

THE HARMFUL CONSEQUENCES OF HEAT STRESS ON CHICKENS INDUSTRY

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ABSTACT

This article dealt with identifying the importance of heat stress in poultry flocks and the damages resulting from the production of eggs and meat and the spread of pathogens, in addition to that ways to mitigate the harmful effects of heat stress, including physiological, nutritional, engineering and genetics, in order to ensure preservation of the product and reduce damages.

الآثار الضارة للإجهاد الحراري على صناعة الدواجن

علي صباح الحسني

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الملخص

تناولت هذه المقالة التعرف على اهمية الاجهاد الحراري في قطعان الدواجن والاضرار المترتبة على انتاج البيض واللحوم وانتشار المسببات المرضية اضافة الى ذلك السبل الكفيلة بالتخفيف من التأثيرات الضارة للاجهاد الحراري ومنها الفسلجية والتغذوية والهندسية والوراثية بما يكفل الحفاظ على المنتج وتقليل الاضرار.

INTRODUCTION

Heat stress is a major problem in the poultry industry that affects the healthIn the poultry business. Heat stress is a serious concern that has a negative impact on the health and productivity of chickens. Because of heat stress, the U.S. chicken industry lost an estimated \$128–\$165 million between 2003 and 2008, and that number is expected to climb as the earth heats. Temperature extremes may cause hens to get overheated; leading to a condition known as "heat stress" It is the combination of several elements, including high ambient temperature and high environmental temperature, which causes heat stress.

Heat stress in poultry: definition and causes

The imbalance between the quantity of energy going from the bird's body to the surrounding environment and the amount of heat energy generated by the bird causes heat stress. To put it another way, heat stress is caused by a combination of environmental and bird-specific variables. Factors unique to certain species of bird (type - metabolic rate - thermoregulation mechanism). Factors that are beyond of the individual's control, such as (sunlight - thermal radiation - humidity - air temperature - air movement.)

The ideal temperature for avian life

The hypothalamus gland is one of the regions of the brain responsible for thermoregulation, begins to grow during the first week of a chick's life, which necessitates a high temperature of around (35-40 °C). The ideal temperature for adult birds is between 19 and 24 °C.

The reasons why birds are more vulnerable to heat stress.

Most of the body is covered in feathers with no sweat glands. The same body temperature increases as other varieties, reaching 40 °C. The existence of a fatty layer beneath the skin that limits heat loss.

Poultry's behavioral responses to heat stress

A variety of actions are used by birds when they are exposed to high temperatures, including :loss of appetite and consumption of less amounts of feed, which reduces food conversion rates , drinking larger quantities of water , raising the wings , panting , lying down, lethargy and lack of the movement.



Pictures (1, 2): Some of the actions birds engage in to combat heat exhaustion

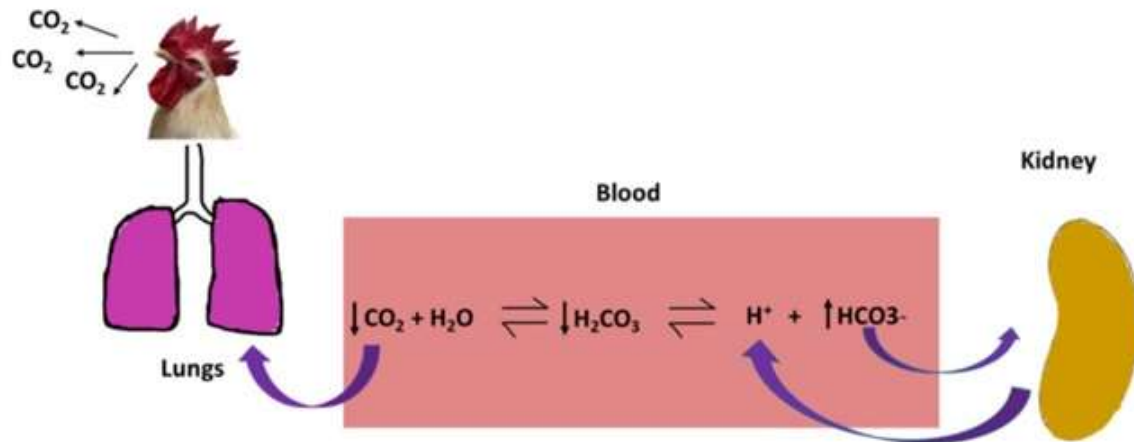
Physiological effects of heat stress in poultry

Homeostasis relies on thermoregulation, which is regulated by the nervous, metabolic, and endocrine systems. The BMR may be calculated using variables such as body mass, confirmation, and morphological factors like fur color. Adaptive thermoregulatory skills let animals thrive under extreme conditions. When temperatures soar outside, birds make adjustments to their own behavior and physiology to try to keep their core temperature stable. When birds are under heat stress, they drink less, raise their wings higher, and go to cooler areas. The birds' air sacs allow them to regulate their body temperature using convection, evaporative heat loss, sweat, and the vasodilation process when the weather outside is cold and wet. Physiological effects of heat stress in poultry could show as:

A- Oxidative stress: is one of the physiological disorders that occurs as a result of heat stress and occurs in the form of an increase in free radicals, which has severe damage to the cell components in the bodies of birds and in turn leads to health disorders and a decrease in growth and production rates.

B - Acid-base imbalance: Because birds lack sweat glands and have feathers covering much of their bodies, they want to lower their body temperature, which causes them to expel more carbon dioxide. As a consequence, the birds' metabolism becomes more acidic, which

lowers their productivity.



Picture No. (3) Shows the acid-base imbalance under heat stress conditions

C- Decreased thyroid hormone levels, which play a critical part in the body's metabolic and development processes.

D- Birds' physiological reaction to heat stress includes a drop in muscle glycogen, an increase in respiratory rate, an enlargement of peripheral blood vessels, and a rise in anxiety.

Heat exhaustion's detrimental impact on immunity and vigor

Poultry's immune systems are known to be affected by heat stress. Thus, infectious poultry illnesses, such as Newcastle Disease (ND) and Gumboro, are more prevalent throughout the summer in locations with warmer climates, as a consequence of this. Species of birds that is able to survive at very high temperatures. In addition, heat-stressed birds have lower levels of antibodies and white blood cells, putting them at greater risk of illness and increasing the breeder's financial burden P`t and the rate of death.



Picture No. (4) Shows a chicken infected with Newcastle disease

Heat stress has a negative impact on productivity

Temperature, light, rainfall, humidity, and altitude are only few of the environmental elements that might affect an animal's diet. Intake may be affected by any of these variables alone or all together. The processes that regulate how much food is consumed and how much blood components are circulating are affected by the inverse connection between the amount of energy required and the effective temperature. High temperatures over the critical limits have also been shown to cause decreased feed intake, decreased feed conversion efficiency, and decreased body weight. Heat from an outside source or from a particular dynamic activity of feed has been seen to affect the rostral cooling center of the hypothalamus, which in turn stimulates the medial satiety center and inhibits the lateral appetite center. Reduced feed intake leads to poorer productivity and/or less efficient reproduction. High levels of sun radiation degrade the chemical makeup and meat quality of broiler chicks. Heat stress has a negative impact on productivity as shown in:

1-Meat production and growth

Broilers' fat deposition and meat quality are influenced by breed-dependent chronic heat exposure. Meat's chemical makeup and quality are also impacted. Chest muscles decreased in percentage, whereas thigh muscles increased in proportion. Due to the detrimental impact on muscle glycogen, the relative protein level is decreased. As a consequence, the body secretes the hormone cortisone in an effort to counteract the effects of overheating. Weight loss and a rise in the food conversion factor are also seen.

2-Egg Production

As a result of the decreased feed intake caused by heat stress, the animals' body weight and food conversion efficiency plummet, which in turn has an adverse effect on egg quality and quantity. As a result, the quantity and size of eggs produced decreases as a result of lower calcium and protein levels in the blood. The quality of the egg shell will be compromised, and the risk of breaking will grow, as will the difficulty of handling and storing the eggs if calcium levels drop and gasping increases.



shows the low quality of eggs as a result of heat stress)5(.Picture No

Reproductive Traits:

The synthesis of sex hormones is significantly impacted by heat stress in male and female, resulting in decreased sexual activity and reduced fertility. Sperm quality, concentration, and vitality in male semen decline under conditions of heat stress. Females exposed to heat stress have fewer eggs and a smaller ovary, which may explain the reduced fertility and low egg weight seen in these women. Egg hatching rates and the number of fledglings produced are both affected by poorer quality shells and an increase in the likelihood of breakage.

Several strategies exist for alleviating hens' heat discomfort.

The capacity of different chicken breeds to endure heat stress varies widely, making genetic improvement an important strategy for dealing with the problem. Dwarfism and a nipple gene. Genes like these may be included into marker-assisted selective breeding to create strains that are both productive and resilient in the face of extreme heat. Rationing food and avoiding feeding during high temperatures are two methods used to prevent heat stress. It's best to feed animals in the early morning or late evening to keep them cooler throughout the day. Feeding birds during the cooler hours of the day has been shown to increase production and lessen their sensation of heat stress. By incorporating water into the diet, wet feeding increases the quantity of water the bird is exposed to and lowers the viscosity of the bird's alimentary canal, resulting in a more efficient digestion process. Pre-digestion, absorption of nutrients from the intestines, and enzymatic digestion of the feed are all boosted by this supplement. Additionally, increased egg production and egg weight of laying hens resulted from the use of wet feeding on broiler birds. Heat stress in chickens may be somewhat mitigated by feeding them high-energy meals rich in fat. In comparison to proteins and carbs, lipids create less heat during metabolism. As a result, increasing dietary fat intake is a tried-and-true method for combating the debilitating effects of heat stress in hot climes. In addition, birds benefit from the addition of mineral salts and vitamins, both of which are excellent for them.

Table No. (1) Shows some vitamins and mineral elements and their effects on birds exposed to heat stress

| additive | Potentially useful for heat-stressed birds. |
|-----------------|--|
| VitaminC | Poultry growth, egg quality, immunological response, and antioxidant status may all be improved by better nutrition. |
| VitaminA | Increase laying hens' live weight, feed efficiency, and egg output. |
| zinc | Vitamin C and vitamin E levels in the eggshells of laying hens may improve eggshell thickness and reduce eggshell defects, as well as improve quail's live weight gain, feed intake, and carcass netting ratio. |
| selenium | Egg output, egg weight, and egg shell strength in laying hens were all improved, as were the birds feed intake, body weight, and egg production. |
| Chromium | weight gain, feed intake, and carcass quality are all improved. Increase insulin levels in broilers by decreasing corticosterone levels and boosting insulin levels |

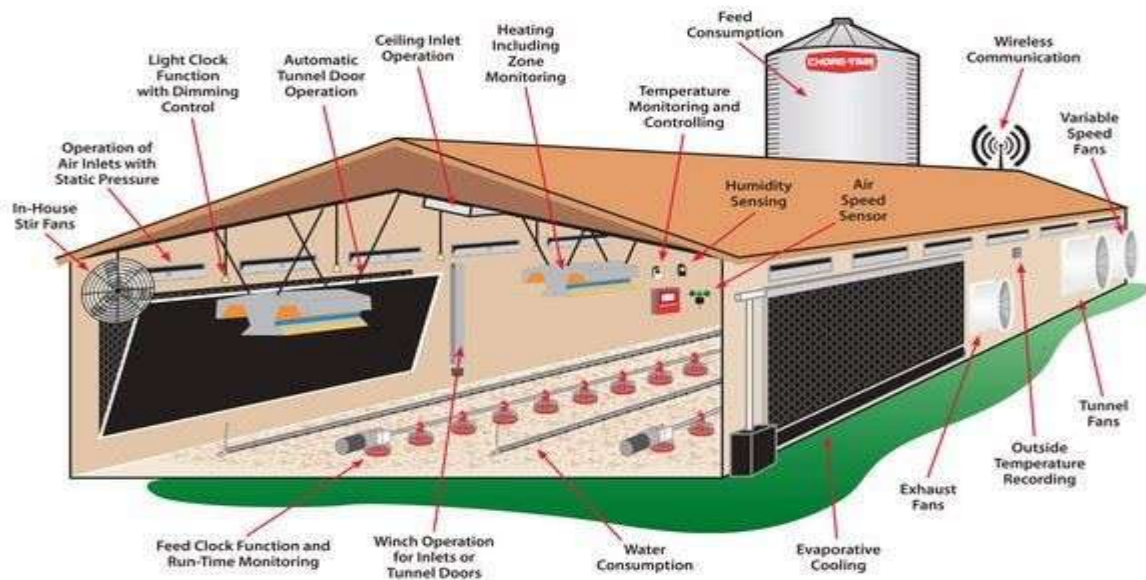
When designing a chicken coop, keep in mind the following:

Because of the increased heat stress caused by a dense population of birds, it is critical to maintain enough floor space for each bird. Air movement in chicken houses is critical not only for maintaining correct levels of oxygen, carbon dioxide, ammonia, and moisture in the air, but also for preventing excessive heat buildup in poultry houses during hot weather via convective heat loss. In order to lessen the intensity of heat surrounding the fields, green spaces and trees should be planted around the fields. Fans are used in conjunction with water sprinklers to counteract the rise in humidity that occurs as a result of the sprinklers' operation.



shows the use of water spray to reduce heat stress in poultry houses)6(.Picture No

As a result of this, the roof should be constructed in the form of a triangle. The field's width ranges from 10 to 12 meters. The walls and ceilings should be covered with a heat-insulating material. It is best to paint the surfaces white so that the sun's rays can bounce off of them. The ceiling-to-floor distance cannot be less than 4 m.



Picture No. (7) Shows a design for a poultry house

Conclusions

Chicken producers lose billions of dollars each year due to the detrimental effects of heat stress on poultry productivity. Heat stress is likely to worsen in the future as a result of increased temperatures brought on by climate change. In addition to decreasing meat and egg production, heat stress also has significant impacts on reproductive efficiency, fertility, and hatching rates in birds that are bred for meat or eggs. Egg quality, yolk color, eggshell thickness, nutritional value, and storage time are all impacted by excessive heat exposure during the production process. Meat quality, chemical composition, flavor, and nutritional value are all adversely affected by heat stress. The synthesis of sex hormones, both male and female, is adversely affected by heat stress, which results in a drop in sexual activity and a decrease in fertility. The quality, concentration, and vitality of sperm in the male semen decreases as a result of heat stress. Females subjected to heat stress had fewer eggs and a smaller ovary, according to research. Genetic enhancement employing genes that boost a bird's capacity to resist heat stress, such as a naked neck and curling feathers, together with adequate food, housing, and care, may be an effective way to alleviate heat stress in birds.

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