Behavioral Differences between Sheep, Goat, Cattle and Buffalo

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ABSTRACT

This comprehensive study delves deep into the behavioral variances in foraging and general activity among sheep, goats, cattle, and buffalo, shedding light on their remarkable adaptation to diverse environmental conditions. Each species displays unique behaviors rooted in evolutionary adaptations and dietary preferences. Sheep, as grazers with a preference for grasses, tend to flock closely, enhancing their safety against predators. In contrast, goats, with their browsing behavior and preference for varied vegetation, exhibit independence and agility, enabling them to exploit a wider range of foraging niches. Cattle and buffaloes thrive in different environments due to their distinct grazing and social behaviors. Understanding these differences is crucial for effective livestock management and can optimize grazing patterns, enhance resource use, and improve sustainability across different environments.

INTRODUCTION

The response of an organism to a stimulus is known as behaviour. Alternatively, the way an organism reacts to a particular situation, circumstance, or stimulus is behaviour. A stimulus could be either endogenous or exogenous. The response

of an organism towards a stimulus may vary depending upon the spatiotemporal situation. Besides, the behaviour itself may be different depending upon the involvement of the system or the function of the organism. The sciences that deal with animal behaviour are classified under 'ethology.' Ethology is one of the most exciting branches of zoology/animal science. It deals with the scientific and systematic study of the behaviour of an animal.

Sheep and goats are ungulates (or hoofed mammals), belonging to the highly successful order Artiodactyla, the family Bovidae (including true bovines, buffalo, goats and sheep) and the tribe Caprini (comprising sheep and goats). In Asia and Europe sheep and goats have competed for habitat, resulting in sheep occupying lower mountain slopes and hills, whereas goats are found in steep cliff areas (Clutton-Brock, 1999). The Capra (goat) and Ovis (sheep) are two different genera which though occur together, yet exhibit striking ecological separation. Moreover, the two species have important anatomical differences therefore it is expected that the sheep and goats would differ in their general behavioural patterns and maternal behaviour.

The wild ancestors of cattle were local races of aurochs (*Bos primigenius*). These were probably domesticated independently around 9000 years ago in western Asia, Africa, China and India (Clutton-Brock,1999). In India a local subspecies of aurochs was domesticated to give rise to cattle with a shoulder hump, floppy ears and pronounced dewlap, and a characteristic form of Y-chromosome, together with distinctively shaped vertebrae. These are called zebu cattle or *Bos indicus*, and are now common in many subtropical and tropical environments worldwide. The hump less cattle that originated elsewhere are known as taurine cattle (*Bos taurus*). In spite of their genetic differences, taurine and zebu cattle will interbreed freely. Bubalus bubalis is the scientific name of the domesticated water buffalo. In Asia, the domestic water buffalo is generally classified into two principal sub-species; the river type and the swamp type. These sub-species have distinct chromosome karyotypes (50 and 48 chromosomes respectively), and some differences in morphology (body frame, body weight, horn shape, skin colour) and behaviour (i.e., wallowing in water vs. mud). The water buffalo is a valuable species in part because it is considered a multipurpose animal since its meat, horns and skin can all be exploited, as can its rich and nutritious milk, which may be converted into many kinds of cheese, primarily mozzarella. In addition, buffaloes are valuable beasts of burden and work animals. For these reasons, the domesticated water buffalo is often called "the living tractor of the East" since it is relied upon for ploughing and transportation in many parts of Asia.

Behavioral differences between sheep and goat

- ***Agonistic behaviour:*** The dominant feature of fights by goats is the 'clash', where opponents rear up on their hind legs and crash their head and horns together. Goat skulls are particularly thick, to protect the brain from the massive impacts that clashes cause. Although sheep also fight by clashing, only mountain sheep are reported to rear up to deliver blows, and physical fights are preceded by ritualized agonistic displays that resemble courtship behaviours, including nudging, kicking with the forelegs, and making 'rumbles or growling vocalizations.

- ***Social recognition:*** Recognition is based on visual and olfactory (smell) cues, and thus animals that appear visually distinct (as with two breeds) do not integrate, whereas olfactory differences diminish over time. Sheep have pedal scent glands on all four feet, as well as inguinal and facial glands, the latter near the eye. Goats have

pedal glands on only two feet and have a tail gland, which may explain why goat tails are constantly raised whereas sheep tails are usually carried low. The ability of sheep to distinguish familiar sheep from pictures of their faces alone has uncovered a remarkable ability of sheep to recognize more than 50 different individuals and to retain that memory for at least 2 years (Kendrick *et al*., 2001).

- ***General Patterns of Behaviour:*** The frequency of grazing at shoulder level and grazing on the hind legs was greater in goats than the sheep. The frequency of grazing head down was greater in sheep than the goats. The goats moved and rested alone to a greater extent than the sheep. The exploration of environment is an important activity, the goats engaged in this behaviour to greater extent than the sheep. The sheltering was also greater in goats than the sheep. The goats showed greater amount of resting in contact/proximity behaviour than the sheep. The sheep mothers allowed greater amount of udder acceptance than the goats. But the goat mothers were more udder rejecting than the sheep. While goats emitted greater number of low-pitched bleats than the sheep; the sheep on the other hand, emitted greater number of high -pitched bleats. The sheep mother approached their young more than the goats. The goats on the other hand, made greater number of departures from their infants. In addition, sheep exhibited greater frequency of tongue manipulation of the palate and smelling than the goats.

- ***Foraging and Feeding Behaviour:*** In general sheep are grazers that occasionally browse and goats are browsers, although they may also graze. This means that, when given the choice, sheep will preferentially eat grass and herbage, whereas goats prefer leaves and shoots from trees and bushes. Goats are well adapted to their browse diet, with mobile lips to select leaves and a digestive system that is more efficient at dealing with roughage than sheep. In addition, as agile climbers, in some environments goats will even climb into trees to obtain browse, e.g. the famous tree goats of Morocco. Sheep prefer clover in the morning and grass in the evening-and seasonal variation, suggesting that animals have some memory of the location of different food types. In specific tests, sheep have been found to have excellent spatial memory and are able to learn the location of food patches after a single trial.

- ***Water intake:*** In general, goats are better at conserving water than sheep and, possibly due to their browse diet, may be able to obtain nearly all their water requirements from their food. In drought regions, such as parts of Australia, sheep may spend considerable amounts of time walking to water, will only forage within range of a water source and can cope with less than daily drinking only when succulent plants are available. Sheep approached the water trough very suddenly and when 1 or 2 animals started to approach the watering point, the other animals followed. When a herd of goats was approaching the water trough, and when occasionally 1 goat decided to drink, the others were not observed to follow.

- ***Fear and predation:*** For sheep in particular, which may be managed in large groups with little contact with man, human contact and handling can be a significant source of fear and stress. most contacts that sheep do have with people are aversive (shearing, dipping, drenching, etc.). As sheep are very good at learning associations between places, people and negative experiences this means that most management actions, even if benign but

occurring in a place where an aversive procedure has happened previously, cause sheep stress. This can be reduced to some extent by quiet, skilled and sympathetic handling and keeping aversive contacts to a minimum. Domestic goats are often kept in smaller groups with closer associations with humans, and may therefore have a more positive view of human contact, although this will still be greatly affected by the quality of handling they receive.

Behavior of cattle

The word "cattle" includes bovine, such as cows, bulls, male calves, and heifers that are mainly domesticated by people for obtaining products, especially for milk and meat.

- ***Grazing/foraging behaviour:*** Among all behaviour's, foraging is essential for any animal for its survival. Searching for food by an animal is known as foraging/grazing/feeding behaviour. It is crucial for an animal for its survival and reproductive fitness. Cattle are diurnal animals **(**Do lev *et al*., 2014) and forage during the daytime. Cattle naturally feed on herbaceous plants, but seasonal and other environmental factors can affect their preference. cattle notably prefer high-quality food (Bailey and Sims, 1998**)**. The cattle do not alter their foraging route when they are confronted with a scarcity of high-quality food; whereas, when food is available in plenty, they change the directions of the foraging route. cattle grazing on high-quality food spend less time, and cattle grazing on low-quality food spend more time to compensate for the nutrient content. Further, cattle spend a long time for grazing in pastures with more quantity of food.

  The smaller the size of the cattle, the higher their step rate is when food is not present in enough quantity. As compared to the large-sized breed (even within the same breed), the small-sized breed is more selective for foraging and adaptive to the availability of the food. the grazing period of cattle is reduced due to the presence of sheep; however, the presence of cattle does not affect the grazing time of sheep. the foraging strategy of cattle is like a goat concerning bite rate and the time spent per foraging station. Additionally, Fiber-rich diets increase the time spent on rumination. The grazing efficiency of cattle depends upon the quality of feed. Cattle fed with protein-energy supplements take more amount of dry matter (DM) and neutral detergent fiber (NDF) and spend more time on grazing as compared with those treated with mineral salt only.

- ***Social behaviour:*** Cattle exhibit several social behaviours, such as licking, grooming, mounting, pushing, butting, flehmen, and grazing together either with their relatives or with non-relatives. Most of the time, they are found in the group, except during the calving time. Cross suckling (calve suckling other than own mother) has also been reported (Edwards, 1983). Maternal cows are more associated with other maternal cows and form a larger group than the pregnant cows. Pregnant cows mostly prefer isolation from the group, but after calving, they tend to associate with maternal cows. stability of association among the males is higher as compared to that of the females.

- ***Cow-calve interaction and maternal care:*** In the case of cattle, only maternal care is found; there is an absence of paternal care. Cows nourish their progeny with milk, and there are several interactions between cow and calf. Maternal care is vital for cow-calve

bonding. Behaviours, such as sniffing, licking, locomotor activity, social play, and grooming, are different types of action that can be seen easily during the first 12 days after calving and afterward also.

- ***Cognitive behaviour:*** Learning and memory are the major components of the cognitive skill of animals. cattle have excellent cognitive ability. The learning efficiency of cattle is very high, and they can learn the association between a blue container and food concentration. cattle can retain their memory. Spatial memory of cattle has been reported, e.g., location of the electric shock **(**Markus *et al*., 2014) and memory for food location. cattle can retain their memory for 48 days. Still, in another study, it was found that memory for visual cues could be preserved for up to one year.

- ***Dominance behaviour:*** Dominance behaviour can be easily observed during feeding. most of the time, high ranking individuals replace the middle and low-ranking individuals and spend more time in the feeding place but took less food as compared to that of the other two. the dominancy of any individual within the herd can be defined by their vocalization. Further, changes in the voice of cattle continue within the course of their aging.

- ***Circadian and circannual cycle in cattle****:* The study of the biological rhythm of livestock may be beneficial for cattle management and welfare. In cattle, feeding starts at the time of sunrise and complete after sunset. two peaks of grazing can be seen along the 24-h cycle during the morning and mid-day and resting at night. more grazing during evening time.

Behaviour of buffalo

- ***Thermoregulations:*** River buffaloes raised in tropical regions have an inefficient thermoregulating system under extreme heat conditions. The buffalo possesses certain advantages: scarcer hair and a thicker layer of surface skin (epidermis) with a high quantity of melanin that absorbs heat and gives the characteristic black coloration. Melanin particles trap ultraviolet rays (UV) to prevent them from penetrating the dermis into internal tissue layers, while simultaneously blocking solar radiation from reaching the core of the animal's body. Another advantageous characteristic of the buffalo is the number of hair follicles: only 135-145/cm^2 compared to 3,000/cm^2 in normal zebus-*Bos indicus* cattle. Buffaloes also have a lower density of sweat glands (168 vs. 1680 glands/cm^2), though theirs are commonly larger than in cattle and provide greater thermoregulation capacity. These traits explain why buffaloes require shade, flood zones, and wetlands as additional preferential mechanisms of thermoregulation. The body heat of buffaloes in environments with high temperatures can only be kept normal if the animals have shade, ponds, swamps, or mud available, or frequent application of water, preferably with a wind current for drying, it dissipates body heat, and maintain comfort levels.

- **General patterns of behaviour:** By nature, buffaloes are social animals and live in herds of varying size having clear dominance hierarchies and, in promiscuous groups, headed by a dominant bull. Buffaloes graze a wider range of plants as compared to cattle. The digestibility of crude protein and fibre fractions of the diet is usually greater than

in sheep and cattle. Buffaloes appear to have a larger rumen, slower rumen movements, a smaller rate of outflow from the rumen, and higher bacterial activity. Together, feeding and rumination may occupy 60-65% of the animals' time. The buffalo cows come in heat throughout the year but tend to result more fertile when day light hours decrease, which coincides in tropical areas with greater forage availability. The length of the oestrous cycle is like that of bovines and is on average 21 days, but there is considerable variation in length of the cycle. In buffaloes, the typical signs of oestrous behaviour (i.e. excitability, standing behaviour) are less pronounced than in cattle. In buffalo cows, the fraction of cisternal milk is lower than in cattle (Thomas *et al*., 2005). As a result, lactating buffaloes seem to be sensitive to the slightest change in milking routines, which determines a decrease of milk flow and milk yield. The peculiar buffalo behaviour of wallowing aimed to gain protection against solar radiation and dermal parasites.

- **Resting, social and oral abnormal behaviours:** Lying patterns may be restricted by other buffaloes which could cause the interruption of pen mate resting by stepping on them (Napolitano et al., 2004). Animals also show decreased levels of lying idle, which is likely to represent a fundamental form of resting. Agonistic interactions and subsequent injuries are an emerging problem in buffalo farming. Animals are not dehorned and free to perform any agonistic behaviour. One or more bulls are usually left in the herd since a specific and effective technique of artificial insemination is not available and males, particularly the older ones, tend to be more aggressive toward females and younger males. A further element of social disturbance is that primiparous buffalo cows are often not separated from multiparous animals. Social rank is correlated with age, weight, and seniority in the group. Primiparous cows occupy the lowest ranks with obviously more frequent problems of skin lesions and injuries to the udder. In buffalo oral abnormal behaviours should be studied more extensively. Cross-sucking is often observed in young animals resulting in inflammation or injuries at the prepuce, teats, or navel, but it is also displayed by lactating animals resulting in milk loss.

- **Foraging and feeding behaviour:** As dairy buffaloes originate from tropical areas, they are well adapted to an environment characterised by large variations in food availability and quality (Bartocci *et al*., 2005). Therefore, they usually graze a wider range of plants as compared with cattle. In addition, the digestibility of CP and fibre fractions of the diet is usually greater than in sheep and cattle. This may be because of the lower energy content of the rations generally offered to these animals as well as to certain features of buffalo rumen, which are different from that of other ruminants: a larger volume, slower movements, a smaller rate of outflow and a higher bacterial activity. However, these characteristics tend to disappear when buffaloes are fed with high-energy diets (Kennedy, 1995). In the same climatic conditions, the dry matter (DM) intake of lactating buffaloes is about 30% less than dairy cattle with a mean of 16 kg DM/animal per day as compared with 22 kg DM/animal per day (Terramoccia *et al.*, 2005). However, the use of a shower to cool the animals before milking and during the hottest parts of the day can

increase buffalo daily ingestion (Thomas *et al*., 2005).

CONCLUSIONS

Farmers have good knowledge of the main browse species preferred by different ruminant species. In the rainy season, sheep behave like cattle when herbaceous plants are abundant, but shift to browsing as the forage declines, behaving like goats. Cattle and sheep grazing together could degrade the herbaceous cover, while grazing cattle and goats together could be advantageous. Awareness of anatomical, physiological, and behavioral differences among animal species is important for selecting those that best adapt to diverse livestock production systems. It is crucial to develop appropriate technologies for milking equipment specifically adapted to the buffalo's anatomical characteristics. It's important to avoid repeating errors of developing highly specialized dairy production, which led to a higher predisposition to diseases compared to rustic animals like the river buffalo. Implementing production strategies that do not compromise animal welfare is essential. Milking reactivity and daily distance travelled reflect different aspects of water buffalo cow temperament. More reactive cows had lower milk yield with lower fat content and higher somatic cell count. Daily distance travelled was mostly not related to production traits, except for a slight increase in somatic cell count in cows that travelled longer distances.

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