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STUDY OF THE INTERACTION BETWEEN GENETIC BACKGROUND AND HEAT-TOLERANCE ONPRODUCTIVE PERFORMANCE AND IMMUNITY IN BROILER CHICKENS

By

OMER MOHAMED FAHEM OMRAN

B.Sc. Agric. Sc. (Poultry Production), Fac. Agric., Ain Shams Univ., (2012)

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ABSTRACT

Omer Mohamed FahemOmran: Study of the interaction between genetic background and heat-tolerance on productive performance and Immunity in broiler chickens, Unpublished M.Sc. Thesis, Department of Agricultural Poultry Breeding, Faculty of Agriculture, Ain Shams University, 2021.

Environmental heat stress is one of the most difficult circumstances on the planet, and it has a negative impact on the poultry industry. Because broiler chickens without sweat glands, they are susceptible to heat stress. The current study was aimed to investigate the effects of heat stress exposed on growth performance and Bio-physiological characteristics for (Cobb, hubbard and arbor acres broiler hybrids) under the summer season when environmental conditions of Egypt were revealed. A total of three hundred one day old (one hundred birds from each hybrid) at one day of age were brooding under the same conditions of water, diet consumed, breeding system, vaccines and medications used during the period birds life even slaughtering age. The three strains were randomly divided into twelve groups using a factorial design (3 strain X 2 treatments X 2 replicates) and every group have a 25 bird. The degrees of environmental temperature and relative humidity during housing are (Environmental temperature = 32±2 Celsius degree, Relative humidity =50± 5 percentage) for control group and (Environmental temperature=40 ± 2 Celsius degree, Relative humidity= 20 ± 5 percentage) for the heat stressed group. The body weight, body weight gain, edible parts of carcass (carcass, thigh, drum, breast muscles and giblets weight) and inedible parts of carcass (blood, feathers, head and legs weight) were recorded to heat stressed group and control group. Lymphatic organs such as spleen, thymus and bursa weight were measured also. The blood plasma constituents were measured (Plasma total protein, Albumin, Plasma cholesterol, Plasma triglycerides, Plasma glucose). The last results concluded that the cobb strain showed the best growth performance and

carcass characteristics under heat stress condition, while the arbor acres strain considered the best strain which didn't effected a lot in their rectal temperature such another strains with heat exposure. The arbor acres strain for each group (control and treated) have the highest viability. The control group and Hubbard strain showed an increase in bursa weight compared to heat exposed group and another strains. It was concluded that the Cobb strain has the best performance comparing to the other strains broiler chicken under heat stress during the environmental conditions of Egypt.

Keywords: Broiler, Growth, Carcass, Blood and Heat Stress.

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INTRODUCTION

The poultry industry was major source protein to human so the poultry production increased during last two decades. However, the high ambient temperatures were negative effect of production traits.

Pourreza and Edriss (1992) compared normal temperatures to raising broilers at 20 or 30°C (control and high temperatures successively) until 45 days of age. High temperatures resulted in a higher dressing percentage and lower carcass weights.

Temperature and humidity are two of the most important environmental factors to consider while keeping chickens **(Lourens *et al*., 2005)**. Because of the greater ambient temperature, the temperature of the poultry body is rising **(Altan *et al*., 2000)**, water consumption is increasing **(Arce-Menocal *et al*., 2009)**, and feed consumption is reducing **(Arce-Menocal *et al*., 2009)**. **(Dozier *et al*., 2007)**.

It has been researching the effects of high ambient temperatures on the performance of several poultry species, including broilers **(Dozier *et al*., 2007)**, and has discovered that high temperatures have negative effects on productivity.

Broilers expose to ambient temperature, rise body temperature **(Reddy, 2000)** consequently released the corticosterone into blood circulation to assist metabolism **(Arce-Menocal *et al*., 2009).**

Because poultry without sweat glands for heat release, if panting fails to lower the high internal body temperature, the birds grow fatigued and die from an electrolyte imbalance **(Swayne, 2017)**. Heat stress is a problem for broiler chickens **(Yousaf *et al*., 2019)**.

The current experiment pointed to investigate the impacts of adaptation of heat stress on growth performance and Bio-physiological characteristics for (Cobb, Hubbard and Arbor Acres broiler strains) under the summer season of Egypt.

REVIEW OF LITERATURE

Overview of Heat stress represent a face to poultry production worldwide, and has a depressing influence on performance and the chicken's health **(Daghir, 2008 and Syafwan *et al.*, 2011).** The poultry industry is acquiring significant significance in the agriculture and allied sectors on a global scale. Heat stress, on the other hand, has been demonstrated to have a negative impact on poultry productivity, particularly in tropical areas. The diversion of energy resources from the production pathway to the adaptation pathway may explain why poultry productivity declines when they are exposed to heat stress. There are various techniques to reducing the negative effects of heat stress on poultry production, such as management, genetic, and dietary strategies. These approaches may reduce the damaging effects of heat stress and enhance the productive performance of poultry. Advanced biotechnological technologies may aid in the identification of appropriate genetic markers in poultry birds, which may aid in the development of new strains with improved thermo-tolerance through the use of a correct breeding programme. These strategies may help to optimize and maintain poultry production in the changing climate situation **(Vanada *et al.*, 2020)**.

While the poultry business has grown globally, it has realised that heat stress, particularly in hot and humid tropical locations, is a severe constraint to their output **(IPCC, 2014)**. For raising broilers, the optimum temperature for performance /thermo-neutral zone is between 18 and 22 °C **(Charles, 2002)**. The following is a list of the different types of heat stress in birds: Acute: 27–38 °C for 1–24 hours; moderate: 27–38 °C for 7 days or more; chronic or severe: 38–50 °C for 7 days or more **(Mujahid *et al.*, 2007 and Sohail *et al.*, 2012)**. Any deviation from these parameters, particularly above the upper threshold temperature, causes heat stress in poultry birds **(Pawar *et al.* 2016)**. Heat stress causes weak growth, worse meat quality, and a lower rate of viability in poultry

(Irshad *et al*., 2012). Heat stress can cause productivity losses and, in the worst-case scenario, fatality in chickens **(McKechnie and Wolf, 2010 and Rath *et al*., 2015)**.

A situation in which distinct genotypes (breeds, lines, or strains) behave differently to dissimilar environments is described as a genotype X environment interaction **(Sheridan, 1990)**. Breeding programmes must develop genotypes that perform better in hot settings if the global poultry business is to improve further **(Cahaner, 1990)**. Although tropical and sub-tropical breeds are better at adapting to summer temperatures, **(Yalcin *et al*. 1997a)** discovered the effect of breeding under varied climatic conditions, where production efficiency of poultry in the tropics is still comparatively poor.

Early heat conditioning is an effective way to improve the heat tolerance of poultry, especially broilers. The procedure entails exposing chicks to a high temperature (36–38 °C) when they are very young (24 hours to 5 days) **(Lin *et al*., 2006)**. When people who had been exposed to heat as chicks were subjected to 35–38 °C as adults, they died at a lower rate than people who had not been exposed as chicks **(Rath *et al*., 2015)**. Early heat exposure strategies could prove beneficial to poultry populations in the face of today's changing climate **(Pawar *et al*., 2016)**.

Poultry exposed to heat stress regularly experience various physiological instability, such as systemic immune dys-regulation and respiratory alkalosis **(Sohail *et al*., 2010 and Lara and Rostagno, 2013)**, which reduce poultry performance and health.

Epigenetic adaptation is a system that helps people adjust to their surroundings. The epigenetic mechanism can prepare chickens to tolerate heat stress throughout the pre-hatching and early post-hatching period **(Nichelmann and Tzschentke, 2002)**. Under these circumstances, there is a point at which thermal conditioning can improve thermo-tolerance without compromising performance **(Decuypere *et al*., 2001)**. Chicks'

ability to regulate body temperature during the post-hatching stage was found to improve with age and to be influenced by hormonal and neurological connections **(Debonne *et al*., 2008)**.

Due to the high metabolic rate of broilers, heat stress during the first week may lead to increased tolerance to high temperatures during the final rearing stage, when local heat production is higher **(Tan *et al*., 2010)**.

1. Effect of heat stress on productive performance

In the following research, heat stress has a deleterious impact on bird performance **(Yardibi and Turkay, 2008; Habibian *et al*., 2014 and Tawfeek *et al*., 2014).**

1.1. Body weight and body weight gain

Heat stress has a deleterious impact on broiler growth, including lower protein retention in muscles and increased heat output **(Zhang *et al*., 2012).**

When comparing chicks reared in a high ambient temperature to those reared in a thermal comfort temperature**, (Oliveira *et al*. 2006)** and **(Silva *et al*. 2009)** discovered that chicks reared in a high environmental temperature gained less body weight.

According to **(Yahav and Mcmurtry 2001),** heat conditioning caused a growth retardation followed by a phase of compensatory growth that allowed the birds to regain their weight; however, feed intake was higher at 42 days of age. These variables are strongly linked to nutrient absorption and digestion, confirming the relevance of thermal comfort in the facilities, particularly during the first week of life.

(Quinteiro-Filho *et al*. 2010) found that heat stress (31 and 36°C) for 10 hours per day from days 35 to 42 reduced broiler body weight, food intake, and feed conversion ratio.