International Journal of Biology Sciences

ISSN Print: 2664-9926
ISSN Online: 2664-9934
NAAS Rating (2025): 4.82
IJBS 2025; 7(8): 134-138
www.biologyjournal.net
Received: 08-06-2025
Accepted: 12-07-2025

Cherryl DM
Department of Livestock Production Management, Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Paramesha SC
Department of Livestock Farm Complex, Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Bharat Bhushan M
Department of Livestock Farm Complex, Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Sushanth Handage
Department of Veterinary and Animal Husbandry Extension Education, Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Aparna Hebbar H
Department of Veterinary Physiology and Biochemistry Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Corresponding Author:
Paramesha SC
Department of Livestock Farm Complex, Shri Bhaurao Deshpande Veterinary College, Athani, KVAFSU, Bidar, Karnataka, India

Impact of domestication on livestock behavior and welfare: A comprehensive review

Cherryl DM, Paramesha SC, Bharat Bhushan M, Sushanth Handage and Aparna Hebbar H

DOI: https://www.doi.org/10.33545/26649926.2025.v7.i8b.457

Abstract
The welfare, physiology, and behavior of livestock species have all been significantly impacted by domestication. However, different types of stress have also been introduced by the domestication process, and this can have a substantial impact on animals' health. The consequence of domestication distress on animals is explored in this paper, with particular attention to how it affects behavioral responses and general welfare. Changes in social structures, environmental conditions, and management techniques are some of the causes that lead to domestication stress, which can lead to behavioral disorders, decreased productivity and weakened health. We look at the physiological processes that underlie stress from domestication, including as changes in immunological response, stress hormone levels and coping mechanisms. The review also emphasizes the behavioral alterations seen in domesticated animals, including odd repetitive behaviors, aggressiveness, and changed food habits. We also go over the effects of domesticated stress on animal welfare, highlighting the necessity of better management techniques that lessen stress and support the mental and physical health of cattle. Developing methods to improve cattle welfare, boost production, and guarantee moral and sustainable farming methods requires an understanding of the connection between domestication stress and animal behaviour.

Keywords: Domestication, behaviour, adaptation, stress, stimulation

Introduction
The evolutionary process by which organisms grow more docile and modify themselves to coexist with humans is known as domestication. Ratner and Boice (1975) [29] specified domestication as the elimination of creatures from certain natural selective pressures across generations. Environmental stimulation and encounters during an animal's lifetime, which include ontogenetic processes, also contribute to adaptation through genetic modifications over generations. Being able to adapt to the functions that are meeting man's needs is the result of deliberate genetic selection. During the domestication process, an animal's natural life is transformed into one that is governed by humans. Animal domestication is the state in which people have a great deal of control over how animals are bred, raised, and fed. Domestication is primarily motivated by increased stress tolerance in many species (Solberg *et al*, 2013) [31]. Stress increases glucocorticoid levels by activating the hypothalamic-pituitary-adrenal axis (Moberg and Mench, 2000) [24].

The genesis of domestication
Domestication began somewhere between 10,000 and 15,000 years ago when man grew sedentary and commanded to meet his own needs and desires. The history of domestication spans 14,000 years before the present (YBP), and this domestication events have place at various locations and times (Belyaev, 1979) [1]. Dogs were the earliest domesticated species, and they were initially used by humans as watchdogs and for hunting (14,000 YBP) (Braastad and Bakken, 2002) [2]. The main domesticated species utilized as food supplies and labor animals date back to about 8000 and 10,000 YBP, with sheep and goats perhaps being the first (Craig, 1981) [6]. Asia and the Middle East were the first places where these animals were domesticated (Bruford *et al*., 2003) [3].

Around 6000 YBP, horses, donkeys, water buffalo, as well as certain llamas had been domesticated in these areas. It seems that domestication of the horse took place concurrently in multiple locations (Bruford *et al*., 2003) [3]. Fish species were not domesticated until the Romans domesticated the carp, whereas the primary bird species were domesticated after mammals, with the domestication of chickens and geese occurring between 5500 and 3000 YBP (Wood-Gush, 1958; Leclercq, 1990) [37, 20]. The domestication of rabbits and turkeys in the late middle ages confirms the domestication of other kinds of animals (Morton, 2002) [26]. Most recently, within the last 150 years, domestication has occurred to satisfy the need for specific items, such as fur, as in the case of mink and fox (Jensen, 2002) [26]. Although it may be difficult to provide milk to captive infants, wild forms are easiest to capture and tame as young animals, especially if they are captured at crucial stages of imprinting or socialization. Tameness, which is the removal of the inclination to run away when humans are around, must be distinguished from domestication. Tameness can be attained by early human association or by avoiding human contact. For instance, because they are not hunted, a number of animal species on the Galapagos Islands don't run away from people. The feral animals, or domesticated creatures that have returned to their wild state, should be distinguished from untamed domestic animals. Numerous types of relationships with men can be a part of domestication. For instance, the close bond between a beloved dog and its human owner or the casual connection between a shepherd and his sheep herd has been a component of domestication for all time. Reproductive success frequently depends on human involvement, yet in either case, the species satisfies the owner's goal to breed effectively in the environment provided by man.

Attributes that support domestication

The process by which people carefully breed and control wild creatures to produce characteristics that are desired for work, food, companionship, or other uses is known as domestication. Few species have been effectively domesticated, despite the fact that many have been tamed. Certain biological, ecological, and behavioural characteristics that support domestication are the basis of this disparity. Both the classical and modern scientific research, describes the main traits that make domestication easier are.

- **Food and habitat characteristics: Dietary Flexibility:** Dietary adaptation is one of the most important variables affecting domestication. Omnivores or herbivores that can eat a variety of foods, especially those found in human-controlled settings, are typically considered domesticable animals. Carnivores are more difficult to sustain financially and typically need high-quality protein. According to Diamond (1997) [8], a variable diet is crucial since raising animals that eat at lower trophic levels uses less energy. Once the animal is confined, it is most essential to prevent it from escaping in search of food and habitat (Smith, 2001) [30]. Those animals without specialized needs of habitat and feed are easily domesticated.
- **Growth Rate and Reproduction: Ability to reproduce in Confinement:** The most likely animals to reproduce are those that are least disturbed while in captivity. Anxious activity that is not conducive to domestication may be the result of flight or fear behaviour. However, the animals most suited to domestication are those that can modify their reproductive behaviour to fit into a small area with minimal endocrine disruption. Domestication is easier with animals that develop quickly and have short generation intervals. These characteristics shorten the time commitment needed and allow people to understand the advantages of breeding right away. High-reproduction species produce quicker and scalable products, according to Zeder (2012a) [39]. Also, when domesticating a species, promiscuous sexual activity in animals is advantageous. Males typically dominate females in ungulates and gallinaceous birds, which lessens animal fighting and makes mating easier (Marshall and Weissbrod 2011) [22].
- **Social structure and hierarchical behavior:** Species with a distinct social order and a herd or mob mentality are easier to domesticate. These animals are more likely to accept humans as leaders or dominant figures within their social structure. Due to their innate tendency to follow hierarchical structures, horses and dogs are receptive to leadership and instruction (Hare and Tomasello, 2005) [13]. Additionally, herd animals accustomed to following a leader might be easier to handle and breed in captivity, according to Clutton-Brock (1999) [5]. Species that, for at least part of the entire year, live in large hierarchically organized flocks or herds including both sexes are especially notable. Such groupings would experience lower levels of stress when constrained since their social behaviour lessens conflict.
- **Docile temperament and low aggression:** A crucial characteristic is temperament; animals with aggressive or flight-prone tendencies are challenging to control in captivity. Domestication is more appropriate for animals who exhibit social tolerance, docility, and little hostility towards people and other animals (Wilkins *et al*., 2014) [36]. The investigation by Trut *et al*., (2009) [33] on Russian fox domestication showed that tameness selection can lead to quick changes in behaviour and physiology. Goats and sheep are docile animals that are less prone to harm people or get out of their cages.
- **Limited tendency to panic or Flee:** Domestication is not appropriate for animals with high flight zones or those that are prone to panic attacks. Domesticated animals can tolerate human presence and show tolerance for confinement. Price (1999) [27] observed that domestication syndromes are linked to reduced response to environmental stresses. During the taming phase, the flight distance may be lowered to zero with cautious handling and approach. The link between humans and animals is stronger when imprinting occurs (Driscoll *et al*., 2009) [10].
- **Utility and Multi-purpose Use:** Animals with many uses (milk, meat, wool, manure and draft) have a greater probability to be domesticated because of their economic efficiency and wider applicability, even though this is not an innate trait (Cucchi *et al*., 2011) [7]. According to Zeder (2008) [38], animals that provide a variety of resources make more suitable choices for early agricultural communities.

Modifications under Domestication

In the evolutionary process of domestication, the focus has moved from natural to artificial selection. The genetic alterations of an animal population, particularly variations in the quantity of features, are part of this process of evolution of domestication. Some biological changes, such as morphological, physiological, or behavioural ones, even take place. Species have evolved through captivity and human contact around this domestication process, which may have had a variety of behavioural effects. Because of artificial selection for features that improve human utility and control, livestock species have experienced major behavioural modifications during the domestication process. Because of careful selection for tameness and docile nature, one of the most noticeable adaptations is a decrease in fear and hostility towards people. For example, domesticated cattle and sheep are easier to herd and confine because they have smaller flight zones and are less reactive to environmental stimuli than their wild counterparts (Price, 2002; Hemmer, 1990) [28, 14].

Social behaviours have also changed; domesticated animals frequently exhibit increased tolerance towards humans and conspecifics, allowing them to live in close quarters without experiencing increased conflict (Koolhaas, 1999) [18]. According to Wilkins *et al*. (2014) [36], these alterations are linked to altered neuroendocrine function, including changes in the hypothalamic-pituitary-adrenal (HPA) axis, which controls stress responses. Additionally, domesticated animals may become more gregarious and dependent, which enhances handling and productivity but decreases their ability to survive in the wild (Trut *et al*., 2009) [33]. All things considered, behavioural changes in domesticated livestock show a complicated interaction between the animals' innate biological plasticity and evolutionary constraints imposed by human preferences.

Humans have provided the fundamental necessities, including food, water, an appropriate environment, veterinary care, and companionship. These creatures are deprived of the freedoms they could have experienced in the wild, including the ability to choose their spouse, companion, food and above all the ability to move around. Animals that have been domesticated for their productivity features through intensification in recent years may devote more resources to production traits and less to other biological processes when under stress (Larson and Fuller 2014) [19]. This could affect the animal's ability to handle stress and adjust to a novel or uncertain environment.

Numerous behavioural anomalies are signs of domestication stress. Well-established signs of impaired welfare and ongoing stress include stereotypes, which are repetitive, non-functional behaviours like crib-biting in horses or bar-biting in pigs (Mason and Rushen, 2006) [23]. These behaviours frequently appear in settings devoid of opportunity for natural behaviours, social interaction, or stimulation. In intense systems, social stress is also common. Pigs and cattle, for example, are selected for social tolerance, yet in situations when they are overcrowded or have inadequate resources, they nevertheless exhibit hostility. This results in accidents, dominance-based social hierarchies, and fear-based behaviours that have a detrimental effect on one's health and productivity (Gonyou, 2001) [12]. Furthermore, early life stress and inadequate habituation exacerbate fear-based reactions to routine treatments, such as restraining, handling, shearing, dipping or any other veterinary interventions (Hemsworth and Coleman, 2011) [15]. Fear reactions can weaken the immune system and make a person more prone to illness, particularly if they persist over time. Frequent stress can raise glucocorticoid levels, which can impact brain regions involved in memory, emotion and learning, including the hippocampus and amygdala. A mother's behaviour and the development of her progeny may be affected by these alterations, which can also decrease cognitive flexibility and learning capacity. Furthermore, different species and breeds have different stress responses. For instance, in contrast to dual-purpose or conventional breeds, dairy calves that have been specifically developed for high milk yield frequently exhibit higher stress-related markers (Von Borell, 2007) [34]. This suggests a welfare trade-off in which sensitivity to social or environmental stresses may be made worse by selection for productivity.

However, their lifespan which could ordinarily reach 20 to 25 years is also shortened by retaining and choosing for commercial production. While some of these modifications have helped animals get more acclimated to their new surroundings, some animals have also experienced adverse side effects (Lindqvist and Jensen, 2008) [21]. Therefore, domestication increases eustress, which improves function, and in other cases, it may induce distress, which encourages animals to withdraw. It is conceivable that an animal with the same genotype will exhibit a new personality trait if it is removed outside the ecological niche of which it originated and placed in a very different environment. According to Wayne and Von Holdt (2012) [35], morphological modifications to colour, form, and functionality can be ascribed to altered sensory thresholds, which makes certain behavioural patterns more prevalent or less prevalent throughout domestication. In terms of morphology, the percentage of white individuals in domestic populations has increased due to the decreased impact of natural selection for predation.

Large species have been intentionally made smaller to make them simpler to handle, while small species have been purposefully made larger to increase the amount of meat. Changes in size are not uniform. For instance, the amount of fat in fish has grown, and the placement of fat in cattle has changed. In domestic animals, it is kept in muscle and close to the tail, but in wild animals, it is stored under the layers of skin and surrounding the kidneys (Clutton-Brock, 1992) [4]. The majority of domestic animals have smaller heads or brains (Diamond, 2002) [9]. Dehorning cattle is another adaptive step in their domestication, in addition to altering their basic structure through selection for the production of meat or milk. The majority of these altered morphological and physiological characteristics are easily explained as direct results of neural crest cell deficits during embryonic development. This leads to the phenomenon known as Domestication Syndrome (DS), which Charles Darwin documented as a result of his research on domesticated animals. The apparent variety of phenotypic changes that affect tissues as a result of neural crest aberrations or as a result of neural crest influences on their development makes Domestication Syndrome unique (Wilkins *et al*., 2014) [36].

The International Dairy Federation (IDF, 2008) [16] has identified four stages of domestication of dairy cattle for human benefit and impact of these stages on their welfare. Firstly, in their wild state the animals expressed natural productivity but their welfare was not maximized because of

predation, disease, lack of feed and other adverse natural events. Second, as they became domesticated, their needs were fulfilled through commercial farming, their production increased and their welfare improved since all their basic needs were m*et al*ong with protection from disease and shelter; this would then have been their point of maximal welfare. Third, beyond this particular period, additional attempts were made to boost output, which begins to affect their well-being. Fourth, the heightened need for output eventually reaches or surpasses their biological limits, resulting in a decline in their welfare.

The characteristics of behaviours do not change or vanish, but their expression thresholds do (Price, 1999) [27]. Domestic pigs in a natural setting exhibit conduct patterns that are similar to those of their wild counterparts, and there is little behavioural difference between pigs and wild boars (Jensen, 2002) [26]. Consequently, because domesticated populations still exhibit genetic variety, domesticated species can likely, if given the chance, return to the behaviour seen in similar wild species.

Behaviour may change as a result of physiological changes brought about by domestication. For instance, alterations in the environment may alter the body's need for water, energy, etc. Under confinement, specific stimulation situations may result in changes. Chickens and turkeys may pile in the corners of their pens in response to certain strange noises in the home environment, which are known as supernormal stimuli (Tinbergen, 1951) [32]. This phenomenon is known as the stimulus and threshold effect.

Developing successful welfare methods requires an understanding of the behavioural and physiological effects of stress connected to domestication. Stress and stereotypes can be lessened by enriched surroundings that provide space, social connection, and behavioural outlets (Fraser *et al*., 2013) [11]. Early habituation and positive human-animal interactions are also crucial. Regular non-aversive interactions with handlers reduce fear reactions and improve welfare outcomes for animals (Hemsworth and Coleman, 2011) [15]. Furthermore, automated stress monitoring and behaviour tracking, two technologies used in precision livestock farming, provide chances to identify early indicators of discomfort and modify management strategies accordingly.

Conclusion

Under domestication, many species with traits that make them suitable for domestication might not show many behavioural changes. As a result of these domestication-related modifications, animals reach an entirely novel adaptive peak and become more adapted to living in captivity under human supervision. Systematic selection has been applied to some production traits, particularly in the last few centuries. Although domesticated organisms have adapted to their settings, they may be less able to adjust to new or changeable environments because of investments in particular production features and the limits of total resources. As a result, there may be stress and further pain and suffering, which are signs of poor welfare. Therefore, increasing an animal's capability for adaptation seems intriguing because it would enable selection for "adaptable" creatures, guaranteeing the animal's capacity to retain their welfare.

References

1. Belyaev DK. Destabilizing selection as a factor in domestication. J Hered. 1979;70:301-308.
2. Braastad BO, Bakken M. Behaviour of dogs and cats. In: Jensen P, editor. *The ethology of domestic animals*. Wallingford (UK): CABI Publishing; 2002, p. 173-92.
3. Bruford MW, Bradley DG, Luikart G. DNA markers reveal the complexity of livestock domestication. Nat Rev Genet. 2003;4:900-910.
4. Clutton-Brock J. The process of domestication. Mammal Rev. 1992;22(2):79-85.
5. Clutton-Brock J. *A natural history of domesticated mammals*. Cambridge: Cambridge University Press; 1999.
6. Craig JV. *Domestic animals behaviour: causes and implication for animal care and management*. Englewood Cliffs (NJ): Prentice-Hall; 1981. p. 21-31.
7. Cucchi T, Hulme-Beaman A, Yuan J, Dobney K. Early Neolithic pig domestication. Science. 2011;333(6038):512-515.
8. Diamond J. *Guns, germs, and steel: the fates of human societies*. New York: W.W. Norton & Company; 1997.
9. Diamond J. Evolution, consequences and future of plant and animal domestication. Nature. 2002;418:700-707.
10. Driscoll CA, Macdonald DW, O'Brien SJ. From wild animals to domestic pets. Proc Natl Acad Sci USA. 2009;106(1):9971-9978.
11. Fraser D, Weary DM, Pajor EA, Milligan BN. A scientific conception of animal welfare. Anim Welf. 2013;12(4):459-478.
12. Gonyou HW. The social behaviour of pigs. In: Keeling LJ, Gonyou HW, editors. *Social behaviour in farm animals*. Wallingford (UK): CABI; 2001.
13. Hare B, Tomasello M. Human-like social skills in dogs? Science. 2005;298(5598):1634-1636.
14. Hemmer H. *Domestication: the decline of environmental appreciation*. Cambridge: Cambridge University Press; 1990.
15. Hemsworth PH, Coleman GJ. *Human-livestock interactions: the stockperson and the productivity and welfare of intensively farmed animals*. Wallingford (UK): CABI; 2011.
16. International Dairy Federation (IDF). The implications of cattle domestication. In: Cow Talk; 2008, p. 25-34. Available from: http://www.publish.csiro.au/ebook/chapter/9781486301614_Chapter3
17. Jensen P. Behaviour genetics, evolution and domestication. In: Jensen P, editor. *The ethology of domestic animals*. Wallingford (UK): CABI Publishing; 2002, p. 13-30.
18. Koolhaas JM. Coping styles in animals: current status in behavior and stress-physiology. Neurosci Biobehav Rev. 1999;23(7):925-935.
19. Larson G, Fuller DQ. The evolution of animal domestication. Annu Rev Ecol Evol Syst. 2014;45:115-136.
20. Leclercq B. In: Sauveur B, de Carville H, editors. *Le Canard de Barbarie*. Paris: INRA; 1990.
21. Lindqvist C, Jensen P. Effects of age, sex and social isolation on contrafreeloading in red junglefowl (*Gallus gallus*) and White Leghorn fowl. Appl Anim Behav Sci. 2008;114(3-4):419-428.

22. Marshall F, Weissbrod L. Domestication processes and morphological change. Curr Anthropol. 2011;52(S4):S397-413.
23. Mason G, Rushen J. *Stereotypic animal behaviour: fundamentals and applications to welfare*. Wallingford (UK): CABI; 2006.
24. Moberg GP, Mench JA. *The biology of animal stress: basic principles and implications for animal welfare*. Wallingford (UK): CABI; 2000.
25. Mormède P, Andanson S, Aupérin B. Exploration of the hypothalamic-pituitary-adrenal function as a tool to evaluate animal welfare. Physiol Behav. 2007;92(3):317-39.
26. Morton DB. Behaviour of rabbits and rodents. In: Jensen P, editor. *The ethology of domestic animals*. Wallingford (UK): CABI Publishing; 2002, p. 193-209.
27. Price EO. Behavioral development in animals undergoing domestication. Appl Anim Behav Sci. 1999;65(3):245-271.
28. Price EO. *Animal domestication and behavior*. Wallingford (UK): CABI; 2002.
29. Ratner SC, Boice R. Effect of domestication on behaviour. In: Hafeez ESE, editor. *The behaviour of domestic animals*. 3rd Ed., Baltimore (MD): Williams & Wilkins; 1975, p. 3-19.
30. Smith BD. Low-level food production. J Archaeol Res. 2001;9(1):1-43.
31. Solberg MF, Skaala Ø, Nilsen F, Glover KA. Does domestication cause changes in growth reaction norms? A study of farmed, wild and hybrid Atlantic salmon families exposed to environmental stress. PLoS One. 2013;8:e54469.
32. Tinbergen N. *The study of instinct*. Oxford: Clarendon Press; 1951.
33. Trut L, Oskina I, Kharlamova A. Animal evolution during domestication: the domesticated fox as a model. BioEssays. 2009;31(3):349-360.
34. Borell VE. Heart rate variability as a measure of autonomic regulation of cardiac activity for assessing stress and welfare in farm animals. Anim Welf. 2007;16(2):175-182.
35. Wayne RK, Holdt VBM. Evolutionary genomics of dog domestication. Mamm Genome. 2012;23(1-2):3-18.
36. Wilkins AS, Wrangham RW, Fitch WT. The "domestication syndrome" in mammals: A unified explanation based on neural crest cell behavior and genetics. Genetics. 2014;197:795-808.
37. Wood-Gush DGM. A history of the domestic chicken from antiquity to the 19th century. Poult Sci. 1958;37:321-6.
38. Zeder MA. Animal domestication in the Zagros: an update and directions for future research. In: Petrography and prehistory of the Zagros; 2008.
39. Zeder MA. The domestication of animals. J Anthropol Res. 2012;68(2):161-90.
40. Zeder MA. Pathways to animal domestication. In: Gepts P, Famula TR, Bettinger RL, Brush SB, Damania AB, McGuire PE, *et al*., Editors. *Biodiversity in agriculture*. Cambridge: Cambridge University Press; 2012, p. 227-259.