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IN LIVESTOCK PRODUCTION

PROCEEDINGS



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INSTITUTE FOR ANIMAL HUSBANDRY
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WELFARE INDICATORS OF DAIRY COWS - SELECTION AND IMPLEMENTATION IN ASSESSMENT

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Invited paper

Abstract: Definition, implementation, analysis of relevance and development of standards of animal welfare on cattle farms have become very important issues in the late 20th and early 21 century. Today, the most widely accepted definition of welfare is that it is the condition of an animal as a response to its attempts to cope with the effects of the environment. Depending on the type, duration and intensity of action of stimuli and the condition of the animal this struggle can be successfully or unsuccessfully completed in which case the animal welfare is endangered. But how do you assess the welfare as satisfactory and when not? In declaration of welfare as a scientific field, the turning point was the observation of its measurable character or the fact that as a result of the reaction to the effects of the stimulus in the organism of the animal changes occur at the physical, physiological, behavioural and emotional level that can be measured. Traits mentioned belong to output or animal-based welfare indicators which have a primary role in the modern methods of assessment. Unlike them, input indicators relate to information resources (resource - based) and applied management (management - based) and are important as additional information in the evaluation. Problems and the importance of selecting indicators in the assessment of the quality of welfare are still present but the practical implementation of a wide variety of assessment methodologies over time should enable better perception, analysis and even synthesis of the most relevant indicators and targets for evaluation of the different methods. This paper presents an overview of the selection, implementation and use of indicators to assess the welfare of dairy cows with a special emphasis on two current methodologies.

Key words: welfare, quality, dairy cows, indicators, assessment, methods

Introduction

Today, taking into consideration the gravity and exposure to influences that threaten the welfare and the number of farmed animals, problem of welfare of dairy cows is one of the most pronounced in Europe (*Hristov et al., 2011a; Ostojić - Andrić et al., 2012; Nakov et al., 2012*). Protecting the welfare of dairy cows is an extremely complex issue that involves different aspects and requires fundamental changes in the breeding programs and management systems (*Hristov et al., 2011b; Ostojić - Andrić et al., 2011, Karasek et al., 2012*) The issue of animal welfare mainly occupies those who are directly or indirectly involved in the production of food - consumers and producers of animal products. In addition, the protection of the welfare of dairy cows is associated with environmental issues, sustainable development, and a range of medical, hygienic, economic and social problems of the society.

The definition and the concept of welfare

The concept of animal welfare involves both ethical and scientific dimension and therefore requires an unambiguous definition (*Duncan, 2003*). Today, the most widely accepted definition of welfare is that it is a condition of an animal as a response to its attempts to cope with the effects of the environment (*Broom, 1986*). In addition, to cope means to fight to gain control of mental and physical stability. There are different coping strategies from behavioural, physiological, immunological and other that are managed by the brain. Feelings, such as pain, fear, and various forms of pleasure, also can be a part of coping strategy. In modern conditions of production, the animals are under the influence of a lot of stimuli to which they have to adjust in order to maintain their physical, physiological and emotional integrity. Therefore, for the maintenance of animal welfare key issue is how to fulfil their needs, i.e. freedoms: (1) Freedom from hunger, thirst and malnutrition; (2) Freedom from thermal and physical distress; (3) Freedom from pain, injury and diseases; (4) Freedom to express natural behaviours; and (4) Freedom from unpleasant emotional experiences (*FAWC, 1979*). Figure 1 shows the general concept of animal welfare, which includes adaptation of physiology and behaviour in order to maintain proper health condition which, as the final result, has increased productivity (*Sejian et al., 2011*). *Sejian et al. (2011) Blokhuis et al. (2003)*

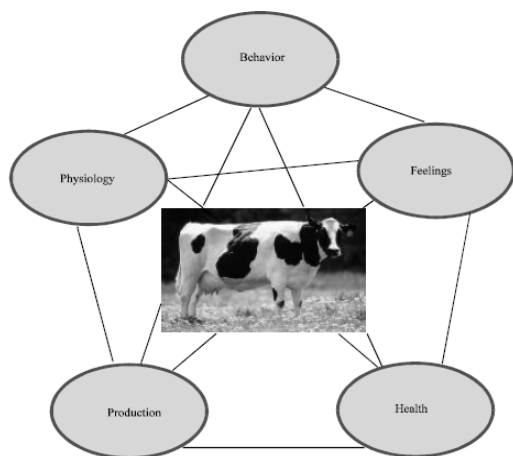


Figure 1. General concept of animal welfare

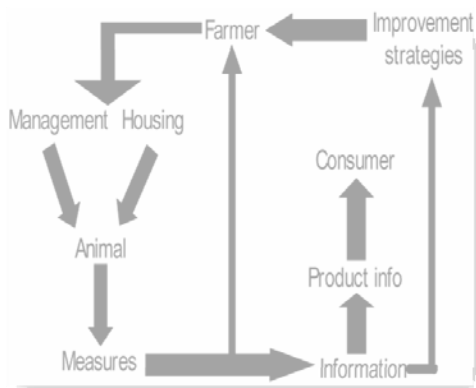


Figure 2. Strategy of improvement of animal welfare on farms

Goals of the animal welfare quality assessment

According to Vučinić (2006) goals for evaluation of the welfare of domestic animals are following: a) to advise owners and breeders to improve animal welfare, b) to compare the conditions of farming and exploitation of animals to the conditions stipulated in the legislation, c) based on the assessment of animal welfare to apply appropriate certification scheme in the production of food of animal origin (for example, "organic food", "dairy products from pasture/grazing farming system of dairy cows", etc..) and d) based on the evaluation welfare to adapt and improve legislation governing animal welfare.

Methods of animal welfare assessment

The overall assessment of animal welfare according to Botreau *et al.* (2007a, 2007b) is a complex problem that requires evaluation of a constructive strategy for the integration of information obtained by various measurements of animal properties and environmental parameters. The method of animal welfare assessment at the same time depends on the concept of welfare, applied indicators and the way to identify and analyze the data. For the definition and use of indicators in practical terms are especially important works of Bartussek (2000), Bracke *et al.* (2001), Bracke and Hopster (2006) and Meagher (2009). Today there is a great knowledge of the indicators of welfare, but to define the methods for evaluation of welfare, the key issue is to reduce their number and include only the most important and reliable indicators. The method of welfare assessment should provide ease and convenience of reference (not expensive, does not take long, does

not disturb the normal process of technology on the farm), while allowing an objective, valid and repeatable results (Hörning, 2001; Spoolder et al., 2003).

Methods for evaluating of animal welfare can be roughly divided into so-called input methods based on information about environmental conditions and resource-output methods that use information about the animals themselves (Main et al., 2003). Welfare assessment, which relies on the assessment of resources such as the type of bedding, food, hygiene and so on, is often simple and fast but it represents only the prerequisite of welfare and not the absolute guarantee. That is why today more importance is given to the methods based on information about animals that include determining of the physical condition of animals (lameness, injuries to the skin), observation of behaviour (fear, liveliness, aggression) and data collection (e.g. on morbidity, mortality, productivity). Output methods are more demanding in terms of data collection and processing as well as the time required but their application still provides reliable results on the quality of welfare (Johnsen et al., 2001). These authors concluded that the best method for welfare evaluation should incorporate both of these types of indicators (input and output).

To date, numerous methods have been developed to assess the welfare of farm animals some of which are included in the legislation of a country or region, and actively implemented, supplemented and questioned. Such is the case with following methods: Animal Needs Index – ANI, EFSA method of risk assessment for animal welfare, Protocol for assessing the quality of welfare (*Welfare Quality Assessment Protocol for Cattle, 2009*). In our country, a method has been developed for assessing of the welfare of dairy cows in the project TR 20110.

EFSA method of risk assessment to dairy cows' welfare

This method allows the assessment of risks to animal welfare, taking into account the different systems of breeding, management, species and categories of animals as well as various aspects of welfare in the specific scenario of exposure to a factor. At the beginning, the keyword in the methodology - hazard, indicated each adverse effect, which increased the risk to welfare, was replaced by a new term - a factor that is related to any aspect of the environment and the changes that can have a positive or negative impact on the welfare state. Factors that influence the state of welfare include sources in the environment available to animals (space, equipment, places where they can lie down) as well as farm management and can be determined by the assessment of appropriate inputs (*resource - based and management - based*) indicators. Animals, depending on their characteristics (breed, gender, age), provide an answer on the effects of these inputs that can be determined through the output (animal - based) indicators. As previously stated, purpose of the assessment of indicators is reflected among other things in defining recommendations for the improvement of welfare. The specificity of this method

lies in the fact that based on the estimated risks specific recommendations for the improvement of welfare are given. The *EFSA report (2012)* stated the 105 recommendations relating to various segments of securing the welfare of dairy cows based on an estimate of the risk of the most common hazards to the welfare of caused by the way of breeding, feeding, management and genetic selection effects on incidence of mastitis, metabolic, reproductive, locomotion , behavioural and emotional disorders.

The Welfare Quality® Assessment Protocol for Cattle (dairy cows)

The *Welfare Quality® Assessment Protocol for Cattle (2009)* is a scientific method for assessing the welfare of farm animals that was obtained from the sixth framework program of the European Union (Sixth Framework Programme - FP6) entitled The Welfare Quality® Project. The main objective of the project was to develop a standardized methodology for assessing the welfare, practical strategies and measures for its improvement, and standardized methodology that would enable for assessed welfare to simply be translated into easily understandable information about the product (Figure 2). The protocol for assessing the quality of welfare initially was based on the definition of welfare by *Duncan and Petherick (1991)* according to which emotions and subjective feelings of animals are of primary importance, and alternative concepts such as natural behaviour and/or environment of less importance. Therefore, the protocol for the assessment of the quality of welfare includes a number of indicators of welfare, which are primarily based on information about the animals and to a lesser extent on the resources or farm management.

Choice of indicators, their relevance, feasibility and reproducibility were considered as the highest priority (*Veissiere et al., 2007*). Eventually, this method is defined by the assessment of 4 basic principles, 12 key criteria and over 30 indicators of welfare and has been developed for cattle (dairy cows, beef cattle and calves), pigs (sows and fatteners) and poultry (laying hens and broilers). Principles and assessment criteria are the same for all types of farm animals, while the indicators of welfare are species specific. The final assessment of the welfare state on the farm is obtained by scoring (giving points) of indicators whose sum specifies one of four qualitative categories of welfare under the respective criteria and principles. The total score classifies the welfare into following categories: unsatisfactory, acceptable, appropriate/adequate and excellent. Starting from a multidimensional concept of welfare, the project highlights the importance of the criteria, i.e. dimensions of welfare in which the application of specific mathematical operations (*Choquet integral*) provides that certain criteria are given more importance relative to the other, while at the same time the possibility of compensation between them is minimized.

Indicators of welfare quality

Depending on the intensity and duration of the stressors and the ability of animals to respond appropriately to environmental impacts, coping mechanisms may operate successfully when the fight is completed or unsuccessfully - when the animal is threatened. However, how to determine whether the welfare of an animal is satisfactory or endangered? For scientists in the field of welfare it is extremely important that the quality of welfare can be measured. Measurability of the quality of welfare stems from the fact that as a result of reactions to the various challenges of the environment, animals exhibit the above-mentioned coping strategies that can be used as indicators of their welfare. Today a wide range of indicators used to assess the quality of the welfare of dairy cows are known, which can be generally classified into two major groups - input and output indicators. Input indicators include all indicators indicating to housing and management conditions, and include resource - based and management - based indicators that are relatively easy to measure. On the other hand, output or animal - based indicators are the result of attempts of animals to cope with their environment and result in certain physical, physiological and mental changes that are also measurable. Table 1 provides an overview of these groups of indicators by *Welfare Quality Assessment Protocol for Cattle (2009)*.

Table 1. Types of indicators used for assessment of welfare of dairy cows

<i>Animal - based</i>	body condition, time needed to lie down, collision with housing equipment, lying partly or completely outside the lying area, cleanliness of udders, flank, upper and lower legs, lameness, integument alterations, coughing, nasal discharge, ocular discharge, hampered respiration, diarrhea, vulvar discharge, milk somatic cell count, dystocia, downer cows, mortality, agonistic behaviour, avoidance distance, emotional state
<i>Resource - based</i>	water provision, cleanliness of water points, water flow, functioning of water points, thermal comfort, presence of tethering, access to outdoor loafing area or pasture
<i>Management - based</i>	disbudding /dehorning, tail docking

Welfare Quality® Assessment Protocol for Cattle (2009)

Animal - based indicators

Animal - based indicators are response of animal to farming conditions. Therefore, their evaluation can determine the current state of animal welfare, including the impact of management and environment. These indicators can be

determined directly or indirectly from animals and based on data available on the farm. Animal - based indicators are intended for:

- assessing the level of disruption caused by injury, disease and malnutrition.
- providing information about the needs of animals and affective states such as hunger, pain and fear often measured by the strength of motivation and aversion in animals
- assessment of the degree of physiological, behavioural, immunological and other changes that animals exhibit in response to a variety of challenges from the environment.

Assessment of the animal - based indicators presented in Table 1 provides information on health and nutrition, hygiene, comfort, health and mortality, as well as the emotional state and the presence of behaviour (*Welfare Quality[®] Assessment Protocol for Cattle, 2009*).

Resource - based indicators

Resource - based indicators include all those indicators relative to the conditions of the farm in terms of farming space (structure, size, floors, bedding, equipment, hygiene), access to outlets or pasture, water supply, ventilation, thermal regime and so on. The importance of this group of indicators is reflected in the following:

- better understanding of the importance of animal - based indicators to assess the welfare;
- as a replacement for one animal - based indicators that are not reliable or suitable for the assessment on the farms;
- as risk factors to animal welfare.

In a study by *Algers et al. (2009)* initially over 90 potential resource - based indicators have been tested, and ranked according to their importance for the welfare and convenience of application in monitoring the welfare on farms. The authors state the most important indicators in terms of dairy cows welfare:

1. Indicators of satisfactory water supply of cows (water supply, water flow, purity and safety of drinkers)
2. Thermal comfort of cows
3. Freedom to move (the presence of tie system and the possibility for use of free range or pasture and demonstrating other forms of behaviour in cows in the pasture).

The size or capacity of the farm according to some authors (*Rauw et al., 1998, Royal et al., 2000*) is also an important factor to be taken into consideration when assessing the resource - based quality indicators for welfare on dairy farms.

Management - based welfare indicators

These indicators relate to the actions and measures that are implemented in the management of the farm. Their biggest importance in the assessment of welfare on farms is reflected in the supplementation of data provided by the animal - based indicators. In addition, they allow the breeders or farm managers to be provided feedback on risk of applied management to the welfare of cows with the ability to apply appropriate corrections (*Waiblinger et al., 2009*). As potential management - based indicators numerous indicators can be stated such as the characteristics of the applied systems of housing, hoof treatment procedure, the presence of equipment-brushes for hygiene, mastitis control, the method of recording data on farm, shortening of the tail, dehorning and the use of anaesthesia and analgesia. *Waiblinger et al. (2009)* reported a list of 53 potential indicators whose assessment may be based on three methods: interview of managers or breeders, direct observation of animals and management systems, inspection of records containing information on the farm or a combination of these methods. After the study of the significance and reliability of the indicators and the evaluation of simplicity of their performance on a farm, finally only two were included in the *Welfare Quality® Assessment Protocol for Cattle (2009)*: dehorning and shortening the tail.

Selection of indicators in welfare assessment

When defining a methodology for the assessment of welfare, we encounter a wide range of indicators that could be used. *The EFSA report (2012)* disclosed over 70 animal - based indicators, stating that it would be highly unrealistic and unnecessary to use all the indicators at each assessment. It is recommended that in such a set of indicators only those necessary to evaluate specific segments of the welfare are selected, e.g. health condition and nutrition, depending on the purpose of assessment (compliance with legal regulations, improvement strategies, etc.). On the other hand, in establishing the *Welfare Quality® Assessment Protocol for Cattle (2009)*, after a thorough examination and assessment of validity, reliability, feasibility and ease of assessment of indicators in farm conditions, only 31 indicators of relevant importance for the assessment of the quality of welfare were selected. The results of these researches are presented within the *Welfare Quality Reports No.11. (2009)*. The exception is the criterion - the thermal comfort of cows, which is a measure of the principles of good posture assessment, it is still considered and reviewed.

Significance and related indicators in the assessment of welfare

In addition to the selection of indicators that will in the best way describe the state of the welfare of dairy cows, it is a question of their individual importance or weight that each has for the overall welfare assessment. *Webster (2005)* states 'ranking' of top 10 indicators of welfare while in *the EFSA report (2012)* the five

most important indicators are stated (Table 2). In the *Welfare Quality® Assessment Protocol for Cattle (2009)*, this problem was solved by applying the so-called weight coefficients (WC) associated with the indicators of welfare (Table 3). Thus, for example, in assessing the proper nutrition as one of the principles of welfare, absence of long-term thirst is allocated greater importance in relation to the absence of hunger. It is important to point out that the importance of indicators is defined on the basis of their impact on the emergence of various welfare problem.

Table 2. Comparative rank list of indicators according to different source

Rank	I n d i c a t o r s	
Source	Webster(2005)	EFSA(2012)
1	Observing lameness	Observing lameness
2	Examining health records	Observing hock, knee skin lesions and swelling
3	Observing disease	Colliding with equipment
4	Observing mastitis	Teat injuries
5	Observing general demeanour	Observing mastitis
6	Scoring body condition	
7	Observing stockmanship	
8	Observing lying behaviour	
9	Examining production records	
10	Observing skin lesions	

Table 3. Relationships in regard to the significance of indicators within the various segments of welfare

		P r o v i s i o n o f																			
		Good feeding			Good housing			Good health						Appropriate behaviour							
		Absence of thirst	>	Absence of hunger	Ease of movement	>	Comfort around resting	>	Thermal comfort	Absence of disease	>	Absence of pain induced by management procedures	>	Absence of injuries	Positive emotional state	>	Good human - animal relationship	>	Expression of social behaviours	>	Expression of other behaviours
wc		0.26		0.09	0.23		0.20		0.18 0.19		0.10		0.06	0.16		0.11		0.10		0.09	

Welfare Quality® Assessment Protocol for Cattle (2009)

Conclusion

Assessment of welfare quality of dairy cows should allow precise identification of risk factors for welfare that lead to undesirable values of welfare indicators, in order to define recommendations for their elimination or at least reduction. To date, however, ideal methodology for evaluation of welfare of dairy cows has not been defined, although in the method of Welfare Quality Protocol and EFFS Risk Assessment great efforts were achieved. Within these methods, of numerous welfare indicators, the most important ones were identified in respect to the assessment of individual segments or providing overall welfare assessment. Also, the score by Welfare Quality protocol takes into account the growing importance of certain indicators in relation to others and minimizes the compensation between them. The ease of this method of assessment is certainly of great practical importance, as well as the specific results of the evaluation in the form of categorization of rated farms. The advantage of a method that is based on the assessment of risk to welfare is reflected in the fact that indicators viewed in the assessment are directly associated with appropriate recommendations, which enables faster action. It can be concluded that the formulation of modern, science-based, method of evaluation of the quality of welfare emphasis is placed on the animal - based indicators, assessing their relevance and ease of use in the assessment. Given the complexity and duration of the overall welfare assessment on farms, the idea of partial welfare assessment based on the purpose of assessment is more often mentioned, as well as the ability, based on the evaluation of provision of certain welfare segments, its overall value is assessed. In spite of the fact that the problems and the importance of selecting indicators in the assessment are still present, broad practical implementation of these assessment methodologies over time should enable better perception, analysis and even the synthesis of the most relevant indicators and assessment targets from different methods.

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Indikatori dobrobiti mlečnih krava - odabir i primena u oceni

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Rezime

Definisanje, uvođenje, analiza relevantnosti i razvoj standarda zaštite dobrobiti životinja na farmama goveda postale su veoma značajne teme krajem 20. i početkom 21. veka. Danas najšire prihvaćena definicija dobrobiti je da ona predstavlja stanje životinje nastalo kao odgovor na njene pokušaje da se izbori sa uticajima iz životne sredine. Zavisno od vrste, trajanja i intenziteta delovanja stimulusa kao i od stanja same životinje ova borba može biti uspešno ili neuspešno okončana u kom slučaju je dobrobit životinje ugrožena. Ali kako proceniti kada je dobrobit zadovoljavajuća a kada ne? Za deklarisanje dobrobiti kao naučne oblasti prelomni trenutak bila je konstatacija njenog merljivog karaktera odnosno činjenica da se kao rezultat reakcije na dejstvo stimulusa u organizmu životinje odigravaju promene na telesnom, fiziološkom, bihevioralnom i emocionalnom nivou koje se mogu izmeriti. Pomenute osobine pripadaju output ili animal-based indikatorima dobrobiti koji u savremenim metodama ocene imaju primarnu ulogu. Za razliku od njih, input indikatori odnose se na informacije o resursima (recourse - based) i primenjenom menadžmentu (management - based) i od značaja su kao dopunska informacija u oceni. Problemi odabira i važnosti indikatora u oceni kvaliteta dobrobiti još uvek su prisutni ali bi široka praktična implementacija različitih metodologija ocene tokom vremena trebala da omogući bolje sagledavanje, analizu pa i sintezu najrelevantnijih indikatora i ciljeva ocene dobrobiti iz različitih metoda. U radu je iznet pregled problematike odabira, primene i korišćenja indikatora u oceni dobrobiti mlečnih krava sa posebnim osvrtom na dve aktuelne metodologije.

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