EFFECT OF STOCKING DENSITY ON THE THERMO-PHYSIOLOGICAL TRAITS OF BROILER CHICKENS

Olaniyi T.A[1]., * Popoola M.A[1]., Olaniyi O.A[2], Yahaya M.O[1]. and Awodola-Peters O.O[1].

[1]*Federal College of Animal Health and Production Technology, Ibadan*

[2]*Federal University of Agriculture, Abeokuta*

* *Corresponding author: herbyolar@gmail.com*

Abstract

The experiment was conducted to assess the effect of stocking density on the thermo-physiological traits of broiler chickens. A total of one hundred and eight broiler chicken were randomly allotted into three treatments (10 birds/m²), T_2 (12birds/m²), T_3 (14 birds/m²) with three replicates per treatment in a completely randomized design. Parameters measured include: rectal temperature, pulse rate and respiratory rate; microclimate data (ambient temperature and relative humidity) were also recorded. Data collected were subjected to analysis of variance using SAS (2004). Results obtained from this study show that there were significant ($p<0.05$) effect of stocking density on pulse rate and the respiratory rate of broiler chickens. However, there was no significant ($p>0.05$) effect of stocking density on rectal temperature of the broiler chickens. Based on the results of this study, heat sensitivity of broiler chicken in terms of pulse rate and respiratory rate increased with increase in stocking density

Keywords: Density, environment, stocking, thermo-physiology

Introduction

Advances in genetics, nutrition, management, housing environment, etc., have been essential to promote better broiler performance. However, increasing production capacity in terms of live weight per area is still a challenge. Several studies have shown that increasing stocking densities had negative effect on broiler growth, welfare, meat water holding capacity, feed intake and feed conversion ratio (Estevez, 2007). However, when housing environment is improved using ventilation and reducing the incidence of solar radiation, for instance, productivity (kg meat/m) considerably increased (Moreira *et al.*, 2004).

The environment directly influences poultry survival and performance. Adequate housing facilities should provide adequate temperature, radiation, relative humidity and air velocity inside the poultry houses in order to allow birds to maintain thermal balance at the lowest metabolic cost, thereby increasing their productivity. There are few studies relating to thermoregulating mechanisms of broilers reared at different stocking densities. To this effect, this present study aimed at evaluating the effect of stocking densities on the thermo-physiological traits of broiler chickens.

Materials and methods

The experiment was conducted at a commercial farm in Ibadan. One hundred and eight (108) Abore acre chickens of four weeks old were used for the study, they were allotted into three treatments at different stocking densities of 10 (T1), 12 (T2) and 14 (T3) birds/m² and each treatment was replicated three times in a completely randomized design. The study was conducted for twenty-eight days. Data were collected on thermo-physiology of the chicken such as rectal temperature, respiratory rate and pulse rate. The parameters were measured twice a week to avoid undue stress to the chickens. The rectal temperature was taken using a digital rectal thermometer (with accuracy of ± 0.1) inserted into the cloaca of the bird and allowed to tilt to one side to avoid reading faecal temperature. The thermometer was held in place and was withdrawn to take the readings as reported by Thwaites *et al.*, (1990). The respiratory rate was estimated as the number of frequency of abdomen movement for 20 seconds and was later calculated as breathes/minute (Thwaites *et al.*, 1990). The pulse rate was also recorded as beats per seconds by placing a stethoscope on the thigh (tarsus bone) of the bird to determine the rhythmic beats of the heart which was calculated as beats/min (Thwaites *et al.*, 1990).The environmental temperature and relative humidity were also measured with the aid of a thermo-hygrometer. The instrument was hung at a side on the wall of the pen. Data collected were subjected to analysis of variance (ANOVA) using SAS (2004); significant ($p<0.05$) differences were separated using Duncan Multiple Range Test as contained in the same statistical package.

Results and Discussion

The effect of stocking density on thermo-physiological traits of broiler chickens is presented in Table 1. The result shows that there were significant ($p<0.05$) effects of stocking density on pulse rate and respiratory rate of the broiler chickens. There was no significant ($p > 0.05$) effect of stocking density on rectal temperature of broiler chickens; which was similar to the reports of **Nogueira *et al.* (2013) who reported** no effect of stocking density on sensible heat loss or rectal temperature. Highest pulse rate was obtained in birds raised on 14 birds/m^2 and highest respiratory rate was recorded in chicken raised on 12 birds/m^2. Havenstein *et al.* (2003) showed that the cardiovascular and respiratory systems of fast-growing broilers are not well developed, and these systems are critical for the control of latent or sensible heat exchange mechanisms. Therefore, in addition to the genetic traits associated to fast growth, it is difficult for broilers to dissipate heat, thereby increasing their sensitivity to environmental stresses. Sensible heat loss capacity may be increased by early thermal conditioning, with lower radiation and convection losses, as shown by Yahav *et al.* (2005). However, in the present study, birds were not subjected to this early conditioning, and therefore, the higher pulse and respiratory rates observed is associated to temperature differences between the skin and the environment. Mclean *et al.* (2001) also reported deep panting of commercial broilers at high stocking density.

Table 1: Effect of stocking density on the thermo-physiological traits of broiler chickens

Variables	10 Birds/m^2	12 Birds/m^2	14 Birds/m^2
Rectal Temperature (°C)	42.42 ± 0.49	41.75 ± 0.02	42.68 ± 0.89
Pulse Rate (beats/min)	192.51 ± 1.41^b	194.59 ± 1.02^{ab}	196.96 ± 0.45^a
Respiratory Rate (breathes/min)	57.34 ± 69^b	62.79 ± 2.24^a	60.87 ± 0.76^{ab}

^{a,b,} means of different superscripts along the same row are significantly different ($p<0.05$)

The result of environmental temperature and relative humidity during the cool and hot hours of the day is presented in Fig 1. The result shows that temperature during the cool periods of the day (morning period) was constant from day 28 to day 42, which increased slightly from day 42 to day 49

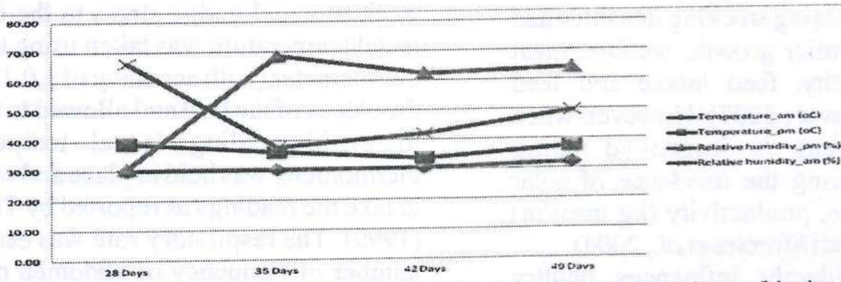

Fig. 1. Environmental temperature and relative humidity during the cool and hot hours of the day

. Fig 2 shows the temperature and relative humidity of the environment as recorded for the days of the experiment. These results also demonstrate the importance of environmental management at both times of the day for the maintenance of broiler energy balance, because the difference between skin and environmental temperatures was more important in the morning than in the afternoon. Consequently, the heat flow between the bird and the environment is higher in the morning than in the afternoon (Nogueira *et al.*, 2013).

(from 30 °C to 33 °C). Also, temperature during the hot periods of the day (afternoon) at day 28 decreased continuously to day 42 (from 40 °C to 34 °C) and then increased slightly till day 49 (from 34 °C to 38 °C). It also shows that relative humidity during the hot period of the day (afternoon) increased continuously from day 28 to day 34 (30 - 68%), it decreased slightly from day 35 to day 42 (from 68 % to 62 %) then increased slightly from day 42 to day 49 (62 to 65%). Also, relative humidity during the cool periods of the day (morning) decreased from day 28 to day 34 (67 to 38%) and then it continue to increase from day 35 to day 49 (38 to 50 %)

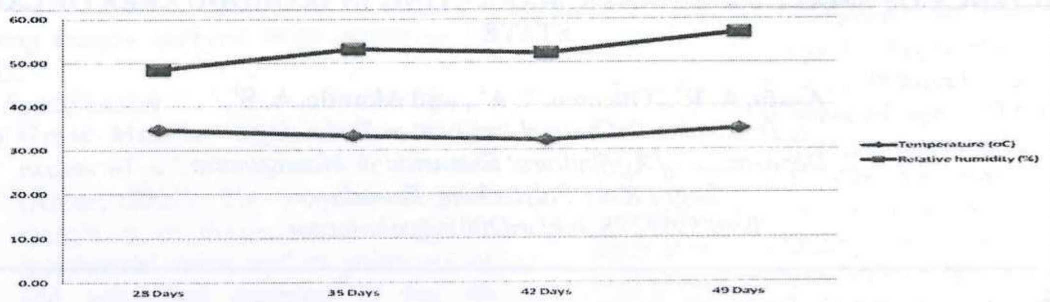

Fig. 2. Temperature and relative humidity of the environment

Conclusion

Based on the results of this study, heat sensitivity of broiler chicken in terms of pulse rate and the respiratory rate increased with increasing stocking density. However, there was no significant effect of stocking density on rectal temperature of the broiler chicken. Thus, broiler chicken be raised on stocking density of $12m^2$/birds putting into consideration their response to heat sensitivity at this stocking density.

References

Estevez, I. 2007. Density allowances for broilers: Where to set the limits? Poultry Science,86:1265–1272.

Havenstein,G.B., Ferket, P.R. and Qureshi, M.A. 2003a. Growth, livability, and feed conversion of 1957 versus 2001 broilers when fed representative 1957 and 2001 broiler diets. Poultry Science; 82:1500-1508.

Havenstein,G.B., Ferket, P.R., and Qureshi, M.A. 2003b. Carcass composition and yield of 1957versus 2001 broilers when fed representative 1957 and 2001 broiler diets. Poultry **Sciencce;82:1509-1518.**

Mclean, J., Savory, J. and Sparks, N. 2001. Welfare of male and female chickens in relation to stocking density. in proc.6^{th} *Europe. Symp. on poultry welfare*, Zollikafen, Switzerland. pp 234-242

Moreira, J., Mendes, A.A., Roça, R.O., Garcia, E.A., Naas, I.A., Garcia, R.G. and Paz, I.C.L.A. 2004. Efeito da densidade populacional sobre o desempenho e rendimento de carcaça e qualidade de carne em frangos de corte de diferentes linhagens comerciais. Revista Brasileira de Zootecnia,33:15061519.

Nogueira, W.C.L., Velásquez, P.A.T., Furlan, R.L. and Macari, M. 2013. *Effect of Dietary Energy and Stocking Density on the Performance and Sensible Heat Loss of Broilers Reared under Tropical Winter Conditions. **Brazilian Journal of Poultry Science.*** 15(1): 53-58

SAS (2004). Statistical analysis user's guide (release 8.03), SAS institute cary North Carolina, USA.

Thwaites, C.J. 1990. Physiology responses and productivity in sheep. *In Yousef M.K. (Ed), Stress Physiology in Livestock CRC Press, Inc.*, Boca Raton, Florida, USA, pp. 25-39.

Yahav, S., Shinder, D., Tanny,J. and Cohen, S. 2005. Sensible heat loss: the broiler's paradox. World's Poultry Science Journal. 61:419-434.