

A Review on Heat Stress in Goats and Adaptation

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Abstract:

Among the farm animals, goats are considered to be the best-suited animals to survive in tropical climates. Heat stress was found to negatively influence growth, milk and meat production and compromised the immune response, thereby significantly reducing goats' welfare under extensive conditions and transportation. Although considered extremely adapted to tropical climates, their production can be compromised to cope with heat stress. Therefore, information on goat adaptation and production performance during heat exposure could help assess their welfare. Balancing rations according to reduced level of production, reducing dietary forage to grain ratio, feeding fat, supplementing sodium bicarbonate and other minerals, and maximizing cold water intake may be beneficial for heat-stressed goats.

Introduction:

Livestock production is considered the most widely adopted agriculture practice by marginal and subsistence farmers, particularly in the developing part of the world. With the increasing concern in securing the global economic viability, recent research efforts have ascertained goats as the ideal climate animal model due to their better thermo-tolerance, drought tolerance, ability to survive on limited pastures as well as their disease resistance capacity. They are widely distributed in regions with diverse climatic conditions and possess unique characteristics such as water conservation capability, higher sweating rate, lower basal heat metabolism, higher respiration rate, higher skin temperature, and constant heart rate and constant cardiac output. Goats because of these characteristics can survive heat stress better than sheep and cattle. However, intake depression and production impairment do occur in goats under thermal stress.

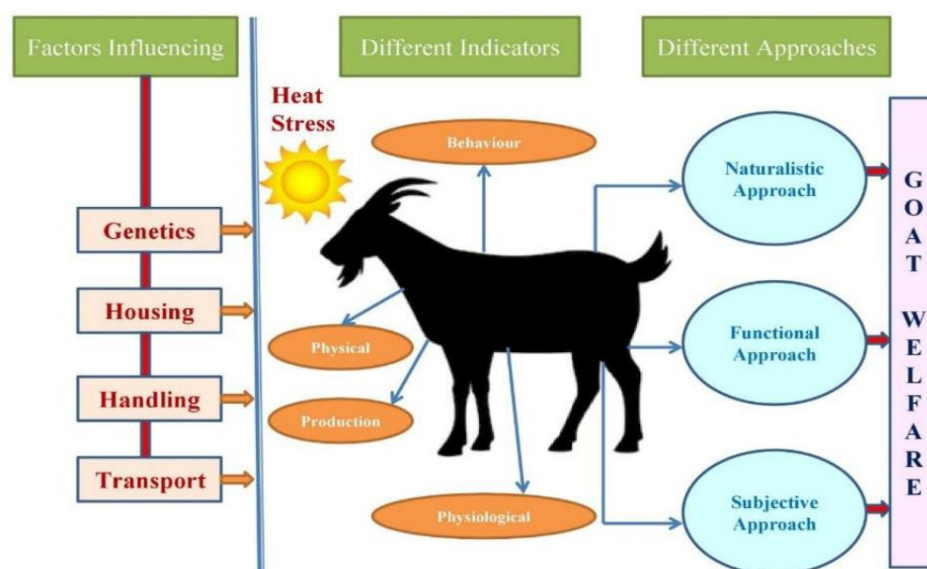
Effect on Goat Production due to Heat Stress:

Extreme heat can have a profound effect on productivity, especially if the onset of heat is sudden, not giving livestock ample time to adapt. It goes without saying that growth

rates are reduced in hot weather, as livestock forage less and have reduced appetites. This situation is often worsened by dry, poor quality forage. If temperatures subside, there is often a risk of acidosis or bloat as livestock engorge on feed.

Prolonged high temperatures (above 90°F/32.2°C) can impair reproduction. Overheated rams may lack libido (sexual desire). Ideally, rams should be sheared six to eight weeks before the onset of the breeding season. Woolly scrotums should be sheared. In extreme heat, rams can be housed during the day and put with the ewes at night. Heat stress lowers the natural immunity of animals, making them more susceptible to disease. It is not uncommon to see cases of pneumonia in extremely hot weather. In general, animals will have less tolerance for parasitic and other opportunistic diseases. During periods of high heat and/or humidity, livestock should be checked frequently for signs of distress.

Physiological Mechanisms of Goats towards Adaptation to Heat Stress:



Upon prolonged exposure to heat stress, goats elicit specific physiological mechanisms that confer them the potential to tolerate heat stress. As an inevitable mechanism that is established during heat stress, physiological variables are often considered among the most reliable goat welfare measures, regardless of breed. Studies on the effect of heat stress in goats have identified a linear relationship between the temperature–humidity index (THI) and the variables associated with the physiological mechanisms. Goats tend to tolerate heat better than sheep. Goats with loose skin and floppy ears may be more heat tolerant than other goats. Angora goats have a decreased ability to respond to heat stress as compared to sheep

and other breeds of goats. Dark-colored animals are more susceptible to heat stress, while light-colored animals may be prone to sunburn. Females usually handle heat better than males. The heat is especially hard on fat animals. Physiological responses to heat stress include increased rectal temperature, respiration rate, heart rate and sweating to facilitate the activation of heat dissipation mechanisms. The changes in rectal temperature, heart rate and respiration rate are the primary welfare indicators of heat stress in goats. The increased respiration rate in goats during heat stress is directly associated with the enhanced evaporative cooling mechanisms to restore the core temperature and meet the higher demand for oxygen. The respiratory frequency is a highly consistent parameter that helps assess heat load or severity of heat stress in goats. The panting scores are assigned based on the visual observations of respiratory patterns of goats using a 5-point or 3-point scale. The heart rate is the regular beat rate of the arteries as the blood is pumped through to the heart. The heart rate varies from 60 to 80 beats/min in goats at resting conditions. The exposure of the goat to heat stress increases the heart rate from 74 to 91 (beats/min), and the increase may be due to elevated respiratory, muscular activity and decreased vascular resistance to blood flow at the periphery.

Future Perspectives:

More research efforts are needed to study goat behavior in their natural environmental condition using advanced facilities to understand the hidden intricacies of their welfare in depth. Welfare information may differ from breed to breed, and such information is very scarce. Therefore, efforts are also equally needed to screen indigenous breeds by subjecting them to various welfare assessment protocols. Such an action would help us understand the genotype–environment interaction and probably help the farming community identify agro ecological zone-specific goat breeds. Such an approach would help the poor and marginal farmers to choose the most suited breed to ensure their economic return. This could be the way forward to optimize goat production and to make goat rearing a profitable enterprise.

Conclusions:

Heat stress is one of the major factors hindering livestock production as it compromises both production and welfare in goats. While goats adapt effectively to heat stress, in doing so, their production is compromised. Therefore, quantifying the various productive and adaptive responses may yield important indicators to reflect both production

and welfare in goats. Therefore, a systematic approach is essential to quantify welfare response in goats based on how they perform in their natural environment, their growth and reproductive performance, physiological function, behavior, feelings, and emotions involving animal psychology. Such an approach may help to assess the stress level in goats during heat stress and probably may provide helpful information to implement appropriate strategies to ensure welfare.

Reference:

- Alam, M.; Siwar, C.; Islam, R.; Toriman, M.E.; Basri, T. Climate change and vulnerability of paddy cultivation in north-west Selangor, Malaysia: A survey of farmers' assessment/*Md. Acad. Ser. Univ. Teknol. MARA Kedah* **2011**, *6*, 45–56.
- Darcen, N.; Cedden, F.; Cankaya, S. Spraying effects on some physiological and behavioural traits of goats in a subtropical climate. *Ital. J. Anim. Sci.* **2007**, *7*, 77–85.
- Livestock systems in developing countries: A review of what we know and what we need to know. *Agric. Syst.* **2009**, *101*, 113–127.
- Robertshaw, D., 1968. The pattern and control of sweating in the sheep and goat. *J. Physiol.*, *198*: 531-539.
- Sejian, Veerasamy, et al. "Heat stress and goat welfare: Adaptation and production considerations." *Animals* **2021**, *11.4*: 1021.