

Intestinal Integrity of Broilers Exposed to Heat Stress

Arda Sözcü*

Ödemiş Vocational Highschool, Ege University, Turkey

*Corresponding Author: Arda Sözcü, Ödemiş Vocational Highschool, Ege University, Turkey.

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Abstract

Commercial broilers are increasingly being more susceptible to environmental stress factors, due to rapid growth. Due to global warming, heat stress has become one of the most important affecting factors of broiler performance. This review focused on the intestinal integrity of broilers exposed to heat stress during growing period.

Keywords: Broiler; Heat Stress; Intestinal Integrity; Feed Efficiency

Introduction

During last decades, significant developments have been made in broiler performance including an increment in growth rate and feed efficiency, by genetic selection [1]. However, during the genetic selection processes, some vital organs, such as cardiovascular system, respiratory system and skeletal system, could not develop as parallel to heavier body weight of broilers [2]. This imbalance between the major systems and body weight causes some physiological reactions, health problems and finally economical losses, especially under extreme environmental conditions, for example heat stress due to hot climate conditions [3].

Physiological responses to heat stress

Broilers exposed to high environmental temperatures exhibit some physiological reactions to alleviate with heat stress. There are some mechanisms to maintain the body temperature of the bird within a normal ranges, by respiratory-evaporative [4-6] and evaporative cutaneous mechanism [7,8], sensible heat loss via radiation, convection [3] and conductance [9]. During long term heat stress conditions, acid-base balance is exposed to a disturbance and cause a respiratory alkalosis [10]. On the other hand, some behavioural changes are observed in birds as fast panting, moving away from others, lifting their wings, increasing water consumption and reducing the feed consumption. These changes cause detrimental effects for performance and productivity of broilers, and finally results with an increment in mortality [11].

Heat stress causes some serious economical losses by decline in feed intake, but also in digestibility of nutrients [12]. A peripheral vasodilation could develop associated with extreme heat production, then blood flow and subsequently functionality of intestine show a decline [13,14]. In a study performed by Souza, *et al.* [12] reported that broilers that were exposed to longterm heat stress conditions increased heat production with a value of 35.5%, whereas decreased metabolic energy retention and efficiency [by 20.9% and 32.% respectively], nitrogen retention and efficiency [by 50.4% and 33.1%, respectively], compared to the control broilers.

Heat stress and intestinal integrity

Under heat stress conditions, some morphologic and physiologic changes are observed in the gastrointestinal tract on account of functionality and integrity of intestinal epithelium [15-17]. Such as: change in intestinal microflora [18], disruption in blood flow of gastrointestinal tract [19] and deterioration in intestinal morphological traits, such as villus height, crypt depth, villus width, ratio between villus height and crypt depth and villus absorptive surface area [20,21]. Deng, *et al.* [22] found a decline in villus height and ratio between villus height and crypt depth under heat stress. In another study performed by Burkholder, *et al.* [21], it was reported that villus height decreased to 18.8% in birds exposed to 30°C for 24 h, compared to the control birds raised at 23°C.

It is well known that intestinal mucosa has an important barrier role to protect the organism against pathogenic bacterias and also for digestion and absorption of nutrients [23-25]. The integrity of the intestinal barrier is composed of enterocytes, mucus and immune cells, for example macrophages [26-28]. When the integrity of intestinal barrier under heat stress conditions impair [29,30], intestinal permeability and subsequently intestinal inflammation could show an increment [27,31]. Stress conditions cause a decline in protective functionality of intestinal epithelium and increase susceptibility of birds against some diseases, for example *Salmonella* spp. infections [17,21,31].

As a conclusion, when considering adverse effects of heat stress, some solutions and strategies to alleviate of the health problems and economical losses in broiler production, could be developed with regard to nutritional and management interventions.

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