

Factors Related to Animal Welfare in the Commercialization of Bovine Livestock According to the Chilean Legislation: A Review

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ABSTRACT

Animal welfare determines the state with which the individual copes with environmental alterations, it is evaluated mainly with biochemical, behavioral, productive, and physiological parameters, allowing to provide them with optimal conditions to improve their quality of life. Production systems expose cattle to stressful situations that alter animal welfare, largely due to increased human-animal interaction. In Chile, Law 20.380, together with decrees 28, 29 and 30 of the Ministry of Agriculture regulate the transport, slaughter, and maintenance of animals in different establishments. However, at present, there are still alterations in animal welfare throughout the production process, reflected in behavioral parameters such as vocalizations and falls, as well as failures in handling by operators and in the process of herding or stunning. The aim of this work was to analyze the factors related to animal welfare in the commercialization of cattle in accordance with Chilean legislation, generating a practical guide for the evaluation of animal welfare based on behavioral manifestations and suggestions for the appropriate handling of cattle.

KEYWORDS: Cattle; Welfare; Stress; Legislation; Chile

INTRODUCTION

Animal welfare has been the subject of analysis for decades and is used to refer to the physical and mental state of animals. In the last 20 years, the agricultural industry has significantly changed the production approach where originally the main objective was to increase economic benefits, to a production based on the respect of animal welfare [1].

The definition of animal welfare has varied throughout history, there are three relevant events in the development of the meaning and its scientific study. The first was the post-World War II agrarian revolution in the 50's, industrialized European countries were forced to increase the production efficiency by developing intensive systems. The second event is a humane progression toward animals

also took place in Europe, mainly in the United Kingdom during the 50's, where the humane treatment of animals was perceived by part of society as a matter of moral relevance. Finally, the third event is distrust and sometimes rejection by consumers toward industrialized, technologized production involved with corporate powers [2].

The basis of animal welfare has its origin in the Terrestrial Animal Health Code by the World Organization for Animal Health in 1989 [3], which states that animals have five basic freedoms that seek to specify their general needs: Freedom from pain, injury, or disease, from hunger and thirst, from discomfort, to express normal behavior and from fear and distress obtaining a state of physical and mental wellbeing. However, there are authors who consider that

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these five freedoms are not entirely optimal for evaluating animal welfare, proposing that sometimes one overlaps with another or that some of these freedoms are too general [4].

To provide a correct animal welfare, it is necessary to provide the animals with preventive medical services such as: shelter where they can be protected from inclement weather, optimal nutrition and adequate management that must be carried out by trained personnel. Prior to and during slaughter they must be handled compassionately, and they must be provided with a stimulating environment in which they feel safe [5].

The animal welfare should be promoted for the following reasons: for a humane concept, which demands that professionals in the agricultural sector avoid unnecessary animal suffering. Another aspect to consider is the loss in the quality of meat products [6] since inadequate handling causes stress, which leads to metabolic and hormonal changes at the muscular level in live animals, resulting in alterations in color, pH, and post-mortem muscular water retention capacity [7].

During the marketing process, livestock are exposed to different factors and stimuli that can alter animal welfare, such as entering unfamiliar environments, overcrowding, unfavourable weather conditions, temperature changes, humidity, and radiation; this situation is caused by poor handling by operators, using sharp objects, noisemakers, or electric prods [8,9]. On the other hand, transport to the establishment can last several hours and the animals are subjected to vibrations, sounds and sudden movements that generally cause bruises, which is considered one of the most stressful events in the life of the animals [10].

Animal welfare involves different physiological, productive, and ethological parameters that make it difficult to carry out an objective evaluation [8]. For this reason, it is considered necessary to develop a bibliographic review that covers the commercialization process of beef cattle in meat production, exposing the main complications during this process, analyzing the current Chilean legislation and the recommendations of the OIE to safeguard the animal welfare. In Chile, different regulations have been created to regulate the different scenarios of livestock production in relation to animal welfare, contained in Law No. 20,380 on animal protection, which has three regulations: Decrees No. 28, 29 and 30. The general objective of this work was to analyze the factors related to animal welfare, considering the behavioral parameters of management, linked to stress in the commercialization of beef cattle according to Chilean legislation.

MATERIALS AND METHODS

Bibliographic sources were reviewed using the library service of the Universidad de Concepción, making use of books and online meta-search engines such as Google Scholar, Pubmed, Web of Science and Scencedirect. Different concepts were entered into the search tools, both in Spanish and English, to find updated information and to evaluate the historical context of the different fields related to animal welfare. The words entered in different meta-search engines were cattle, animal welfare, animal welfare law, stress factors and five animal freedoms.

Governmental and non-governmental platforms of global relevance related to the research to be developed were used, with the aim of evaluating Chilean legislation and international recommendations for optimal animal welfare. Research carried out since 2000 was mainly included, except in those cases where

a historical comparison of a concept or procedure was carried out.

RESULTS

Problems of Livestock Production

In Chile, cattle breeding systems are based on dual-purpose cattle for producers with less technological development, while more specialized producers raise breeds focused on beef production, mainly Hereford and Aberdeen Angus [11]. For this stage, producers purchase weaned calves, acquired at cattle fairs, and transported to and from different farms. These changes in location and environment, added to wean, will generate negative alterations in animal welfare [12]. Another factor to consider in breeding is feeding, which under certain conditions is carried out intensively, the animals are confined in pens, reducing their ability to move without having enough space to lie down and being deprived of access to water, as suggested by Grandin.

Covid-19: The sudden restrictions on the general population caused by the pandemic also affected agricultural workers, significantly reducing permanent surveillance of animal needs and health status, limiting intervention on their behalf [13]. Alternatively, slaughterhouses and meat packing plants were temporarily closed, as the proximity of their operators became critical points for the spread of the virus [14]. This resulted in longer transport distances to operating plants, which were also unable to maintain adequate slaughter rates, producers began to over-stock animals, increasing stress related to overcrowding and altering immune system functions, producers were encouraged to reduce growth rates, but some had to slaughter animals on-farm in ways that probably included suffering [15].

Transport problems: Cattle in Chile are transported long distances that usually take between 1 to 12 hours, even extending up to 60 hours due to commerce, which consists of traveling from the farm to the livestock fair or to the slaughter plant [16], as well as possible alterations in the road, lack of vehicle maintenance, climate variations and geographical characteristics [17]. During these events, cattle are subjected to different stressors such as: 1) increased handling, since the animals must be introduced inside the transport vehicle; 2) cattle are mixed with different densities of cargo being altered their social structure and exposing them to trauma from blows among their fellow animals, against solid structures of the vehicle or falls; 3) they are exposed to different physical challenges such as going up and down ramps, movements, noises and vibrations during the trip; 4) they are exposed to new environments, where there are changes in climatic conditions such as temperature, radiation and humidity; 5) they are deprived of water and food; 6) they are prevented from resting [16,18,19]. All these factors generate stress in animals and consequently alter animal welfare [16,20,21].

Handling in the transport and stocking density: In 1994, Law No. 19,162, known as the Meat Law in Chile, which refers to the transport of cattle, including the handling to which the animals must be subjected and the characteristics that the vehicle in which they are transported must have. It also mentions the load density, which must not exceed 500 kg per square meter. According to a study by Tadich et al. [18], three hours of transport are enough to show biochemical alterations in blood, which are compatible with stress. Another study, this time by Gallo [22] showed that the maximum limit allowed by law is often exceeded, recording densities of up to 693kg/m² at Región de Los Lagos, while at Región Metropolitana

densities up to 632kg/m² was recorded, showing a lack of control to correct these practices.

Transport can also affect the quantity and quality of the meat that will be produced, because the movements and inadequate handling measures can result in the death of the animal, generating total loss of the meat products. They may suffer weight loss, lesions such as hematoma and alterations in quality, resulting in dark, firm, and dry meat [23]. Barbosa & González showed that, in Nicaragua, despite having laws regulating the use of electric prods, there is greater abuse by operators at the time of transport than in any other process of the production cycle.

Operators and transporters must have sufficient knowledge to ensure animal welfare, it has been shown that the training, experience and skill of drivers, as well as the age of the animal, duration of transport to the slaughterhouse, climate, among others; have impact on the final conditions of the meat to be obtained [24,25], to achieve humane handling practices requires investment in effective training programs to operators, informing them of their roles and responsibility to ensure animal welfare, and on the other hand, reducing occupational risks for workers [26]. Mancipe-Arias & Ariza-Suárez [27] reported that in Colombia, 80% of workers indicated having heard about animal welfare, however only 36% were trained in this area, while 52% of operators consider that the seizure of carcasses and poor meat quality does not lead to economic losses for the market, evidencing that they are not aware that inadequate actions in the handling and treatment of animals are reflected in the final product.

In Chile, Decree 30 establishes that there must be a person responsible for the welfare of livestock during travel, loading and unloading, who must have knowledge related to the behavior and needs of the animals and must be able to handle them efficiently, preserving their welfare. Transporters must have a certificate of approval of an official training course, recognized by the competent authority (Agricultural and Livestock Service), unless they are technicians or professionals linked to the livestock industry [28]. During 2017 and 2018, 190 transporters were surveyed of which 80% assured to have the required training [29].

The deprivation of food and water: The transport of cattle usually involves the deprivation of food and water, Law No. 19.162 establishes that the maximum continuous transport time must not exceed twenty-four hours; in the case of trips that must be longer than this, the animals must have a rest period of eight hours where they are provided with food and water. It should be considered that in addition to the travel time, the animals must be loaded and unloaded, which extends the process. According to studies by Gallo et al. [10], cattle spend an average of more than sixty hours fasting in the case of animals that are transported from the Región de los Lagos to the Región Metropolitana, while the fasting time can exceed one hundred hours in the case of cattle that are transported from the Región de Aysén del General Carlos Ibáñez del Campo to the Región Metropolitana.

Difficulties prior to slaughter: However, according to Grandin [30], there are five factors in slaughter plants that may prevent cattle from reaching an optimal welfare state prior to slaughter: 1) the equipment and work method; 2) distractions that interrupt animal movement; 3) lack of personnel training and lack of personnel to supervise such training; 4) lack of maintenance of equipment and facilities; and 5) poor condition of the animals upon arrival at the plant. The animals must be unloaded into chutes intended

for transporting the cattle to the slaughter area. Injuries found on post-slaughter carcasses, such as lacerations, and bruises, may be the result of poor handling in the stages prior to slaughter, such as commerce, transport and also handling at the slaughter plant [23].

Evaluation of animal behavior: For the evaluation of animal welfare different parameters can be used, one of the most basic and simple to implement in any production plant is the behavioral ones because it is not an invasive methodology, it does not require sophisticated implementation and behavioral changes can manifest alterations even prior to other indicators. For this reason, it is fundamental to understand the causes, functions, and importance of behavioral patterns in the bovine species. It can be said that behavioral changes in general, constitute the animal's first line of defense against environmental alterations that can generate stress [31].

The different types of stress should be considered, among which the following stand out:

1) **Acute stress:** Bovines are a gregarious species, they present a natural behavior under typical conditions of their environment, cattle are prey animals so their response to threat is flight, which normally occurs when crossing the flight zone, where the most important line is that of the withers, if the person is located behind this line the animal will advance, if it is in front, will retreat [32]. This can be used by the operators to direct the animal in the desired direction. In addition, cattle have 340° vision (stereoscopic in front and monoscopic to the sides) and do not have vision of exactly what is behind their tail, constituting the blind spot.

When cattle are moved their natural gait must be respected, if they are forced to increase this rhythm, either because they must trot or gallop, it implies a forced and highly stressful movement. Cattle are not a species that commonly react to pain with vocalizations, which is why it is manifested, it is because the level of pain or fear is high [33].

2) **Chronic stress:** If stressful situations persist over time, the animal may be affected in productivity and immune status. Cortisol is released in response to stress, so it has long been used as a biomarker in animals [34], chronic exposure to high concentrations of cortisol generates alterations such as hyperglycemia, depression, and immunosuppression. In cattle, excessive and prolonged cortisol concentration has been linked to reduced reproductive rates, stunted growth, suppressed milk production, and immune system failures that increase vulnerability to pathogens [35].

3) **Heat stress:** Occurs when an animal cannot maintain the balance between heat accumulation and dissipation, temperatures above 22 °C, direct and indirect solar radiation, and high environmental humidity influence this parameter [36,37]. If animals reach body temperatures of 42 to 45 °C they enter an acute phase of heat stress, which will probably lead to heat stroke and subsequently death, being reported that the summer carries a higher risk of death in cattle [38] so appropriate precautions should be taken: avoid stressful handling such as castrations, vaccinations and herding during the hottest hours, in addition to promoting the transport of cattle between 8 pm and 8 am [39].

This type of stress may be increased due to climate change; it is estimated that extreme thermal events such as the number of hot days and the number of heat wave will occur more frequently. In the future, it is likely that these heat and cold waves will have a greater

impact on production animals due to their frequency, duration, and intensity [40].

4) **Other stress factors:** It is considered that a level of mud that exceeds the insertion of the hooves generates alterations in the animal welfare in cattle, although the formation of mud is related to the type of soil in which bovine production is developed, this has a negative effect on the conversion and consumption of dry matter, in addition, these animals have a higher load of microorganisms, and as a consequence, greater predisposition to foot disorders [33].

Animal Welfare

Animal welfare during transport: During the transport process, it is possible to measure animal welfare based on behavior, using different characteristics such as those specified out by Cafazzo et al. [41], where indicators of good animal welfare and indicators of bad animal welfare were designated, a study that was replicated by Romero et al. [42], concluding that the location of the animal in the transport truck is a factor that influences animal welfare, observing that there were alterations in cortisol and lactate in those that were transported in the rear compartment of the truck.

Animal welfare in pens and herding: The herding processes throughout the bovine production are a critical point with respect to animal welfare, and the permanence of the animals in the corrals can mean, due to the time they remain in these spaces, the difference between a good animal welfare or an insufficient one. It has been proposed for about three decades that vocalization in cattle is related to higher cortisol levels [43], vocalizations are increased by exposure of cattle to unpleasant situations [6], such as the use of electric prods. The evaluation of this parameter should be done circumstantially, i.e., if they moo during herding, handling, or other manipulations, it correlates with uncomfortable sensations that affect animal welfare; however, if they moo at rest, it is due to a social response and should not be considered an indicator of stress. According to Grandin [44], to determine the level of stress in pens, chutes, loading and unloading or in the toolbox, she recommended measuring vocalizations in at least 100 animals and then classifying them into one of the following levels: Excellent: <0.5% of cattle vocalize; Acceptable: 0.5-3% of cattle vocalize; Not Acceptable: 4-10% of cattle vocalize; Severe Problem: >10% of cattle vocalize.

Slips and falls reflect a negative alteration in animal welfare due to errors in the infrastructure or in the handling of the cattle. A slip is understood as when the animal loses balance when resting its carpus against the ground, while are when the animal rests another part of its body on the ground other than its hooves or carpus. Grandin [44] has created a scale to evaluate this parameter: Excellent: no slips or falls; Acceptable: slips <3% of animals; Not acceptable: >1% of falls; Serious problem: >5% of falls or >15% of slips. All the parameters mentioned in this point were included in the animal welfare evaluation guide.

Animal welfare at slaughter: During the slaughter process, stunning acquires great relevance because it avoids suffering of the slaughtered animal [23], providing safety to the operators and the animals. It is possible to evidence alterations in animal welfare according to the behavior they present once subjected to the stunning process [45] and it can be measured basis on vocalizations [46] an animal that is properly desensitized should not be able to emit vocalizations and should not fall before stunning. The struggling of the bovine when its head and neck are restrained by the restraint device should be avoided, escape attempts from the toolbox, either by climbing, turning, or crawling under the walls

or doors are indicative of high stress, so it is not desirable in this process [45,47].

After stunning, animal welfare can be measured by vocalizations, paws movements, presence of corneal reflex and elevation of the head and/or neck, these are indicative of a bad stunning process and therefore suffering [48,49], the above-mentioned parameters were included to develop the practical evaluation.

Management Parameters

Herding: The frequency of the use of electric prods during herding is a crucial factor for the alteration of animal welfare, although the implementation of these is not prohibited in Chile, it should be considered that a misuse can be harmful to animals and producers due to losses associated with injuries. To avoid or reduce the use of signs that may be harmful, it is recommended to replace them with flags, plastic tubes and bags, together with proper training, where the operator should be taught the behavior of the cattle [50]. Grandin [44] recommends evaluating the use of the electric prod with respect to the total number of animals (without mentioning how many times the electric prod can be used on the same animal) as follows: Excellent if less than 5% of the total herd is prodded; Acceptable if less than 25% of the total herd is prodded; Unacceptable if between 26-49% of the total herd is prodded; Serious problem if more than 50% of the total herd is prodded.

Management during slaughter: Muñoz et al. [45] propose that the handling of the animal in instances prior to and after stunning can be evaluated by the number of shots fired to induce stunning per bovine, the skull of the animal is evaluated by counting the number of holes present and the proximity to the target site. This management can also be measured by evaluating the blow with the knockout box door, the use of electric prod, the place and time of restraint until stunning is achieved and finally, the interval between stunning and bleeding.

Animals According to Chilean Legislation

Currently, talking about animal rights is complicated; society has not yet managed to unify criteria with respect to this issue because there are differences of opinion when talking about companion animals, production, and wild animals. Chilean civic society has shown particular interest in the legal protection of animals, particularly companion animals, noting that current regulations are inefficient enough to guarantee their protection [53].

With respect to animal law, it can be understood as a set of theories, principles and norms created to offer legal protection to all non-human animals [51]. Within this there are two main positions, the first seeks to regulate production within the commercial and industrial framework to which they are exposed, thus avoiding unnecessary suffering and mistreatment; on the other hand, it is proposed that animal law should seek something that transcends the commercial by affirming that these are not only an object tradable by humans, but a being with autonomy which should be endowed with rights as such.

According to the Chilean Civil Code, animals are classified as objects or things, based on Roman law, in article 566 it specifies that things can be divided into movable or immovable goods, according to article 567 movable goods are those that can be moved, either semovientes or inanimate, while 568 states that real estate, also called farms or properties, are those that cannot be transported from one place to another such as land, mines, and things that are attached to these such as buildings and trees [51]. Under this

classification, animals are under this classification, animals are called movable property, therefore, they can be the object of any legal business [52].

Previous laws: Although there are regulations prior to the Penal Code of 1874, they were unclear, so it was necessary to include legislation that addressed animal welfare, in which a punishment of 41 to 69 days of imprisonment was proposed being this commutable by a fine, which was applied in case of demonstrating excessive mistreatment against any animal [53]. However, the application of an effective punishment was unlikely, since the penalties are low and the law is not precise in defining clearly what is understood as excessive mistreatment, so it was necessary to develop new legislation (Law No. 18.859) enacted on November 29, 1989. Law No. 18.859 establishes similar bases, but considers more intense sanctions, increasing the days of imprisonment from 61 to 540 days in conjunction or alternatively to a fine. In addition, the term excessive is extracted, so now it can be understood that any type of mistreatment against an animal is punishable [52].

Law No. 20.380: On October 3, 2009, Law No. 20.380 was enacted, whose objective, according to its article 1°, is to know, protect and respect animals because they are considered living beings and part of nature, to provide them with an adequate treatment and avoid unnecessary suffering. This law broadly regulates the treatment of animals, regulating transportation, confinement, experimentation, and education. With respect to protection, Article 3 of the law stipulates that any person who owns a domestic animal must provide adequate care, shelter, and food, at least to satisfy the minimum needs of each species. Regarding penalties, it considers that people who commit acts of mistreatment or cruelty against animals will be sentenced to a minimum to medium term imprisonment, and/or a fine ranging from two to thirty Unidades Tributarias Mensuales (UTM), on the other hand, it applies a more severe punishment in terms of imprisonment, ranging from 540 days as maximum penalty to three years [54].

International Recommendations

The problem regarding animal welfare has been presented for several years and transversal in several countries, regardless of their level of development, which is why the need has arisen to create guide documents to solve this question. Currently, livestock production at industrial level is the area that generates the greatest concern with respect to animal welfare in the world because billions of animals are produced in intensive, confined systems, growing at extremely fast rates, and reaching physical limits to obtain the highest possible productivity [55].

The five animal freedoms are globally accepted, these have been the initial bases of the animal welfare concept, however, they have evidenced certain problems mentioned above, due to this, the proposal for the valorization of the animal welfare of the Welfare Quality® project was developed [56,57]. This protocol designed to be applied in the European Union maintains the bases of the five freedoms, but with some modifications based on answering the following questions: Are the animals fed correctly, are the animals properly housed, are the animals in an adequate state of health, does the behavior of the animals reflect an adequate emotional state, are the animals in an adequate state of health, are the animals in an adequate state of health and does the behavior of the animals reflect an adequate emotional state? These questions are the starting point to evaluate animal welfare in production plants during all stages of production [58,59].

CONCLUSION

The frequency of vocalizations during herding, fasting time and density during transport stands out as behavioral and management parameters that reflect stress in cattle, while post stunning, the presence of vocalizations and corneal reflex alter animal welfare.

Law 20.380 protects animals during production, addressing commerce, confinement, transport, and slaughter stages, making it clear that existing regulations are not enough, and that greater education and oversight are needed for the benefit of animal welfare.

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