Assessment of bovine welfare: Evolution towards the approach from the 5 Domains

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ABSTRACT

Positive animal welfare (PAW) is a relatively recent concept that focuses on enhancing animals’ mental well-being by emphasizing positive experiences. The objective of this review was to describe the indicators used in bovine welfare protocols, identify the domains considered, and establish a proposal focused on indicators to assess positive welfare. It was identified that the protocols require excessive evaluation times, are qualified by granting a single score, and do not allow for regional adaptations based on the critical conditions that may exist in different countries. Furthermore, the existing protocols primarily focus on the first 3 domains (nutrition, physical environment, and health), while giving less importance to recording the behavior and mental state of the animals. A series of indicators was specified to promote positive well-being, focusing on the domains of physical environment and behavioral interactions. These indicators emphasize comfort, environmental quality, social interactions, sensory stimulation, and nutritional enrichment. In conclusion, it is necessary to include a comprehensive diagnosis of the mental state of animals to identify shortcomings and propose improvements that contribute to enhancing the quality of life for animals.

Keywords: Bovine welfare; behavior; domains; mental state; indicators; protocols (Source: DeCS).

RESUMEN

El bienestar animal positivo es un concepto novedoso que valoriza la importancia de las experiencias gratas de vida para contribuir al estado mental. El objetivo de esta revisión fue, describir los indicadores de bienestar utilizados en protocolos de bienestar bovino, identificar los dominios contemplados y establecer una propuesta de indicadores enfocados a evaluar el bienestar positivo. Se identificó que los protocolos requieren tiempos excesivos de evaluación, califican otorgando un único puntaje y
no permiten adecuaciones regionales según las condiciones críticas que puedan existir en distintos países. Además, el enfoque principal de los protocolos existentes está en los primeros 3 dominios (nutrición, ambiente físico y salud), dejando el registro del comportamiento y el estado mental de los animales en un menor grado de importancia. Se propuso una serie de indicadores, que fomentarían el bienestar positivo, relacionados con los dominios de ambiente físico e interacciones comportamentales, haciendo énfasis en confort, enriquecimiento ambiental, social, sensorial y nutritivo. En conclusión, es necesario incluir el diagnóstico del estado mental de los animales de forma integral para identificar falencias y proponer mejoras que contribuyan a mejorar la calidad de vida de los animales.

**Palabras clave:** Bienestar bovino; comportamiento; 5 dominios; estado mental; indicadores; protocolos *(Fuente: DeCS)*.

**INTRODUCTION**

Farm animals represent the largest group of mammals in human care. Therefore, the assessment and continuous improvement of their welfare are fundamental pillars for the production and ethics of the agri-food system. The importance that society assigns to animal welfare in livestock production is constantly growing, which necessitates increasingly accurate methods for its evaluation. (1,2)

In response to the concerns of consumers and society in general, welfare programs, legislation, and quality assurance certification systems have been developed over the last few decades. These initiatives are facilitated through private platforms for audits, animal welfare labels, and organic/ecological production processes. (3,4,5).

The first protocols formulated to evaluate bovine welfare at the primary production level, such as Welfare Quality (6), were based on 4 principles: feeding, environment, health, and behavior. This model was designed to identify the absence of negative experiences by emphasizing the minimization of suffering and evaluating indicators related to negative welfare. (7)

However, the current understanding of animal welfare goes beyond biological functioning to include monitoring the behavior and emotional state of animals. Mellor & Reid (8), developed the Five Domains model based on the Five Freedoms. This model posits that changes in the physical or functional domains (health, nutrition, physical environment, and behavioral interactions) are reflected in the animal's mental domain, resulting in negative and/or positive mental experiences relevant to welfare assessment. (9)

The focus on fostering positive affective states, in addition to preventing and/or minimizing the negative ones (10), allows for a more accurate assessment of the severity of the impact (11), cost-benefit analysis, and promotion of the environmental enrichment that animals may receive. The concept of the Domains can be enhanced by incorporating information from surveys and expanding the evaluation to include a broader range of emotions, taking into account new methods of emotion assessment that have been developed. This model also contributes to the concept of quality of life (QoL) and emphasizes the value of each animal’s life to those working on the farm. (12)

Focusing especially on the validity of the protocols currently used, some authors have detected that several protocols used in farm categorization do not comprehensively consider animal welfare. This leads to different results that may not accurately reflect the current state of animal welfare. Consequently, they suggest that in the assessment of welfare, it is necessary to develop protocols that evaluate the five domains, including indicators of the mental state experienced by the animals. In this way, the degree of meeting needs, satisfaction of desires, and the provision of resources for the animals, including those that enable them to make choices and feel in control of their environment, are considered. Therefore, as knowledge about the states that animals go through increases, there is a need to update the protocols for assessing the degree of welfare in a multidimensional, reliable, and practical way.

Based on the integral approach to welfare assessment offered by the five domains model, the general objective of this review is to identify the welfare assessment protocols
used worldwide, characterize the domains they encompass, and propose a comprehensive, updated, and practical criterion for assessing the welfare of cattle in production. For this purpose, the following specific objectives are proposed: 1) to delineate the indicators utilized in global reference protocols and their applicability in primary production systems; 2) to identify the specific and tangential domains covered by these protocols; and 3) to develop a theoretical framework for indicators aimed at assessing animal welfare positively. These indicators will be assessed in forthcoming commercial farm settings and research endeavors.

The scientific literature was collected using ScienceDirect and Scopus from Elsevier, as well as PubMed from the National Center for Biotechnology Information (United States). The selected manuscripts were grouped based on the Five Domains (evaluated directly or indirectly) and the indicators outlined in the protocol. Only peer-reviewed scientific literature in Spanish and English published between January 2000 and July 2022 was included. Some of the search terms included: Farm protocol, welfare, assessment, evaluation, evaluation, scheme, cattle, bovine, positive welfare, five domains, indicators, measures, and quality of life (also in Spanish).

The transition from negative to positive animal welfare. The neutralization of animals’ stressful situations reduces negative effects, but it may not be enough to achieve animal welfare. In turn, positive welfare enhances states of normalcy towards higher levels of well-being. The evolution from a “welfare level of commitment” approach, which focuses on correcting poor welfare states, to a “degree of improvement” approach that emphasizes promoting positive states, is a trend that has gained considerable momentum in recent years (11).

Current paradigms suggest that for animals to have “lives worth living” (ideally at their highest level: “a good life”), it is essential to minimize their negative experiences while providing opportunities for positive experiences. These observations have important implications that warrant review and commit us to continue updating the indicators used in animal welfare assessment protocols.

Protocols, criteria, indicators and domains considered. In Table 1, the protocols developed for animal welfare assessment are described, and categorized by the domains addressed and indicators used. Within the protocols of global reference, 4 protocols were found to be developed in the European Union (EU), 1 in the United Kingdom and 2 in Argentina. The Welfare Quality (WQ), included in the checklist for assessing the strengths and weaknesses of breeding systems, also addresses indicators related to animal welfare. The protocols developed in Argentina are based on Welfare Quality with regional adaptations. However, they do not evolve to include more domains or address the excessive time needed for evaluation. Typically, these evaluations require full working days in establishments with more than 200 animals. The Austria TGI-ANI 35L and Germany TGI 200 protocols utilize environment-based indicators and place a greater emphasis on resources, facilities, and management.

The protocol proposed by Martínez and Suárez (16) allows the reduction of evaluation times to 2-4 hours by suggesting representative sampling. The indicators are measured on individuals, but it is also important to evaluate indicators at the group level to expedite the diagnosis of welfare. For instance, assessing the success of a sanitary plan or the availability of feed that can impact all animals (21).

The Colombian Agricultural Institute has developed a methodology to assess the welfare of cattle and buffalo (22). The model proposes methods to verify welfare levels that reduce the observer’s subjectivity. It proposes a sample size based on the farm’s size and also a score that considers tools to reduce pain, fear, or stress (analgiesia and anesthesia) and the expertise of the person performing the activities. In this sense, these advances represent progress in diagnosing and enhancing welfare in Latin America. This is crucial as the region is currently adapting to new quality standards to stay competitive in the global market for animal products (23).
### Table 1. World reference protocols for cattle welfare evaluation.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Country/Region</th>
<th>Production system</th>
<th>Contemplated Domains</th>
<th>Evaluation criteria and principles</th>
</tr>
</thead>
</table>
| Welfare Quality (14) | European Union | Cow-calf (cows), rearing (calves), fattening (feedlot), dairy herd (milking cows) systems | N | -Absence of hunger: Body condition  
- Absence of thirst: water provision, water cleanliness, animals per water trough |
|                |                |                   | H | -Absence of injuries: lameness, wounds  
-Absence of disease: diarrhea, respiratory problems, mortality  
-Absence of pain: method, use of analgesia and use of anesthesia  
-Social behavior: agonistic, affiliative, flight distance  
-Positive emotional state: Qualitative behavioral assessment (QBA) |
| Bienest.AR (15) | Argentina | fattening (feedlot) | N, H, B | -Comfort and rest: animal cleanliness, time to lie down  
-Movement: characteristics of the pens, access to grazing  
Body condition, social behavior, hygiene, presence of flies, health (panting, lameness, skin lesions, laminitis, bloating, nasal and ocular discharge) diarrhea score, facilities, capacity and waterlogging of pens, resources to reduce thermal stress. |
| Animal welfare evaluation protocol in bovine herds (16) | Argentina | Dairy herd (milking cows) | N, E, H, B | Quality and provision of food and water, body condition, housing, hygiene, health (foot diseases, mastitis), milking routine, animal management, fear, production level and mortality. |
| RSPCA Protocol (17) | United Kingdom | Dairy herd (milking cows) | B, H | Hygiene, behavioral restrictions, body condition, health (mastitis, skin lesions). |
| TGI-ANI 35L (18) | Austria | Cattle herd, pigs and poultry (all categories of animals) | E, B | Facilities, space available for movement, socialization, floor condition, environment (light and noise) and care of livestock. |
| TGI 200 (19) | Germany | Cattle herd, pigs and poultry (all categories of animals) | N, E, B | Locomotion, nutrition, socialization, rest, comfort, cleanliness and care of animals. |
| Welfare in dairy cows (20) | France | Cattle herd, (all categories of animals) | N, E, H, B | Behavior, skin lesions, facilities and food. |

Domains directly or indirectly contemplated in the protocol, N: nutrition, E: physical environment, H: health, B: behavioral interactions, M: mental state.
Proposal of Positive Bovine Welfare Indicators. In recent decades, welfare has primarily been assessed based on stress and the absence of welfare indicators. The mission has been to assess the negative effects that management, environmental conditions, and the presence of humans have on the condition of the animals. The indicators most commonly used in the protocols primarily evaluate the domains of environment, nutrition, health, and behavior.

One of the main limitations reported as regards the implementation of the protocol proposed by the WQ is the time consumed, and consequently, the cost, to evaluate in the field. At present, we are working on adapting the WQ protocol to various production systems. However, we have not yet succeeded due to limitations related to execution time, which currently stands at approximately 8 hours for 200 animals (20).

Complexity was detected in the recording of information, with protocols containing over 50 different observations to determine levels of well-being. Various authors have shown that welfare assessment can vary depending on the protocol used (24). In addition, depending on the region, type of production, and/or scale of the farm, it is necessary to focus on various aspects and sampling sizes. For instance, in a herd situated in a tropical environment, particular attention should be given to thermal comfort. Conversely, in a feedlot located in a region with abundant rainfall, it will be essential to prioritize the hygiene and health of the cattle (21). Therefore, it is possible that not all welfare study protocols can be adopted on every cattle farm.

Grandin (20) discovered that relying on a single score can mask a serious well-being issue. This system allowed a dairy herd with 47% lame cows to pass a welfare audit because they had high scores on other welfare indicators, such as access to clean water. In addition to diagnostics, beef cattle producers need to understand how the housing decisions they make impact the performance, health status, physiology, and behavioral repertoire of the cattle in their care (25).

In this review, we searched for and selected indicators that focused on the “positive affective engagement” of animals, related to anticipatory assurance, goal achievement, and memory. The aim was to assess the presence of stimulating farm environments that enable animals to experience comfort, pleasure, and confidence. Indicators and are crucial for their well-being. Physiological and pathological responses can lead to additional energy expenditure, known as the “biological cost of stress.” The intensity can be quantified by the rate of change in biomarkers and their duration over time. There is currently a need for further development of simple, comprehensive, and objective methodologies. Although indicators measured through blood may be challenging to translate and implement on a large scale, they provide a high level of precision regarding the physiological and mental state of the animals.

DISCUSSION

Traditionally, intensive production systems have been designed to facilitate management practices without considering the behavioral needs of individuals (29). The intensification of livestock systems challenges individuals to adapt to changes in the physical and social environment, leading to persistent states of uncertainty that impact animal welfare. Insufficient space, changes in diets, constant social reorganization, and the management of animals during sensitive periods (gestation, weaning, castration, dehorning, transport, etc.) interfere with the expression of normal animal behavior patterns. The alteration of behavior triggers the development of adaptive mechanisms associated with a stress response (23).

Social play in calves or grooming in adult cows are examples of positive social activities. Cattle engage in these behaviors only once their primary needs are satisfied. However, such assessments have not been considered in the protocols reviewed in this article. In many situations, energy is diverted to ensure survival. Depending on the level of intensification, inadequate space allocation and antagonistic events between animals can affect the time they devote to innate and natural behaviors such as feeding, walking, resting, and grooming (30). These changes lead to a decrease in positive social activities to prioritize basic needs, and monitoring the frequency of these activities can serve as an indicator of welfare levels.
were identified and selected to demonstrate whether animals engage in voluntary, self-generated activities and goal-directed behaviors, which are linked to an overall sense of control. The selected indicators are intended to answer, among others, the following questions formulated in Mellor’s work (11): Does the system or practice induce negative mental states, frustrate normal behavior, preclude positive experiences, or cause physical debilitation? Does the system prevent the animal’s physiological and mental needs from being met? What provisions have been made to ensure that the consumption of the provided food is an enjoyable experience? What environmental strategies can be utilized to promote exploration and food procurement? How can we promote the expression of normal behavior through rewarding activities? Finally, the social well-being of the animals is linked to the quality of the food provided.

Although addressing all the aspects mentioned above is complex, some indicators have been selected and proposed that are easy to adopt without a significant increase in costs and time. These indicators contribute partially to this mental domain, the assessment of which should be enhanced (Tables 2 and 3).

In conclusion, this systematic review identified several existing indicators in the assessment protocols that are highly valid and useful for evaluating the well-being associated with the first 3 domains (nutrition, health, and environment). Behavior is a domain that is assessed to a lesser extent, while mental status does not play a significant role and is perhaps the most relevant when studying the overall welfare of animals. The author of the present work has proposed expanding positive welfare indicators in the evaluations of two key domains to assess and rectify conditions to promote quality of life. These domains include the physical environment (characteristics of the surroundings) and behavioral aspects (facial expressions and comfort indicators associated with rest and socialization). This approach allows for the evaluation of not only the degree of commitment but also the degree of improvement.

The improvement of animal welfare necessitates dedication from all stakeholders in the livestock chain, including academic and research institutions. In addition, we must move towards a holistic and contemporary approach to our relationship with animals within the framework of animal welfare. It will require the promotion of public policies that accompany and support the development of effective and practical tools that foster continuous improvement of welfare based on the contemporary approach of considering the animal as a sentient individual deserving of a good life. This commitment to undeniable moral imperatives and sustainability guides us toward a future where every sentient being can enjoy a dignified existence in peace with its environment.

<table>
<thead>
<tr>
<th>Description of indicators</th>
<th>Questions for assessment</th>
<th>Measure</th>
<th>Improvement proposal</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group rearing of calves</td>
<td>Does the producer</td>
<td>Record of social activities typical of the species</td>
<td>Enclosures with a surface suitable and adequate for group housing that allows interactions between animals as a source of auditory, olfactory and visual stimulation.</td>
<td>Development of cognitive and social skills. Reduction of behavior and reactions associated with stress.</td>
</tr>
</tbody>
</table>
**Table 3.** Proposed additional indicators related to the physical environment to contribute to the evaluation of comprehensive positive welfare of cattle.

<table>
<thead>
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<th>Description of indicators</th>
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<th>Measure</th>
<th>Improvement proposal</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort: Shade in pens to reduce heat stress</td>
<td>Does the producer offer shaded spaces?</td>
<td>Individual panting score, animal location (eating, drinking, shade) and animal posture. Food and water consumption</td>
<td>Provide shaded spaces to reduce direct and indirect radiation on animals</td>
<td>Animals adapted to environmental conditions</td>
</tr>
<tr>
<td>Housing: Space restriction can affect the response to a fearful situation through an escape response. (30)</td>
<td>Does the producer offer sufficient space when handling the animal in pens?</td>
<td>Movements-locomotor activities, exploratory behavior assessment, escape attempts, flight</td>
<td>Alternative enclosures (space divided into different functional areas)</td>
<td>Exploration opportunities and time spent on this activity increase, as well as opportunities and shelter spaces.</td>
</tr>
<tr>
<td>Feeding Enrichment: Cattle spend a large part of their time searching for and consuming food.</td>
<td>Does the producer guarantee the necessary amount of food with easy access for the different animal categories and times of the year?</td>
<td>Stereotypes and inactivity, food consumption quantification</td>
<td>Use of food dispensaries, possibility of choosing different food resources</td>
<td>Increase in the performance of “typical” eating behaviors, reducing boredom due to increased food search time</td>
</tr>
<tr>
<td>Sensory Enrichment: Auditory stimuli for training livestock to approach a food source and offering novel food (31)</td>
<td>Does the producer use auditory stimuli or variety to encourage getting closer to the food?</td>
<td>Food consumption quantification</td>
<td>Promote association between the auditory stimulus and behavior through classical or operant conditioning. Promote of freedom of choice of variety of food, forages, grains and feeder options or way of offering food.</td>
<td>Weight gain Increase in feelings of pleasure from food options and variation</td>
</tr>
<tr>
<td>Sensory Enrichment: Tactile stimulation. In cattle, grooming is done to eliminate parasites and organisms in the fur and is also a social activity. They use grooming behavior to help deal with stress.</td>
<td>Does the producer provide elements to promote grooming behavior?</td>
<td>Animal cleanliness</td>
<td>Provide resources to perform normal behaviors such as automated brushes for self-grooming</td>
<td>Decreased stress, less boredom, increased motivation and sensory capacity</td>
</tr>
</tbody>
</table>

**Conflict of Interest**

The authors declare that they have no conflicts of interest.

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REFERENCIAS


