Nutritional Strategies to Enhance Efficiency and Production of Chickens under High Environmental Temperature

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ABSTRACT

Climate model projections indicate that the global surface temperature will probably rise a further 1.1 to 6.4°C during the twenty-first century; therefore, with this rise in global average temperature significant impact on efficiency, production, morbidity and mortality can be expected on birds and animals. Presently, high environmental temperature exposure is of major concern for poultry industry especially in the hot region of the world because of the resulting poor growth performance, immuno-suppression and high mortality. Different methods are available for decreasing the heat production using various nutritional strategies to alleviate stress in high temperature-exposed chickens. The nutritional strategies are designed after considering the factors such as type of birds, age of birds, stage of production, duration of heat exposure, intensity of heat exposure and health of the birds. The nutritionists can base their strategy on less heat-production, increased nutrient intake, decreased energy wastage, and reduction in heat-induced oxidative stress and damage in birds to overcome the deleterious effects of high temperatures on metabolism, physiology, feed efficiency, production performance and health. This can be accomplished by traditional nutritional strategies to reduce heat stress by feeding good quality feed with high digestibility and nutrient density, adding fat as an energy source, balancing and provision of additional amino acids, and supplementing with vitamins, minerals and glucose. Recently, there are new concepts for nutritional strategies to focus on redox status of the chickens and to decrease the oxidative stress and damage on exposure to high environmental temperature. None of these strategies are effective alone in terms of growth, feed efficiency, livability, meat quality, stress tolerance or immune response, therefore, a combination of the nutritional strategies may help to alleviate the deleterious effects of heat stress and improve the chicken performance under high environmental temperature.

Key words: heat stress, chicken, nutrition, oxidative stress, oxidative damage, uncoupling protein

REVIEW

During the last century global surface temperature increased 0.74±0.18°C, and climate model projections summarized in the IPCC report indicate that the global surface temperature will probably rise a further 1.1 to 6.4°C during the twenty-first century (IPCC, 2007). There is growing evidence that climate-health relationships pose increasing health risks for humans under future projections of climate change and the warming trend over recent decades has already contributed to increased morbidity and mortality in many regions of the world (See review by Patz *et al*., 2005). Same is true for birds and animals, where significant impact on efficiency, production, morbidity and mortality can be expected with rise in global average temperature.

Presently, high temperature exposure is of major concern for poultry industry especially in the hot region of the world because of the resulting poor growth performance, immunosuppression and high mortality (Bottje and Harrison, 1985; Young, 1990; Mujahid *et al*., 2005, 2009b). The continuous selection for fast growth has been associated with increased susceptibility of broilers to high temperature (Geraert *et al*., 1993; Cahaner *et al*., 1995; Berong and Washburn, 1998). Exposure of chickens to high temperature cause significant changes in physiological responses (Harrison and Biellier, 1969; Altan *et al*., 2003, Toyomizu *et al*., 2005, Mujahid *et al*., 2009b). Thermal stress exerts its deleterious effects on feed intake and