Indian Journal of AgriVet Research
Volume 1, Issue 4, 2021, Pp. 162-164
Available online at https://aavpublisher.com
ISSN: XXX-XXX

ORIGINAL ARTICLE

Heat Stress in Buffalo and its Management

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INTRODUCTION

Heat stress is a major problem causing economic losses to the dairy farmers. It causes hyperthermia and at its most severe form can lead to death. More commonly, heat stress reduces feed intake, milk yield, milk constituents, growth rate and reproductive function in livestock. The plains, coast-line and foot-hill regions of the Indian subcontinent, home to over 90% of the world's buffaloes, experience varied and extreme weather conditions, with temperatures reaching up to 48℃ in summers and as low as minus 2℃ in winters. The presence of large buffalo population in India as per climatic conditions indicates that buffaloes are well-adapted to such climatic extremes. **Yet, it is generally believed that buffaloes are sensitive to heat stress, owing to:**

Thick black skin color that absorbs more solar radiations, which are high in the region.
Sparse hair coat, considered inadequate to insulate the buffalo from high temperatures.
Buffalo skin has fewer (almost 1/6th) sweat glands in the skin than Zebu, situated deep in the skin, compromising heat dissipation through evaporative heat loss. These peculiar morphological and anatomical characteristics make buffalo poor thermoregulatory, thereby tending to increase the internal body heat, which in turn, takes its toll on food intake, productivity as well as the reproductive performance of the animal. Thus it leads to scarcity of milk during summer months, while most of the calving is concentrated during rainy and winter months of the year.

NATURAL DEFENSE MECHANISM TOWARDS HEAT STRESS

Characteristic black skin that contains numerous melanin granules, which provide protection against UV rays component of sunlight. UV rays are abnormally high in the typical hot climates of the tropics.

Buffalo dermis has well-developed sebaceous glands and their oily secretions make skin slippery for water and mud. The oil secretions from skin make it more lustrous during summer to reflect solar radiations more effectively.

Common terms associated with heat stress:

- Muscular pain and spasm due to heavy exertion in a hot climate.
- Excessive loss of body fluids (usually through sweat) leading to fatigue.
- Break-down in the thermoregulatory system of the body leading to increased internal temperature with no sweating and death, if not immediately treated.

How to recognize heat stress:

- Changes in consciousness: Rapid and weak pulse, rapid but shallow breathing;
- Abnormal vital parameters: Elevated heart rate, respiration rate, rectal temperature;
- Unusual salivation: Capillary refill is very fast
- In case of heat stroke - Very high body temperature sometimes as high as 106–108°F. Heat stroke is life-threatening, so immediate veterinary attention is a must while moving the animal to a cooler place, giving a bath with cold water or wrapping in wet sheets and providing a fan. Signs of heat exhaustion: Dizziness/unconsciousness; skin becomes dull and may be cold too.

MANAGEMENT OF HEAT STRESS

Modification of the micro-environment / Use of cooling system:

Good management practices include modification of the surrounding environment to reduce the impact of environment and at the same time promote heat loss from the animal. Combating heat stress in buffaloes can be through various management practices such as the provision of shade, increasing air movement and repeatedly wetting the animal with cold water for greater evaporative cooling.

Shade: Simple shade is the basic method of protecting animals from direct solar radiation in day-time during summer. The most effective source of shade is the trees and plants. They provide not only protection from sunlight, but also create a cooling effect through the evaporation of moisture from their leaves.

Air movement: Air movement becomes more important during hot-humid climate for providing cooling and comfort to the animal. Apart from shifting animal to shaded airy place, fans or dairy fans and different types of coolers can also be installed for making the place airy. Air movement increases the rate of heat loss from animal's body surface, only as long as the air temperature is lower than the animal's skin temperature.

Evaporative Cooling: For this, various cooling systems have been developed such as holding-pen cooling, exit-lane cooling, and free-stall cooling. These systems are applicable for the animals maintained in covered pucca sheds. An evaporative system which uses water mist with fan is more effective and economises water use in comparison to repeatedly bathing the animals. Some farmers prefer sprinklers or mister, installed on the roof or at various places in the barn. The use of a combination of evaporation and air movement such as 'mist fans' are more effective, economical

and useful than fans and wetting alone. Water sprinklers generate a large volume of wastewater.

Feeding strategies in hot environment:

There are several key areas of nutritional management which should be considered during hot weather. These include special formulation to account for reduced dry matter intake with corresponding greater availability of key nutrients and to compensate for dietary heat increment while avoiding nutrient excesses. The energy requirements of lactating buffaloes also increase under high-temperature conditions, but this increase is apparently caused primarily by the increase in metabolic energy.

Water intake: Water is the most important nutrient for buffalo during hot climate. Water intake is closely related to dry matter intake and milk yield, but regardless of the rate of increase, it is important that abundant water must be available at all times under hot conditions. Hot weather, declining dry matter intake and high lactation demand require increased dietary mineral concentration. The primary cation in bovine sweat is potassium. Sharp increases in the secretion of potassium through sweat occur during hot climatic conditions Alterations in mineral metabolism also affect the electrolyte status of buffalo during hot weather. So it important to supplement minerals during hot climate.

Night Grazing: Buffaloes kept in a shed maintain rapid heartbeat during the night. However, when the animals are allowed out into a pasture at night, these physiological responses decrease immediately. This is the result, both of a reduction in radiation heat from the surrounding buffaloes, as well as increased heat loss from the animal itself.

Feeding High-Energy Diets: Low-fibre, high fermentable carbohydrate diets lower dietary heat increment compared to high fiber diets. Although the metabolic energy of dairy buffaloes increases in a hot environment, heat stress depresses feed intake. For this reason, it is important to increase the energy content of the diet of dairy buffaloes, in order to maintain their energy intake under hot conditions. The heat increment, which is an internal heat stressor in hot environments, is lower in highly metabolizable diets. So it is imperative to use fatty feeds, or calcium salts of fatty acids, as the means of improving energy supply for buffaloes in summer. Buffaloes fed on such diets have higher milk yield, and a lower body temperature and respiration rate.

Feeding by-Pass Protein: Dietary protein degradability is also critical under heat stress conditions. It is well known that excessive protein intake increases heat production and decreases reproductive performance. However, the protein requirement of buffalo increases and dry matter intake decreases in a hot environment, consequently, the protein supplied to lactating buffaloes during summer is not always sufficient. By using fish meal, which is a by-pass protein, the milk yield and protein content of buffalo milk increases but the ruminal ammonia production decreases.

CONCLUSION

In hot-humid climates, although buffalo attempts to acclimatize through physiological changes including cutting down on feed intake and heat production, this does not come without sacrificing part of its productivity. In order to prevent this economic loss to the farmer, there is need to understand and effectively combat heat stress by minimizing its impact on the animal body and its productivity.