that is made of sand can get holes in it very easily, especially when a lot of cows walk on it a few times a day.

3 points	Grass
1 point	Concrete
0 points	Sand

Mud

A lot of mud can make the floor slippery. Mud is a good environment for bacteria which can affect the health of an animal. Besides it makes a claw wet and this can decrease the hardness of the claw. Cows with softer claws are at greater risk for lameness.

3 points	No mud
0 points	A little bit of mud
-5 points	A lot mud

Surface

It is very uncomfortable and can be dangerous if the surface is severely convex or has a lot of holes. If the surface is convex all the cows are walking in a line in the middle or on the sides. The middle and sides are a little bit flat and the rest is not. A poor quality of the surface contributes to the incidence of lameness in pasture-based systems. The incidence of lameness can be considerably reduced by paying attention to walking surfaces and maintain them carefully.

3 points	A flat surface
1 point	A convex surface
0 points	Severely convex surface

Rubbish and obstacles

Rubbish and obstacles are annoying for cows. They have to walk around it and if they accidentally step on it they can get injured.

0 points	No rubbish or obstacles
-3 points	A little bit of rubbish or obstacles
-5 points	Lots of rubbish or obstacles

Walking distance

It costs a lot of energy for an animal to walk very far, especially when the walkway is in bad condition. Loss of energy affects the milk production. A long walking distance also contributes to the incidence of lameness in pasture-based systems. The walking distance (from the meadow to the milking parlour) can be measured with a pedometer.

5 points	< 1 km.
0 point	1 – 3 km.
-1 points	> 3 km.

Slopes

Slopes can be an obstacle for the animals; they can slip or fall down. Especially when the slope is wet it can be dangerous. In this situation animals walk very slowly and act reluctant when passing a slope. They look scared and try to avoid it.

- 2 points No slopes present
- 0 points Slopes present

Speed of walking of cows

Cows can walk with a firm stride on a walkway that is in good condition. When a walkway is full of rubbish, obstacles and holes they will walk slowly. The investigator has to walk along with the cows and use a speedometer to measure the speed.

- 2 points If the cows walk with a firm stride, and they run without sliding > 4 km. p/h
- 1 point If they walk with a firm stride and a bit cautious 3 – 4 km. p/h
- 0 points If the cows walk cautiously or slowly < 3 km. p/h

Loading site

Maximum points 0

Steepness

The loading site has to be steep to bring the cows on the level where they have to be to get in the transport trucks. But it is uncomfortable to walk on a steep slope. So the lesser the slope the better it is for the cows because excessively steep ramps may injure animals. The loading sites are equally steep because they are aligned to the same sort of transport trucks. However, a loading site can be less steep if the place for the truck is lower than the place where cows enter the loading site.

- 0 points Slope is expressed in degrees from 0 till 15 degrees
- 1 points More than 15 degrees

Safety

A loading site is not safe when it contains sharp edges, protruding screws etc. A cow can get injured when walking on a loading site that is not safe.

- 0 points Safe
- 1 points Not safe

Flatness and smoothness floor

Holes or lumps in the floor of the loading place, even a steep site, can make a cow fall down or trip. It is also unpleasant for an animal to stand unequally because the floor is not flat or has holes and lumps, while waiting to enter the transport truck.

- 0 points Flat floor
- 1 points Small holes/ lumps

Straight end (-1 or 0 points)

A straight end of the loading site is much more comfortable for cows. It is easier for cows when passing the transition between loading site and transport truck when the end of the loading site is straight.

- 0 points If the loading site ends straight
- 1 points If the loading site does not end straight

Pastures

Minimum points 35, maximum points 70

Shade during hot hours of the day

It is important that cows have the opportunity to stand in the shade during the hottest hours of the day, the cows will always be drawn to the shade. If there is not enough shade for all cows,

they will only keep their heads in the shade. Cows who are without shade may suffer from heat stress. Having many shaded places that provide enough space for all cows to stand with their whole body in the shade is most optimal.

20 points	If > 99% of the cows have a place in the shade
10 points	70-99% of the cows have a place in the shade
0 points	40-70% of the cows have a place in the shade
-10 points	30-40% of the cows have a place in the shade
-20 points	< 30% of the cows have a place in the shade

Food availability

Food availability is important for animals; it is one of the 5 freedoms. Availability to enough grass means that all cows can eat and express their natural behaviour such as grazing and exploration. If there is only a small area of grass, it might be too little for all cows to eat and express their natural behaviour.

20 points	Pasture full of grass
10 points	Pasture with sufficient grass
0 points	Pasture with some grass
-20 points	Pasture with (almost) no grass

Mud

A pasture with a lot of mud can decrease the welfare of a cow, mud disturbs the normal way of walking. Mud (and faeces) provides a good environment for bacterial growth which can affect the health of animal. Mud also makes a claw wet and this can decrease the hardness of the claw. Cows with softer claws are at greater risk for lameness.

10 points	Clean pasture
0 points	Mud / faeces on the pasture
-10 points	A lot of mud / faeces

Rubbish and obstacles

Rubbish and obstacles are irritating and annoying for cows. They have to walk around it and if they accidentally step on it they can get injured by falling down.

10 points	No rubbish or obstacles
0 points	A little bit of rubbish or obstacles
-10 points	A lot of rubbish or obstacles

Presence of extra pasture

An extra pasture is used with excessive climates. In Uruguay there are periods of massive rainfall or extreme dryness. The extra pasture is close to the milking parlour which means that the cows do not have to cover a large distance to go to the milking parlour. The other pastures and walkways, which are not used, will retain a good condition.

5 points	Extra pasture present
0 points	No extra pasture present

Mud on extra pasture

A pasture with a lot of mud can decrease the welfare of a cow. Mud (and faeces) can be a good environment for bacterial growth, which can affect the health of animal. Besides it makes a claw wet and this can decrease the hardness of the claw. Cows with softer claws are at greater risk for lameness.

5 points	Clean extra pasture
2 points	Mud / faeces on the extra pasture
0 points	A lot of mud / faeces

Farmer and staff

Minimum points 35, maximum points 70

Relevant education of farmer

A relevant education gives the farmer more insight about keeping and handling cows in a good and professional way. This benefits the well-being of the cows and reduces stress.

- 5 points Relevant education
- 0 points No relevant education

Relevant education of staff

A relevant education gives the staff more insight about keeping and handling cows in a good and careful way. This benefits the well-being of the cows and reduces the stress for the cows.

- 5 points Relevant education
- 0 points No relevant education

Way of herding

Herding by foot is much quieter than by horse. Herding with a motorbike gives a lot of noise. A horse and motorbike are fast so the cows can be chased.

If someone walks behind the animals to take them to the waiting room, the cows can walk at their own pace. When a person herds by a horse or a motorbike, cows are forced to walk as fast as they can. This causes them to trip, bump into each other or get injured. They become anxious and panic a bit while trying to walk as fast as possible. Best is to move cattle at a slow pace. Fearful animals are more difficult to handle. Handlers should move slowly and deliberately. Sudden jerky motions frighten the animals. In the wild, sudden movements are associated with predators.

- 10 points By foot
- 0 points By horse
- 10 points Herding by motorbike

Way of treating the cows during herding

Being quiet during herding is the best way to keep the cows calm. Cows do not like noise and thus they do not like whistling or yelling. Shouting at cows works aversive. Beating them or using an object (for example a stick) is even worse. This is painful for the cows and makes them anxious and scared. Poor herding skills contribute to the incidence of lameness in pasture-based systems.

It is possible that multiple options can be applied. If that is the case, points are summed up.

- 15 points Quiet
- 0 points Whistling
- 5 points Yelling
- 15 points Beating (hitting / kicking)
- 15 points Using an object

Way of treating the cows around the milking parlour

Being quiet during herding and milking is the best way to keep the cows calm. Cows do not like noise and thus they do not like whistling or yelling. Shouting at cows works aversive. Beating them or using an object (for example a stick) is even worse. This is painful for cows and makes them anxious and scared. This way they will develop an aversion for the milking process and the next time it will be even more difficult to get them in the milking parlour. It is possible that multiple options can be applied. If that is the case, points are summed up.

- 15 points Quiet
- 0 point Whistling
- 5 points Yelling
- 15 points Beating (hitting / kicking)
- 15 points Using an object

Use of automatic driving aids

The use of automatic driving aids (for example electrical prods or a backing fence) forces the cows in the direction of the milking parlour. This is easy for the farmer but cows do not like forced traffic. It alters milk quality and eating behaviour. Electric prods, restraint and other handling stressors will also lower female reproductive function.

- 10 points No automatic driving aids
- 0 points With automatic driving aids
- 10 points With electricity driving aids

Management assistance (guidance by the veterinarian)

Guidance by a veterinarian will improve the welfare on a farm, because it will prevent illness and thereby the welfare of the cows. This point belongs to general.

- 10 points Monthly management assistance
- 5 points Once every two months
- 0 points Less frequent or no assistance

Environnemental management

Minimum points 2, maximum points 5

Rest during hot hours of the day

A cow is supposed to rest during the hot hours of the day to save energy. A farmer can choose to leave the cows in the field where they can rest wherever they like. Or he can bring the cows to the milking parlour, milk them before heat and make sure the outlet is big enough for all the cows to rest, eat grass and lie down in the shade. In the last case the outlet is a sort of pasture.

- 3 points Rest during the hot hours of the day
- 0 points No rest

Milking hours aligned to the climate

It is in the best interest of the cows to milk them during colder hours of the day. This means that they do not have to walk from the pasture to the milking parlour and that they do not have to wait in the waiting room during the warmest hours of the day.

- 2 points If the milking hours are in the cows best interest
- 0 points If not

Animal health

Minimum points 90, maximum points 187

Although certain pathogens infections have little effect on the host, the welfare of most diseased animals is poor and disease reduction is the most important part of welfare improvement. For this reason 200 points are assigned to animal health out of a total of 500.

Hair

Animals that are acutely ill are usually depressed, lethargic and have no appetite. Body care may be neglected and that is why the animal's coat may become rough and dirty.

- 5 points Smooth, shiny and compact hair
- 0 points If not

Hemorrhages and lesions

- 2 points No hemorrhages and lesions
- 3 points Small lesions or hemorrhages
- 10 points Big wounds

Lameness and locomotion

Lameness in dairy cattle can be caused by trauma, infection, nutritional deficiency or metabolic disturbances. There are several factors affecting the incidence of lameness: the type and maintenance of the farm track, the patience of the stock person in handling the cows and the herd size. Lameness can be considered as a welfare problem because of problems such as pain, reduced food intake and loss of body condition. A cow should walk with firm steps and put the same amount of weight on each leg also while standing. Its back should be straight. Lamé animals often adopt characteristic postures depending on the locations of the lesion or inflammation.

In case that the farmer or veterinarian holds records, both scores (locomotion score and % lameness/year) are combined. In case the farmer and veterinarian both do not hold records, only the locomotion score is used.

% lameness / year

Here cow-cases per year are given. Do not count repeated cases twice.

20 points	< 10%
10 points	10 – 15%
0 points	16 – 25%
-10 points	26 – 40%
-15 points	41 – 60%
-20 points	> 60%

Locomotion score

A locomotion scoring system is used for this parameter:

Normal:	Stands and walks normally with a level back. Makes long content strides.
Mildly lame:	Stands with flat back, but arches when walking. Gait is slightly abnormal.
Moderately lame:	Stands and walks with an arched back and short strides with one or more legs. Slight sinking of dew-claws in limb opposite to the affected limb may be evident.
Lame:	Arched back while standing and walking. Favoring one or more limbs but can still bear some weight on each limb. Sinking of the dew-claws is evident in the limb opposite to the affected limb.
Severely lame:	Pronounced arching of the back. Reluctant to move, with almost complete weight transfer off the affected limb.
10 points	Normal
5 points	Mildly lame
0 points	Moderately lame
-2 points	Lame
-5 points.	Severely lame

Thick hocks and thick carpi

A hock can be thickened due to bone formation. In such cases the cow is not harmed clinically at that moment. The thickening is usually caused by repeated trauma and is an indication for reduced lying comfort.

0 points	< 15% per year
-10 points	15 – 25% per year
-20 points	26 – 40% per year
-30 points	41 – 60% per year
- 40 points	61 – 80% per year

-50 points > 80% per year

Claws

The claws have to look good and are judged on form, angle and position.

20 points Good claws

10 points If the claws are not good but also not very bad

0 points Very bad

% mastitis / year

Take the number of cow-cases per year into account. If a cow is considered healthy and it recurs after 14 days as a clinical case, then consider this as a new case.

15 points < 5%

10 points 5 – 10%

5 points 11 – 15%

0 points 15 – 25%

-3 points 26 – 40%

-5 points 41 – 60%

-10 points 61 – 80%

-15 points >80%

Abomasal dislocations

10 points 0% per year

0 points 0-5% per year

-5 points 6-10% per year

-10 points 11-15% per year

-15 points >15% per year

Filling of the rumen

Sample 10 of these cows: 5 that calved less than 3 months ago and 5 more than 3 months ago. The filling of the rumen is good if it measures up to the average rumen score of cows in that particular stage of lactation.

A deep hollow left flank. The skin below the transverse processes sinks in. The skin fold from the hipbone nodule runs vertically down. The rumen quarry behind the rib arch is more than one hand deep. From sideways it looks like a rectangular area. The cow has eaten little or nothing due to acute illness, poor food availability or lack of tasty food.

The skin below the transverse processes sinks in. The skin fold from the hipbone nodule slants forward to the rib arch. The rumen quarry behind the rib arch is one hand deep. From sideways it looks triangular. This score is often seen in cows during the first week after calving. Later in lactation, it is a sign of inadequate intake or excessive transit time.

The skin on top of the transverse processes runs one hand vertically down and after that bows to the side. The skin fold from the hipbone nodule is not visible. The rumen quarry behind the rib arch is visible. This is the desired score for lactating cows with adequate food intake and where the food can remain inside the rumen for a sufficient time.

The skin on top of the transverse processes bows to the side at once. Behind the rib there is no rumen quarry visible. This is the desirable score for cows at the end of lactation and for dry cows.

The transverse processes are not visible because the rumen is filled. The skin of the abdomen is round like a barrel and very tense. There is no transition to the ribs visible. This is the desirable score for dry cows.

5 points Good

0 points Sufficient

-10 points Bad

% milk fever / year

Noticed from the questionnaire

5 points	0%
0 points	< 5%
-2 points	5-10%
-5 points	10-15%
-10 points	> 15%

Acetonaemia

Noticed from the questionnaire

5 points	0%
0 points	< 5%
-2 points	5-10%
-5 points	10-15%
-10 points	> 15%

Body Condition Score

The body condition score of a dairy cow is an assessment of the proportion of body fat and it is recognized by animal scientists and producers as an important factor in dairy cattle management. Body condition scores provide an indication of the energy status of dairy cattle. Thin cows in a negative energy balance are unable to perform at maximum capacity in the herd. Cows that are too fat are more prone to metabolic problems, produce less milk and go off feed more easily. The BCS will show whether the cows are fed well or not.

Very bad condition (emaciated):	Spinal crest looks like the teeth of a saw, transverse processes are very prominent > ½ length visible, ischial bones very prominent with a deep V-shaped cavity below the tail.
Skeleton clearly visible:	Spinal crest vertebra's individually recognizable, transverse processes are ½ – 1/3 visible, ischial bones prominent, U-shaped cavity below the tail.
Skeleton and covering well balanced:	Spinal crest forms a sharp edge, transverse processes ¼ visible, ischial bones softly curved, shallow cavity below tail
Almost everything covered:	Vertebra's of spinal crest are flat and cannot be individually defined, transverse processes are softly curved, ischial bones are surrounded by fat, cavity filled with some fat.
Too much fat:	Spinal crest covered with fat, edge of transverse processes barely visible because of fat, ischial bones covered by fat, cavity filled with fat, folds arise.

25 points	When the BCS is determined and the average is equal to the desired score of the lactation stadium
5 points reduction	In case of 0.5 points difference with the desired score
0 points	If the difference is more than one point give 0 points.
The desired score may vary per country and breed.	

Sunburn

Sunburn is painful (Mayer 1992, Rowe 1989), and therefore it impaired the welfare of the cows. It is relevant to include the percentage of animals with sunburn in the scoring system. Sunburn develops when the animals are in the bright sun. Sunburn belongs to the category 'Animal health'.

10 points	0%
-2 points	0-5%

-5 points	6-10%
-10 points	10-15%
-15 points	> 15%

% rumen acidosis / year

Noticed from the questionnaire

15 points	< 5%
10 points	5 -10%
5 points	10-15%
0 points	> 15%

Fertility

Fertility rates can be judged based on the calving interval, the way of fertilization (insemination and/or use of a bull) and the times needed for the fertilization.

25 points	If the fertility rates are good
10 points	If the fertility rates are sufficient
0 points	In case of moderate fertility rates
-10 points	If the fertility rates are bad give

% of cases that needed assistance of the veterinarian

Noticed from the questionnaire

15 points	< 5%
10 points	5 -10%
5 points	10-15%
0 points	> 15%

Cow mortality

% of cases in which the cow dies with or without any explanation. Mortality rates in South-America tend to be much higher than in Europe.

Subtract 5 points per % of mortality.

Youngstock

Minimum points 20, maximum points 40

Colostrum

Colostrum is very important because newborn calves haven't antibodies in their blood. They have to get immediately after birth colostrum of their mother with antibodies. So there will be a serum immunoglobulin concentration. Calves with low serum immunoglobulin concentration have an increased risk for disease and dead. Several factors of colostrum management are of influence on the serum immunoglobulin concentration. Therefore an adequate supply of colostrum is important for good passive immunity (Logue and Mayne, 2014).

Direct after birth minimum 2 litres	10 points
> 2 litres before 6 hours after birth	5 points
Lower amounts of colostrum	0 points
None	-10 points

Water and feed

Until weaning

Good: Colostrum, milk replacer, water, concentrate and hay.

Bad: Separated milk, high cell count milk and after weaning only hay and no concentrates

Good	10 points
Bad	0 points

After weaning

Good: Sufficient good quality roughage (grass sufficient to grazing), no mould or heating and fresh drinking water in sufficient quantity

Bad: Rest feed or lower quality silage, mould or dirty feed and dirty or too little water.

Good 10 points

Bad 0 points

Lodging

Group with shade 10 points

Group without shade 0 points

Single with shade 0 points

Single in sun -10 points

**Group means that the calves can play with each other, not when they are together hold on a cord with a pin in the ground.

Diseases

Diarrhea

Percentage of diarrhea over the last year

0% 0 points

0-5 % - 5 points

6-10% -10 points

>10 -15 points

Pneumonia

Percentage of pneumonia over the last year

0% 0 points

0-5 % - 5 points

6-10% -10 points

>10 -15 points

Calf mortality

... % subtracts 5 per % of mortality.

Appendix 2 – Questionnaire

General information / Información general	
Date of visit: <i>Fecha visita:</i>	
Number farm: <i>Matrícula:</i>	
Number of dairy cows: <i>Número de vacas lecheras:</i>	
Number of cows in lactation: <i>Número de vacas en lactancia</i>	
Race: <i>Raza:</i>	
Average age dairy cows: <i>Edad promedia de las vacas lecheras:</i>	
How many employees are there? <i>¿Cuántos empleados hay?</i>	

Are you educated? <i>¿Está educado?</i>	
Are the employees educated? <i>¿Se educa a los empleados?</i>	
Is there any further training and retraining? <i>¿Hay más Top formación y el reciclaje?</i>	
Size area (ha): <i>Tamaño en hectárea:</i>	
Size area (ha) for the cows: <i>Tamaño en hectárea de las vacas:</i>	
(Animal)health / Sanidad	
How many cows are crippled at the moment? <i>Cuántas vacas rengas hay hoy?</i>	
What is the percentage cows that were suffering from lameness this year? (Don't count repeated cases twice) <i>¿Qué porcentaje de las vacas estuvieron rengas durante el año pasado? (no contar vacas repetidoras)</i>	
How many cows are you treating today for mastitis? <i>¿Cuántas vacas reciben tratamiento por mastitis clínica hoy?</i>	
How many cases (%) of mastitis did you have this year? (in case of 14 days healthy and then again mastitis counts as a new case) <i>¿Cuántos casos de mastitis clínica hubo durante el año pasado? (la definición de un caso nuevo es: luego de 14 días sin problemas)</i>	
What is the percentage of cows with abomasal dislocations per year? <i>¿Cuál es el porcentaje de vacas con dislocaciones abomasales por año?</i>	
What is the percentage of cows with milk fever per year? <i>¿Anualmente, cuál es el porcentaje de hipocalcemia?</i>	
What is the percentage of cows with acetonaemia per year? <i>¿Cuál es el porcentaje de vacas con acetonemia por año?</i>	
What is the percentage of cows with rumen acidosis at the moment? <i>¿Qué porcentaje de las vacas ha sufrido acidosis en este momento?</i>	
What is the percentage of cows that is directly pregnant after the first insemination? <i>¿Cuál es el porcentaje de preñez a la primera inseminación?</i>	
What is the average time between calving? <i>¿Cuál es el intervalo entre partos?</i>	
What is the percentage of cows that get pregnant after insemination? <i>Cuál es el porcentaje de preñez final?</i>	
How many cases (%) needed assistance at calving?	

¿Cuántas vacas necesitaron asistencia durante el parto durante el año pasado?	
How many cases (%) needed assistance of a veterinarian at calving? ¿Cuántas vacas necesitaron asistencia veterinaria durante el parto durante el año pasado?	
How many cows (%) died in the last year with an explanation? ¿Cuántas vacas (%) fallecieron en el último año con una explicación?	
How many cows (%) died in the last year without an explanation? ¿Cuántas vacas (%) fallecieron en el último año sin una explicación?	
Miscellaneous / Misceláneo	
How many times per day are the cows fed? ¿Con qué frecuencia se suministra el alimento (1 o 2 veces/día)?	
How do you estimate the quality of the nutrition? Cuál es su evaluación de la calidad del alimento? (bien / mal)	
Are there differences in diets between the cows or the cows in different stadia of lactation? ¿Hay diferencias en las dietas entre las vacas o las vacas en diferentes etapas de la lactancia?	
Are the cows resting during the hot hours of the day? ¿Las vacas pueden descansar durante las horas de mayor calor?	
Is there ad libitum water available for the cows? ¿Las vacas tienen acceso a agua fresca y limpia todo el día?	
What are the milking hours? ¿Cuáles son los horarios de ordeño?	
How long are the cows maximal waiting in the waiting area? ¿Cuál es la duración máxima que el lote (la vaca) permanece en el corral de espera?	

Appendix 3 Checklist

This checklist contains all equipment and scoring sheets the investigator needed for a complete welfare check.

- Body condition score sheet
- Glass (clear)
- Hygiene score sheet
- Locomotion score sheet
- Lux meter
- Measuring tape
- Protractor triangle
- Pencil
- Rumen score sheet
- Questionnaire
- Thermometer
- Welfare scorings system

Appendix 4 Number of cows to score

This table contains the numbers of cows that needs to be checked and scored individually at a certain farm size.

Cows at farm	Number of cows to score
30	15
40	15
50	17
60	19
70	21
80	22
90	24
100	25
110	26
120	27
130	28
140	29
150	30
160	30
170	31
180	32
190	32
200	33
210	33
220	34
230	34
240	35
250	35
260	35
270	36
280	36
290	36
300	37

Cow compass, 2012

Appendix 5 Method table

This table includes the measurements the investigator needs for some chapters. The parameters for which several cows need to be scored are also displayed in the method table. The chapters which need a score sheets are also displayed in the method table.

		Measure- ment	Score sheet	Questio- naire	Number of cows
General					
	Fear behaviour		x		x
	Stretching when raising from the pasture				x
	Tails are hanging straight and relaxed				x
	Broken tails				x
	Bellowing				x
	Environmental noise				
	Flies				x
	Tail docking				x
	Cleanliness score		x		x
Milking parlour and waiting area					
	Behaviour				x
	Max. time waiting before entering the milking parlour			x	
Waiting area					
	Shade				
	Presence of a ventilation system				
	Presence of sprinklers				
	Slipperiness floor				
	Cleanliness floor				
	Flatness floor				
Milking parlour					
	Placing of feeding troughs				
	Space	Measuring tape			
	Slipperiness floor				
	Cleanliness floor				
	Flatness floor				
	Stairs and slopes				
	Walking related to the placement of the shafts				
	Light	Lux meter			
	It smells nice				
	% kicking cows				x
Exit milking parlour					
	Floor				
	Mud				
	Surface				
	Rubbish and obstacles				
	Slopes				
Water					
	Ad libitum water available				
	Type of place to drink				
	Cleanliness	Glass			
	Temperature	Thermometer			
	Distance from the pasture with cows to the place to drink				
	Sufficient amount and size of drinking troughs	Measuring tape			
	Safety of the drinking trough				
Feeding sites					
	Additional feeding sites in the pasture				
	Surface				
	Cleanliness of the surface				
	Feeding place per cow				
	Contamination of the feeding site				
	Distance from the pasture to the feeding site				
	Quality			x	

Walkways				
	Floor			
	Mud			
	Surface			
	Rubbish and obstacles			
	Walking distance			
	Slopes			
	Speed of cows walking	Pedometer		
Loading site				
	Steepness	Protractor		
	Safety			
	Flatness floor			
	Straight end			
Pastures				
	Shade during hot hours of the day			
	Food availability			
	Mud			
	Rubbish and obstacles			
	Presence extra pasture			
	Mud extra pasture			
Farmer and staff				
	Relevant education farmer		x	
	Relevant education staff		x	
	Way of herding			
	Way of treating the cows during herding			
	Way of treating the cows around the milking parlour			
	Use of automatic driving aids			
Environmental management				
	Rest during hot hours of the day		x	
	Milking hours aligned to the climate			
Animal health				
	Hair			x
	% lameness / year and locomotion	x	x	x
	Hocks			x
	Carpus			x
	Claws			x
	% mastitis /year		x	
	Abomasal dislocation		x	
	Filling of the rumen	x		x
	% milk fever /year		x	
	Acetonaemia		x	
	Body condition score	x		x
	% Rumen acidosis / year		x	
	Fertility		x	
	Calving		x	
	Cow mortality		x	

Measurement; What is needed to check a point.

Score sheet; Is there a score sheet available?

Questionnaire; The point is highlighted from the questionnaire.

Number of cows; If the point is scored by checking several cows, it takes more time.

Appendix 6 Body condition score sheet

This sheet shows the way to score the body condition of the cows. The number of cows that needs to be scored individually is indicated in appendix 4...

No Matter How You Look At It...

Body Condition Scoring

Is An Important Part of Modern Dairy Management.

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In the dairy cow, body condition is an indicator of the amount of stored energy reserves and changes with different stages of lactation. Fresh cows in peak lactation tend to be in a negative energy balance and therefore lose body condition. Late lactation cows, dry cows and low producers are in a positive energy balance and gain condition. There is no one ideal body condition score. There is a range of desirable scores which change for individual cows over the different stages of each lactation.

Dairy farmers should regularly evaluate the body condition of their cows and heifers so they can fine-tune feeding and management practices. Adequate body reserves are necessary to maintain health, production and reproductive efficiency. Underconditioned cows are prone to reduced milk production and poor persistency of lactation. Overly conditioned cows are predisposed to calving difficulties, fatty liver syndrome, impaired reproduction and metabolic disorders.

Body condition scoring of cattle is an essential management tool for the progressive dairy farmer. It can be mastered with a little training and good observation skills, using both sight and touch to evaluate each cow.



BCS = 3



BCS = 1



BCS = 4



BCS = 2



BCS = 5

Photos by Craig Johnson

No Matter How You Look At It...

Body Condition Scoring

...Is An Important Part of Modern Dairy Management.



BCS = 1

Deep cavity around tailhead. Bones of pelvis and short ribs sharp and easily felt. No fatty tissue in pelvic or loin area. Deep depression in loin.



BCS = 2

Shallow cavity around tailhead with some fatty tissue lining it and covering pin bones. Pelvis easily felt. Ends of short ribs feel rounded and upper surfaces can be felt with slight pressure. Depression visible in loin area.



BCS = 3

No cavity around tailhead and fatty tissue easily felt over whole area. Pelvis can be felt with slight pressure. Thick layer of tissue covering top of short ribs which can still be felt with pressure. Slight depression in loin area.



BCS = 4

Folds of fatty tissue are seen around tailhead with patches of fat covering pin bones. Pelvis can be felt with firm pressure. Short ribs can no longer be felt. No depression in loin area.



BCS = 5

Tailhead is buried in thick layer of fatty tissue. Pelvic bones cannot be felt even with firm pressure. Short ribs covered with thick layer of fatty tissue.

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Lilly Corporate Center
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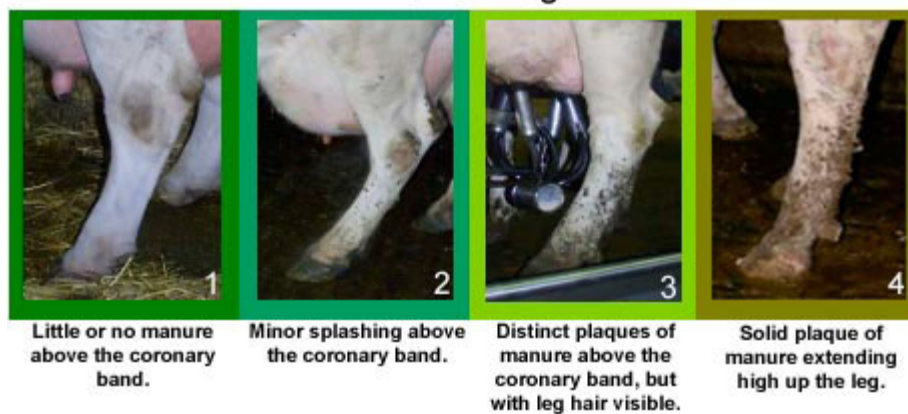
Appendix 7 Hygiene score sheet

This sheet shows photographs for comparison reasons to score the hygiene state of cows. The number of cows that needs to be scored individually is indicated in appendix 4.

Upper Leg & Flank



Lower Leg




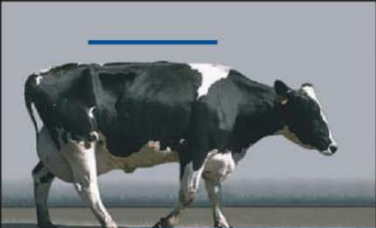


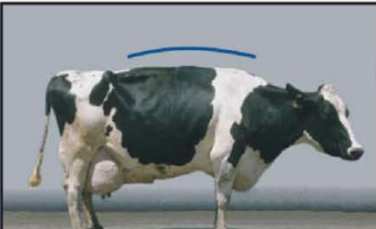
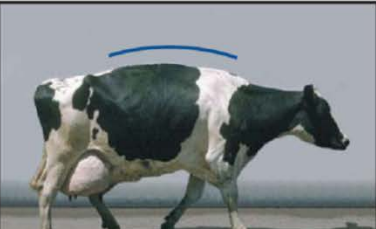

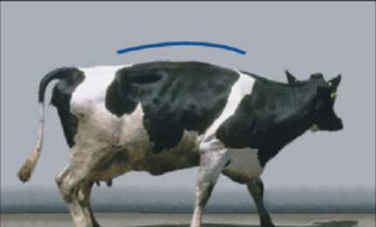


Udder



Getting the score on cow hygiene November 2011 [<http://patzcorp.com/getting-the-score-on-cow-hygiene>]

Appendix 8 Locomotion score sheet

This sheet shows photographs for comparison reasons to score the locomotion of cows. The number of cows that needs to be scored individually is indicated in appendix 4.

<p>LOCOMOTION SCORE 1</p> <p>Clinical Description:</p> <p>NORMAL</p> <p>Description: Stands and walks normally with a level back. Makes long confident strides.</p>	 <p>Back Posture Standing: Flat</p>	 <p>Back Posture Walking: Flat</p>
<p>LOCOMOTION SCORE 2</p> <p>Clinical Description:</p> <p>MILDLY LAME</p> <p>Description: Stands with flat back, but arches when walks. Gait is slightly abnormal.</p>	 <p>Back Posture Standing: Flat</p>	 <p>Back Posture Walking: Arched</p>
<p>LOCOMOTION SCORE 3</p> <p>Clinical Description:</p> <p>MODERATELY LAME</p> <p>Description: Stands and walks with an arched back and short strides with one or more legs. Slight sinking of dew-claws in limb opposite to the affected limb may be evident.</p>	 <p>Back Posture Standing: Arched</p>	 <p>Back Posture Walking: Arched</p>
<p>LOCOMOTION SCORE 4</p> <p>Clinical Description:</p> <p>LAME</p> <p>Description: Arched back standing and walking. Favouring one or more limbs but can still bear some weight on them. Sinking of the dew-claws is evident in the limb opposite to the affected limb.</p>	 <p>Back Posture Standing: Arched</p>	 <p>Back Posture Walking: Arched</p>
<p>LOCOMOTION SCORE 5</p> <p>Clinical Description:</p> <p>SEVERELY LAME</p> <p>Description: Pronounced arching of back. Reluctant to move, with almost complete weight transfer off the affected limb.</p>	 <p>Back Posture Standing: Arched</p>	 <p>Back Posture Walking: Arched</p>

* Adapted from Sprecher, D.J.; Hostetler, D.E.; Kaneene, J.B. 1997. Theriogenology 47:1178-1187 and contribution from Cook, N.B, University of Wisconsin.

Appendix 9 Rumen score sheet

This sheet shows photographs for comparison reasons to score the content of the rumen. The number of cows that needs to be scored individually is indicated in appendix 4.

Rumen score:



Score 1

A deep dip in the left flank. The skin under the lumbar vertebrae curves inwards. The skin fold from the hook bone goes vertically downwards. The paralumbar fossa behind the last rib is more than one hand-width deep. Viewed from the side, this part of the flank has a rectangular appearance. The cow has eaten little or nothing, which could be due to sudden illness, insufficient or unpalatable food.



Score 2

The skin under the lumbar vertebrae curves inwards. The skin fold from the hook bone runs diagonally forward towards the last rib. The paralumbar fossa behind the last rib is one hand-width deep. Viewed from the side, this part of the flank has a triangular appearance. This score is often seen in cows in the first week after calving. Later in lactation, this is a sign of insufficient food intake, or a rate of passage that is too high.



Score 3

The skin under the lumbar vertebrae goes vertically down for one hand-width and then curves outward. The skin fold from the hook bone is not visible. The paralumbar fossa behind the last rib is still just visible. This is the right score for milking cows who have a good food intake and when the food is in the rumen for the correct amount of time.



Score 4

The skin under the lumbar vertebrae curves outwards. No paralumbar fossa is visible behind the last rib. This is the correct score for cows nearing the end of lactation, and for dry cows.



Score 5

The lumbar vertebrae are not visible as the rumen is very well filled. The skin over the whole belly is quite tight. There is no visible transition between the flank and ribs. This is the correct score for dry cows.

D. Zaaijer, W.D.J.Kremer, J.P.T.M. Noordhuizen (2001), in J. Hulsen, Cow Signals.

Appendix 10 Water score sheet

This sheet shows a photograph of different cleanliness's of water. With a glass, it is possible to score the water quality.



Bron: Folder "Schoon oppervlaktewater: van wezenlijk belang"