AGRIALLIS
Science for Agriculture and Allied Sector: A Monthly Magazine
Volume 6, Issue 12
www.agriallis.com

Article Id
AL04411

HEAT STRESS MANAGEMENT IN POULTRY FARMS

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Heat stress is a significant concern in poultry farming, especially during the summer months, when ambient temperatures rise. This condition occurs when there is an imbalance between heat production and heat dissipation in the bird's body. Poultry have the ability to regulate their body temperature throughout the year, but their thermoregulatory systems function optimally only within a thermoneutral zone, typically between 27.5 and 37.7 °C (Scanes, 2015). When temperatures exceed this range, birds struggle to maintain their body temperature, leading to heat stress. Heat stress is a critical issue, as it can lead to major financial losses in poultry production, affecting feed intake, growth, egg production, and overall health.

Thermoregulation in Poultry

Birds have a variable internal body temperature, which is different from mammals. For instance, a newly hatched chick's body temperature is approximately 39.7 °C (103.5 °F) (Dawson and Whittow, 2000), while an adult chicken's body temperature ranges around 40.5 °C (Donald and William, 2002). Poultry require a body temperature of around 106 °F (41.1 °C) for optimal production. Factors such as plumage, body weight, acclimatization, dehydration, and feather distribution influence the thermoneutral zone in chickens (Dawson and Whittow, 2000; Donald and William, 2002). During high temperatures, their ability to maintain a stable body temperature is compromised, which can lead to metabolic disturbances and reduced performance.

Strategies to Prevent Heat Stress in Poultry

To mitigate heat stress and its associated negative impacts, various management strategies must be employed, focusing on environmental control, nutrition, and health.

Management techniques

House Design and Environmental Control

The construction and design of poultry houses play a crucial role in preventing heat stress. Proper orientation and ventilation are essential for maintaining a comfortable temperature inside the poultry house. In warmer climates, poultry houses should be oriented with the long axis running east to west to reduce the exposure to direct sunlight and encourage natural airflow. The roof should be insulated, as about 60% of heat from outside enters through the ceiling (Donald and William, 2002). To improve airflow and reduce heat buildup, air velocity should be optimized. High air velocity significantly enhances heat loss through radiation and convection, which can help cool the birds (Yahav et al., 2004). For regions with high ambient temperatures and low humidity, evaporative cooling systems, such as cooling pads and sprinklers, can be used to maintain an optimal temperature and humidity level within the house.

Feeding management

Feeding practices are essential in managing heat stress, especially during the hottest parts of the day. Intermittent feeding programs have been found beneficial in poultry farming, where broilers are fasted before or during peak heat hours (Farghly et al., 2018a). This approach helps reduce the metabolic heat produced during digestion, absorption, and metabolism. Feeding should ideally be done in the early morning and late evening when ambient temperatures are lower. While reduced feed intake may lead to slower growth rates, it allows birds to conserve energy and manage heat stress more effectively (Richards and Proszkowiec-Weglarz, 2007). In tropical regions, wet feeding has been shown to mitigate heat stress, improving bird performance by increasing water intake and hydration (Awojobi et al., 2009; Lin et al., 2006).

Water management

Birds' body temperature is lowered by their increased water intake (Lara and Rostagno, 2013). Birds typically drink 2–3 ml of water in the winter and 4–5 mL in the summer for every 1 g of feed consumed. Ad libitum access to clean, chilly water below 25 °C with ice added is necessary to maintain a steady body temperature in birds. To keep birds from being dehydrated, there should be more drinkers, more space, and a guaranteed water supply (Abbas et al., 2008).

Litter management

In warmer weather, the temperature of the litter rises. Litter should be kept fairly moist to lower its temperature (Bessei, 2006). Wet litter in the summertime indicates higher humidity levels within the poultry house, while dry litter might lead to excessive heat and lower humidity (Donald and William, 2002).

Health management

High ambient temperatures cause unfavorable changes in the gut's natural bacterial populations. Probiotic supplementation may improve the diversity of microbiota in birds' caecum and jejunum, preserving natural stability and microbial equilibrium. Layer and breeder flocks should undergo routine serological screening for Newcastle disease (ND), avian influenza (A.I.), salmonellosis, and mycoplasmosis.

Nutritional manipulation

a. Protein level

In chickens, excessive protein metabolism worsens ionic imbalance and raises the heat burden (Donald and William, 2002). Lower protein rations enhanced with some important amino acids, like tryptophan, lysine, methionine, and threonine, will perform better under heat stress circumstances than higher protein rations (Donald and William, 2002).

b. By using fats in ration

Adding fat to the diet to increase its metabolizable energy level is a popular summertime practice (Donald and William, 2002). By increasing calorie intake and decreasing the feed's particular dynamic action (Lara and Rostagno, 2013), fat helps birds adapt to extreme temperatures (Abbas et al., 2008). Because fat has a lower heat increase than protein and carbs, a higher fat content (up to 5%) in chicken helps lessen the negative effects of heat stress (Ghazalah et al., 2008). Additionally, eating fat slows down the rate of passage of digesta through the gastrointestinal tract (Donald and William, 2002), boosting the absorption and retention of nutrients (Daghir, 2008).

c. By using synthetic amino acids

Suganya et al. (2015) state that critical amino acid levels should be between 5 and 10% greater than those typically used with the same amount of protein. Feed should not contain a lot of crude protein and should be made up of up to 100% digestible amino acids (Adzona

and BangaMboko, 2017). Digestible lysine-to-energy ratio should rise by 5% to 10% in conditions of heat stress.

d. By vitamin supplementation

During heat stress, corticosterone levels can be lowered by adding vitamin C to drinking water or feed (Attia et al., 2009). vitamin C also helps birds with heat stress (Attia et al., 2009), feed intake, body weight gain, body temperature, oxidative stress, hatchability of fertile eggs, carcass grade, carcass yield, and weight (Khattak et al., 2012; Abidin and Khatoon, 2013; Attia et al., 2016). Vitamin C and E supplements can enhance physiological function, organ weights during heat stress, nutrient digestibility, egg quality, and production performance (Attia et al., 2016; Kumbhar et al., 2018).

Conclusion and recommendations

Heat stress is a significant concern for poultry keepers as it negatively impacts growth, meat quality, laying rate, and egg quality, leading to economic losses. Strategies to manage heat stress include maintaining air flow, feeding at cooler times, wet feeding, and dimming lights. Additionally, maintaining good ventilation, increasing energy levels in rations, and supplementing diets with vitamins, antioxidants, probiotics, and minerals can help mitigate heat stress. Future protein demands may necessitate exploring novel farming practices, nutritional manipulation, and genetic selection to reduce heat stress's negative effects on production.

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