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NUTRITIONAL MANIPULATION OF HEAT STRESS IN BROILERS

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Introduction

Birds in hot environments reduce feed consumption naturally, reducing heat from metabolism. Feed conversion efficiency and growth rate is also reduced. Techniques that increase activity or stimulate food consumption may be counterproductive. Feed removal prior to the hottest part of the day has been shown to be beneficial in reducing mortality. The advantages are reduced metabolic heat output, and where feeds systems can be lifted, increased floor space and improved air distribution over the floor. Where feed consumption is decreased due to spells of hot weather, dietary adjustments can help maintain a good supply of nutrients. Protein contributes more metabolic heat than fats and carbohydrates, so a correct energy: protein ratio is important. Dietary vitamins and minerals can be reformulated.

Comfort zone of temperature in poultry:

Birds perform well within a relatively wide range of temperatures. Whether they are broilers, layers or turkeys, this range extends between 10 and 27° C. The highest growth rate of broilers occurs in the range of 10-22° C while maximum feed efficiency is at about 27° C (Kampen, 1984). The optimum temperature for performance of growing broilers is 18-22° C (Charles, 2002). It is known, however, that what is ideal for growth is not ideal for feed efficiency. The most important factor affecting performance in broilers subjected to high temperature is reduced feed intake. However, only part of the reduced performance of broilers is due to reduced feed intake and the rest is due to high temperature per se. In broilers 63% of the reduction in growth is due to reduced feed intake (Dale and Fuller, 1979).

Nutritional manipulation:

Environmental interventions available for reducing the temperature are not economically feasible for many broiler producers to modify the environment. Hence, reducing the heat stress on broilers through nutritional manipulation would be valuable.

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Dietary protein level:

Birds reduce feed intake under heat stress conditions. Broiler chickens reduce feed intake around 3.6% for every increase (1ºC) in environmental temperature from 22 to 32ºC (Ain Baziz *et al*., 1996). This reduction aims to avoid increasing of endogenous heat production since heat production is high when feed intake increase (Koh & Macleod, 1999). Considering the low feed intake of heat-stressed birds associated to diets with low-protein content there is a deficiency of amino acids intake.

The reduction in the crude protein levels in the diet does not affect feed intake of broiler chickens (Blair *et al*., 1999). Modulation of feed intake is not a consequence only of crude protein amount, but also of protein quality, meaning concentration and balance of amino acids. Low-protein diets, formulated according to ideal protein concept, did not increase feed intake (Faria Filho, 2003). Hence, the excess of essential non-limitating amino acids, usual in commercial diets, may help to avoid these nutrient deficiencies during heat stress conditions.

In hot weather the need for maintenance energy is much lower than at an ideal temperature and birds respond by eating less. With the reduction in consumption, there is often a reduction in intake of essential nutrients such as protein, essential amino acids, minerals and vitamins. When this reaches a critical level, the result is reduced growth performance in broilers.

Increasing dietary protein might be detrimental to the bird as more heat is produced during its utilization that may well overload heat dissipation mechanisms (i.e., panting, blood circulation etc.). Therefore, improving overall balance of the diet by amino acid supplementation appears to be more effective than increasing protein intake.

Amino acid digestibility

In heat stress conditions, there is a decrease in amino acid digestibility, but this effect depends on bird sex, being more evident in females (Wallis & Banalve, 1984). Broiler chickens under heat stress during the growing phase had reduced rate of arginine intestinal absorption *in vitro*, hence, the ideal arginine:lysine ration should be higher for broilers in this environmental situation (Brake *et al*., 1998).

Vitamin and Mineral supplements:

Imbalances in acid-base balance occur in heat stressed birds. Therefore, inclusion of various compounds in the diet or water is a common practice to alleviate the adverse effects of heat stress. These include sodium bicarbonate (NaHCO3), potassium chloride (KCl), calcium chloride (CaCl2), ammonium chloride (NH4Cl) and vitamin C (ascorbic acid). Sodium

zeolite and aspirin are also beneficial in reducing the effects of heat stress in poultry. Ascorbic acid and NaHCo3 appear to be the most popular electrolytes used in tropical and subtropical poultry production. Stressors such as disease and heat stress may increase the chickens' need for vitamin C. During heat stress the chicken is not able to synthesize enough vitamin C to meet physiological demands, hence the need for mineral and vitamin supplementation. Supplementation of vitamin C in drinking water at 40 milligrams per bird per day is reported to give beneficial effects in broilers. Also, aspirin in soluble liquid form can be used for its antipyretic (cooling) effect at the rate of 0.3 grams per litre of water. Research has shown that sodium bicarbonate at high temperature stimulates water and feed consumption as well as contributing to improved weight gain. Sodium bicarbonate provides an alternative source of sodium that assists with litter control by providing drier litter and a healthier living environment. The addition of 8 grams of sodium bicarbonate to the 100 litres of drinking water (or 35 grams per 25 kilograms) can be useful in heat stressed broilers to stimulate water consumption (Butcher & Miles, 2003).

Feeding Management:

Reduced feed consumption is the main cause of poor performance at high temperatures and the feeding practices are reported to improve performance of birds under heat stress.

- Ensure good physical quality of feed (crumb, pellets or mash) to encourage appetite.
- If there is enough floor space, extra feeders should be added.
- Feed should not be stored for longer than two months, especially in summer to reduce the possibility of mycotoxin formation.
- Encourage eating at cooler times of the day, i.e., early morning or in the evening.
- Remove feed 4 to 6 hours prior to an anticipated heat stress period.
- Birds should not be fed or disturbed during the hottest part of the day.
- Dim the lights while feeding – using low light intensity during periodic feeding reduces activity that reduces heat load.

Conclusion

The higher production performance and feed conversion efficiency make the chickens more susceptible to heat stress. To alleviate the effects of heat stress, dietary manipulations are necessary, as these can help reduce metabolic heat production and maintain nutrient intake.

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