

Ethological implications for management and welfare of dairy animals under climatic stress in tropics

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High yielding dairy animals particularly cattle and buffalo suffer a lot during adverse climatic conditions in tropical countries. India, being the world leader in milk production, possesses highest buffaloes and 2nd highest cattle population in the world. The production potential of these milch livestock not only depends upon their genetic merits but also on the ways they are reared or managed. Behaviour of dairy animal is one of the crucial and direct indicators for assessing the welfare status at farm. It is the behaviour by which a stockman can understand how livestock feels and reacts to certain change in environment and body conditions. In tropical countries like India, there are two kinds of climatic stress prevails viz. heat and cold stress which may severely affect the performance and welfare of livestock. Keeping in view of the significant impact of climatic stress, the present article highlights the ethological implications for management and welfare of dairy animals at farm conditions.

Keywords: Dairy animals, Climatic stress, Livestock behaviour, Management

Importance of livestock behaviour

The science which deals with the study of behaviour and its implications is called as *ethology*. The study of livestock behaviour helps to know how and why they react which could lead to a safer working environment at farm for animals as well as handlers. The behavioural principles can be applied for humane handling procedures of livestock in order to minimize unnecessary stress. Most animals respond to calm, gentle, and consistent handling. Livestock have a definite social order. They may become agitated when isolated and will try to return to the group. Behavioural and physiological systems are both involved in the response to stress and are often used in combination to assess stress. Behavioural responses to aversive stimuli often act to remove the animal from a potentially harmful situation as a first line of defense. Factors that may influence a behavioural response include the individual's characteristics, species,

breed, previous experience and the nature and severity of the stressor. Shelter seeking behaviour is quite prominent in livestock under climatic stress conditions and acts as one of the important indicators to assess the welfare of livestock (Fig. 1).

Climatic stress

There are mainly two types of climatic stress in tropical countries viz. heat and cold stress. These stress factors affect most of the livestock species irrespective of their age or sex. Global warming is one of the specific examples of climate change which refers to the observed increase in the average temperature of the air and oceans in recent decades. Livestock production is adversely affected by detrimental effects of extreme climatic conditions. Consequently, adaptation and mitigation of detrimental effects of extreme climates have played a major role in combating the climatic impact in livestock production. Reducing climate related stresses on livestock

remains a major challenge to livestock producers, entrepreneurs and research professionals. Welfare of livestock is mainly dependent on housing system and management practices at farm which varies upon the existing climatic conditions and production systems.

Heat-stress in dairy animals

Heat-stress is very common in tropical countries due to long period of adverse agro-climatic conditions which may lower the productive and reproductive efficiency of livestock based on its severity during the summer season. It occurs when atmospheric air temperature in association with relative humidity goes on higher side beyond the threshold level of animals tolerating capacity. High ambient temperature, relative humidity, and radiant energy compromise the ability of animals to dissipate heat. The level of tolerance in heat-stress varies based on species, breed and physiological condition of the



Fig. 1. Shelter seeking behaviour during heat stress

livestock. The indigenous or native cattle (*Bos indicus*) are well known for their resistance whereas crossbred and exotic cattle (*Bos taurus*) are more prone to heat-stress.

Behavioural signs of stress in dairy animals

When heat-stress occurs in dairy animals, they show significant changes in behavioural signs while performing routine activities which can be described as below:

- **Reduction in feed intake:** Heat-stress causes reduction in feed intake of livestock as a consequence to physiological adaptation. In summer stress, the flow of blood to the internal organs is reduced which results in decreased activity of digestive organs leading to sub-optimal appetite and reduced feed intake.
- **Increase in water intake:** Due to increased fluid loss from body through sweating and evaporation, there is increased water intake, practically more common in high-yielding dairy cows.
- **Reduced rumination:** As the feed intake is low and due to elevated rumen temperature, the rumination activity is consequently reduced.
- **Increased salivation:** If temperature and humidity is too high, the livestock may start salivation to dissipate heat from the body.
- **Panting:** In extreme heat stress condition, some of the livestock show rapid respiration rate along with drooling of saliva.
- **Restlessness:** The extent of restlessness in livestock can be noticed from the increase in moving pattern with symptoms of showing uneasiness or discomfort.
- **Abnormal behaviour:** The livestock may also display some abnormal behaviours like licking inanimate objects, stamping of feet or legs and nervous signs such as excitement or exhausted conditions.
- **Change in body conditions:** The livestock during heat-stress may get dehydrated due to excessive fluid losses. The ocular mucosa sometimes gets congested and eyes become sunken due to dehydration. The hair coat or skin shows burning sensation if solar radiation is too intense. The white pigmented animals and particularly exotic breeds or its crosses are more prone to sun burn.

Ameliorative strategy to heat-stress

Heat stress not only affect the livestock performance and behaviour but also compromise to basic needs pertaining to welfare measures of livestock. To ameliorate heat stress in livestock, several principles of management practices can be applied such as modified shelter, change in feeding strategy and selection of tolerant breeds. Following practices should be adopted to combat heat stress in livestock:

- The orientation of the building must be considered while planning the animal shelter. The preferred orientation of the buildings is an east-west orientation to avoid solar

radiation and to achieve maximum shade.

- Provision of shade reduces the 30% of heat load compared to the house without shade. Trees can be very effective for providing shade to animals. There are various type of roofing materials and the most effective is a sun reflective roof made with insulation property.
- A fogging system is effective in hot areas with low humidity.
- A misting system consists of a series of misting nozzles placed in a sequence in tubing and pressurized to provide a fine spray of water droplets. Misting systems are used with good success where humidity is typically low.
- Evaporative cooling through water evaporation in the incoming air flow is an economical method for combating heat stress but it causes an increased relative humidity up to 90%.
- Tunnel ventilation is another option that increases airflow to reduce summer stress.
- Conductive cooling with water-cooled summer exchangers has the advantages of recycling water and this application may also improve animal hygiene and reduce humidity in the house compared with evaporative cooling systems.
- Air conditioning is the most effective option for reducing air temperature and relative humidity. Because of the installation costs and lack of compatibility with housing systems, this has not become a common cooling system.

- In summer season, the proportion of green fodder should be increased and concentrate or protein rich component should be reduced in feeding to livestock particularly the dairy animals. The feeding time may also be shifted towards evening or night to ameliorate from heat-stress. Plenty of fresh, clean and wholesome water should be made available all the time.
- Tropical conditions are very vulnerable to susceptible livestock thus selection should be aimed to increase the heat tolerant varieties or breeds in view of minimizing the impact of climatic stress.

Cold-stress in dairy animals

It occurs when environmental temperature reduces below to the threshold temperature of the body. The livestock being homoeothermic in nature try to maintain their internal body temperature by conserving heat loss and increasing metabolic activities. The normal body temperature of livestock varies from species to species, however in most of the case it is approximately 39°C. If ambient temperature reduces below 15°C, dairy animals need additional care and management to combat cold stress. They need more calories and protein rich in diet to increase internal heat.

Behaviour changes during cold-stress

The dairy animals in general display following behavioural changes during cold-stress conditions. They start shivering, try to huddle

together if kept in groups, the hair on coat may raised or erected, increased feed intake particularly dry feed or concentrate, reduce water intake etc. The hair on coat becomes dense and longer particularly in high altitude regions.

Management of livestock during cold-stress

The livestock should be protected from cold-stress than only their welfare measures can be taken into account. Following important points should be considered while cold-stress management of livestock

- Provide proper shelter to livestock as per the prevailing climate. The young animals should be especially protected from draft air during the winter.
- The additional heat-sources like heat radiator or convector may be installed in closed housing system.
- There should be provision of proper bedding to livestock especially neonatal calves and pregnant animals.
- Feed extra supplementation on concentrate or protein rich diets. Energy rich supplement may also be added to increase the palatability and calorie values of the feed.
- The ventilation of shed should be regulated in such a way that air flow should neither be too high or very low.

Need to adopt welfare measures of livestock

The welfare of livestock relates primarily to its ability to cope, both

with its external environment, including housing, weather conditions and with its internal environment such as specific pains, fever and nutritional status. Livestock should be provided sufficient floor space indoor as well as outdoor for displaying their innate natural behaviour. The feeding should be proper and regular with balanced feed. Implications of behaviour knowledge and welfare standards of livestock are very important for sustainable production system.

Climatic stress may negatively affect the production and reproduction performance of livestock under tropical climatic conditions. As the heat and cold stress are obvious, livestock producers should be well prepared to provide essential needs to protect these valuable live assets to mitigate their effect. The heat-stress can be reduced by providing proper shelter and altering the existing nearby environment whereas cold-stress can also be taken care in account during winter months in tropics. The climatic stress needs to be alleviated by application of livestock behaviour based on their preference, comfort and welfare standards for better optimum productivity in tropical conditions.

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Jai Kisan, Jai Vigyan

- A total of ₹ 788.33 crores have been sanctioned for opening six new agricultural colleges for eastern India under Central Agricultural University, Imphal, and a new Central Agricultural University in Meghalaya.
- For the establishment of two new agricultural research institutes in Assam and Jharkhand, a sum ₹ 100 crores is allocated.
- First academic session of the Rani Lakshmi Bai Central Agricultural University has been allocated for four new agricultural colleges in Dantiwada and Jhansi.
- An Memorandum of Understanding was signed for transforming the Rajendra Central Agricultural University, Pusa, Samastipur, Bihar. A proposal of ₹ 400 crores is submitted in EFC.
- Post-Graduate Institute of Horticulture is being established in Amritsar, Punjab.
- Foundation stone of the Indian Institute of Agricultural Biotechnology is laid at Ranchi for promoting agricultural biotechnology.