



ISSN: 2456-2912

VET 2024; 9(4): 205-208

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www.veterinarypaper.com

Received: 02-04-2024

Accepted: 06-05-2024

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Dairy cattle welfare assessment models for dairy farms: A review

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Abstract

Science is quickly advancing the field of herd welfare assessment. Providing suitable, repeatable, valid, and feasible models for this assessment is a major contribution of the scientific community. Unfortunately, opinions on animal welfare differ, so reaching a consensus on what constitutes animal welfare is essential to its evaluation. Then, as various aims necessitate varying combinations of welfare indicators, it is imperative to examine the objectives of the welfare evaluation models. Welfare assessment models can be broadly classified into categories such as research, legislative requirements, certification systems, and advisory and management tools. These models aim to achieve different objectives: quantifying welfare, ensuring welfare standards, or managing welfare. It is generally agreed that the most effective way to assess welfare involves using multiple measures. Thus, a welfare assessment model for a livestock herd should incorporate two types of measures: descriptions of the housing system and management practices (indirect indicators) and data on the animals' responses to these conditions (direct indicators). A simple and easy-to-use, on-farm dairy cattle welfare assessment protocol suitable for northern Indian conditions has been recently developed, which is based on 20 input- and output-based welfare indicators.

Keywords: Animal welfare, dairy cows, DCWS, welfare assessment, welfare indicators

Introduction

India's national economy is intricately woven with the livestock industry, holding a pivotal role. Among the noteworthy economic endeavors within rural areas is livestock rearing, which supplements the income of numerous families reliant on agriculture (FAO, 2020) ^[12]. This surge of interest in the welfare of dairy cattle mirrors the heightened awareness and concern of individuals in recent years. The term "welfare" encapsulates the state of a human or animal's sound, content, and secure existence (Wehmeier, 2005) ^[29]. At the core of an animal's "needs" lies the essentials for survival, while optimal well-being necessitates supplementary requisites that enhance living conditions and potentially augment productivity (Stull *et al.*, 2005) ^[27]. The success of a dairy farmer in ensuring both quality and quantity of milk hinges upon fulfilling the welfare requirements of dairy animals (Fraser, 2003) ^[13]. The crux of efficient farm animal husbandry rests on furnishing the necessary resources and oversight to ensure the efficient production of sustenance and commodities, while safeguarding the animals' health and welfare (Appleby, 2005) ^[1]. In the contemporary context, dairy welfare is integral to milk quality standards, instilling consumer confidence through assurance that products originate from animals nurtured and raised in accordance with proper farming practices (Hristov *et al.*, 2012) ^[15].

A comprehensive evaluation of animal welfare in the context of dairy cattle has led to the categorization of indicators into two distinct domains: animal-based indicators encompassing mastitis, lameness, and human-animal interactions, and environmental-related indicators that encompass housing and management factors (Phillips, 2002) ^[22]. Historical perspectives on farm animal welfare assessments have largely concentrated on quantifying the resources availed to animals, primarily focusing on housing standards and design. While these resource-based criteria are rapid and dependable as well as offer an indirect measure of animal welfare but they may not always provide a complete picture (Knierim & Winckler, 2009) ^[19]. Intriguingly, the dynamics of management practices and the bond between humans and animals constitute additional facets of husbandry that wield influence over animal welfare.

However, evaluating the impact of these elements can prove to be more intricate (Hemsworth *et al.*, 2015) ^[14]. It's important to remember that although good management and conducive surroundings greatly enhance animal welfare, they do not always ensure that high welfare criteria are met (Sejian *et al.*, 2011) ^[25]. Delving into the realm of dairy cattle criteria unveils a diverse array of categories. These encompass production-related, physiological, pathological, ethological, and integrated dimensions, collectively offering a comprehensive framework to gauge the multifaceted aspects of dairy cattle welfare (Calamari & Bertoni, 2009) ^[6]. The assessment of dairy cattle welfare is a critical aspect of modern livestock farming, ensuring that animals are kept in humane conditions that promote their health and productivity. Various models and methodologies have been developed to assess welfare on dairy farms, incorporating both animal-based and resource-based measures.

Assessment methodology of dairy animal welfare

Systems for assessing animal wellbeing that are used in dairy farms may vary depending on how animal welfare is defined and what the assessment is intended to achieve. As a result, the selection of welfare indicators and assessment techniques reflects the fundamental assumptions behind how animal welfare is interpreted. The welfare of the animals in the herd should be described, and a useful welfare assessment system should enable the farmer to monitor changes over time and take necessary action (Napolitano *et al.*, 2005) ^[21]. However, choosing and creating accurate and practical measurements for on-farm assessment protocols can be difficult. Even though these indirect resource-based welfare assessment criteria are quick, simple, and somewhat reliable, relying solely on their results may not indicate whether the animals' welfare is good or poor (Knierim and Winckler, 2009) ^[19]. A high degree of animal wellbeing is not always achieved, even when good management and environmental resources are provided (Sejian *et al.*, 2011) ^[25]. A parameter or direct indicator that is based on an animal can be used to measure animal welfare. These indicators are more trustworthy because they show how the animal was impacted by variables in its immediate environment or housing system and how it responded to those variables (Carenzi and Verga, 2007) ^[9]. Additionally, the design of a given welfare assessment system depends on whether it is intended to certify or regulate the welfare level on particular farms, assess welfare in various production systems, or act as a tool for advice that enables the farmer to recognise, avoid, or resolve welfare issues on his or her farm (Whaytt *et al.*, 2003) ^[31]. However, due to the multi-disciplinary nature of animal welfare, it is difficult to choose and develop reliable and, at the same time, feasible measurements for on-farm assessment protocols (Baird *et al.*, 2016) ^[2]. To determine risk factors and the actual status of animal welfare on farms, a combination of resource-based and animal-based metrics must be used (Rushen *et al.*, 2008; European Food Safety Authority, 2012) ^[24, 11]. In conclusion, animal-based indicators are likely to draw attention to the most significant and urgent welfare issues, thereby focusing priorities for corrective action. The resource and management-based indicators are more likely to draw attention to the future danger of decreased welfare and aid in determining the causes of current animal welfare issues. As a result, a control or evaluation strategy must include both animal-based and non-animal-based measurements (European Food Safety Authority, 2012) ^[11]. Animal-based metrics are output

measures, whereas non-animal or resource-based measures are input measures.

Model to evaluate welfare at dairy cow farm

The welfare score is an ordinal metric that allows each potential welfare state that an animal could encounter to be given a score, with a greater welfare state receiving a higher score than a lower welfare state. As a result, it ranks animal welfare in cases where relative welfare scores are available (Kehlbacher *et al.*, 2012) ^[18]. The Animal Needs Index (ANI) system, which rates housing arrangements, was created based on four key aspects of animal husbandry (possibility of movement, social contact, flooring quality, interior climate, and stockman's care) (Bartussek, 1999) ^[3].

The Bristol Welfare Assurance Programme (BWAP) is purely an "outcome-based assessment" that looks at the farm's history of sickness and treatment documentation in addition to observations of the physical conditions and animal behaviour. As part of an Ethical Account for Livestock Farming, a prototype of a welfare assessment system useful as a decision support system for the farmer has been created at the Danish Institute of Agricultural Sciences (DIAS). This system mixes animal behaviour and health with system descriptions and management, and it depends on animal welfare by emphasizing both the good and bad experiences that animals have. An Integrated Diagnostic System Welfare (IDSW) was developed on basis of this concept which was briefly described by Calamari *et al.* (2003) ^[7] and partially validated by Calamari *et al.* (2004) ^[8] for assessment of animal welfare at dairy farms. The many models for evaluating welfare, according to Calamari *et al.* (2003) ^[7], can be broadly divided into four categories: research, statutory requirements, certification systems, and advisory/management tools. These models may be used to quantify welfare, guarantee welfare, or manage welfare, among other objectives. However, it is generally agreed that welfare is best assessed using a variety of measures. As a result, a model for assessing the welfare of a livestock herd may include data on both indirect and direct indicators, including a description of the management and housing systems.

Kamboj *et al.* 2022 ^[17] described a Dairy Cattle Welfare Scale (DCWS) that is based on the IDSW (Integrated Diagnostic System Welfare) of Calamari and Bertoni (2009) ^[6] and is modified according to Indian conditions. Twenty wellbeing indicators were selected based on the "Four Principles" to satisfy the "Five Freedoms" of animal care and the methods for measuring them under typical circumstances. Ten indicators in components A and B were based on resources or the environment, whereas ten indications in component C were based on animals. Depending on the scientific advice and the current farm conditions, each of these 20 indicators was characterized by a pattern. Each pattern was given a value according to how many scientists had verified it. Score given to all patterns of an index was pooled into a single score for that index (Table 1.). These animals and environment-based indicators were classified into three components-

Component A: - Animal housing and other facilities (Weightage 30)

Component B: - Feeds and feeding practices (Weightage 30)

Component C: - Animal health, performance and behavior (Weightage 40)

Table 1: Components of Dairy Cattle Welfare Scale (DCWS) (Kamboj *et al.*, 2022) ^[17]

Components	Indicators	Score
Animal housing and other facilities (30)	1. System of housing & availability of floor space	10
	2. Type & height of roof	3
	3. Type of floor	2
	4. Microclimate protection measures	5
	5. Feeding and watering space availability feeding and watering systems with frequency	5
	6. Availability of milking parlour/ separate milking place, water for bathing cows, udder washing, cleaning of milking utensils and availability of lighting	5
Feeds and feeding practices (30)	7. Availability of feeds & fodders	10
	8. Availability of feeds and fodder storage/prevention space	5
	9. Feeding practice of different categories of animals	10
	10. Colostrum and feeding of milk to calves and heifer feeding	5
Animal health, performance & behavior (40)	11. Average productivity	8
	12. Body condition Score	4
	13. Cow comfort Index	5
	14. Cow cleanliness Index	4
	15. Hock Injury Scoring	3
	16. Human animal interaction	3
	17. Lameness scoring	4
	18. Mastitis detection	4
	19. Reproduction	3
	20. Abnormal behaviours	2

Assessment of animal welfare

Using the Welfare Quality® Assessment Protocol (2009) ^[30], Popescu *et al.* (2010) ^[23] evaluated the welfare of 285 dairy cows on 10 farms in Romania, where they were housed in tie-stalls and free housing. They found that 80% of the farms scored "unacceptable" on the welfare scale, while 10% of the farms scored "acceptable," and one farm scored "enhanced." Coignard *et al.* (2013) ^[10] used the Welfare Quality® assessment protocol (2009) ^[30] to conduct a study to evaluate the overall health score of French dairy cattle herds. They found that no herd was classified in the "good" category for the overall health score (score above 55), and the vast majority (95.4%) fell in the intermediate category, "moderate" (score between 21 and 55).

When evaluating the overall level of animal welfare in Dutch dairy herds, Vries *et al.* (2013) ^[28] used the Welfare Quality Multi-Criteria Evaluation (WQ-ME) model (Botreau *et al.*, 2009) ^[5] and found that 16 herds were rated as unacceptable, 85 as acceptable, 78 as enhanced, and none as excellent. Benatallah *et al.* (2015) ^[4] in Algeria stated that out of 100 dairy farms analyzed on a welfare scale, 95 farms were classified as unacceptable, 4 farms as acceptable, and only one farm as upgraded. Using the Welfare Quality® Assessment Protocol (2009) ^[30], Krug *et al.* (2015) ^[20] evaluated 24 Portuguese dairy farms with 1930 dairy cows, focusing mostly on animal based or outcome-based factors. They stated that 5 farms (20.83%) fell into the poor group and that 19 farms (70.16%) fell into the good welfare category. Salas *et al.* (2017) ^[32] reported that all production units received the final classification of acceptable welfare in their study to evaluate the level of welfare of dairy cattle in Mexico using the Welfare Quality® assessment protocol and that the scores for each principle (P) were 39 points for P1, 48 points for P2, 23 points for P3, and 28 points for P4.

Kamboj *et al.* 2022 ^[17] conducted a study on dairy cattle welfare using the DCWS (Dairy Cattle Welfare Scale), evaluating 60 commercial farms in Punjab and 50 in Haryana. The farms were categorized based on adult herd sizes: small (S < 20), medium (M = 21-50), and large (L > 50). In Punjab, welfare scores were higher in large-sized herds (76.60 [± 1.70]) and medium-sized herds (68.40 [± 22.27]) compared to small-sized herds (60.80 [± 2.77]). Similarly, in Haryana,

welfare scores were higher in large-sized herds (68.10 [± 1.18]) than in small-sized herds (60.50 [± 2.74]) and medium-sized herds (59.35 [± 22.17]). The overall average welfare score was greater in Punjab (68.60 [± 1.49]) compared to Haryana (62.65 [± 2.02]). Welfare was deemed 'acceptable' at more than 75% of farms in Punjab and more than 50% of farms in Haryana according to the assessment criteria.

Conclusion

An objective assessment of welfare is crucial, as it serves research purposes and ensures consumer well-being. It also enables farmers to enhance welfare and boost herd efficiency. Achieving these objectives requires the use of both indirect and direct welfare indicators, which must be valid, reliable, and feasible. The developed model for evaluating welfare on dairy cow farms provides a comprehensive and systematic approach to assessing animal well-being. By integrating multiple indicators such as health status, behavior, housing conditions and management practices, the model offers a robust framework for identifying welfare issues and guiding improvements. The implementation of this model can help farmers and stakeholders ensure higher standards of animal welfare, enhance productivity, and promote sustainable farming practices.

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How to Cite This Article

Madhan ABC. Marine bacteria: A pandora box against cancer. *International Journal of Veterinary Sciences and Animal Husbandry.* 2024; 9(4): xx-xx.

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