INFLUENCE OF STOCKING DENSITY ON THE TEMPERATURE AND HUMIDITY OF BROILER CHICKEN PENS

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ABSTRACT

This study was conducted to investigate the effect of stocking densities on the temperature and humidity of broiler pens during the wet season. Ninety day-old chicks of Arbor acre breed were used for the experiment which lasted 8 weeks. The birds were randomly assigned to three treatments of stocking densities 5, 10 and 15 birds/m^2 with three replicates per treatment in a deep litter house. Data on daily ambient Temperature and Relative Humidity within the pen were obtained using the Maxims thermocron i-button Temperature and Humidity sensors, which were programmed to measure at 10 minutes sampling interval. Virtually no significance observed between the stocking densities in weekly mean temperature and relative humidity in the broiler chicken pens throughout the period of the study. Therefore, it is concluded that stocking density does not influence broiler chicken's ambient temperature and humidity.

Key words: Broilers pens, stocking density, temperature, humidity

INTRODUCTION

The commercial production of broiler chickens under intensive management is commonly at stocking densities higher than optimum stocking density of 5 birds per m^2 (Asaniyan and Agbede, 2012). This may influence the ambient condition of the birds. The impact of the ambient condition may be beneficial or detrimental, depending on the extent of weather elements variations. The impact of weather elements may be expressed singly or in combinations; for instance, Bianca (1976) reported that low ambient temperature plus high air movement (cold) or high ambient temperature and high relative humidity plus solar radiation (heat) exert various effects on animal well-being, demonstrated in neuroendocrine, cardiorespiratory and behavioural responses. The concern for weather elements in recent years is due to the fact that they are not constant, but change continuously. Such changes affect the internal environment of birds, including the blood through the nervous and endocrine systems (Oladele *et al*., 2003). In the tropical environment, weather elements exert significant influence on domestic birds. Direct weather elements affecting birds include, especially, high ambient temperature and high relative humidity, resulting in severe heat stress (Ayo *et al*., 2011). The report of Egbunike (1979) suggests that the effect of a hot environment on the body of birds depends not only on the nature of the microclimatic factors involved, but also on their intensity. Heat stress is very common and on the increase in the tropical and subtropical production of poultry chickens. It inflicts heavy economic losses on poultry production as a result of stunted growth (Sahin *et al.,* 2001). In Nigeria, the combination of high ambient temperature and high relative humidity, reaching climax at the onset of the rainy season, constitutes extreme heat stress, which depresses the production of broiler and layer birds. Conversely, the low ambient temperature and low relative humidity, prevailing from November to February during the Harmattan season, especially in the morning and evening hours of the day, enhance egg and broiler production (Bannor and Ogunsan, 1987). Heat stress depresses growth rate and production as a result of a down-turn in voluntary feed intake in broilers (Sahin *et al.,* 2001). Heat stress is a deterrent to successful and profitable poultry production (McNabb and King, 1993). The optimum ambient temperature range for poultry is 12–26◦C (Plyaschenko and Sidorov, 1987). However, the ideal temperature for broilers is 10-22˚C to get optimum body weight and 15-27˚C for feed efficiency (Rama Rao *et al*., 2011). A temperature above 30˚C represents a heat-stressed condition for birds and is one of the most common stressors that affect the production criteria in poultry (Rama Rao *et al*., 2011). Broiler heat loss is comprised of two components; latent heat loss and sensible heat. Latent heat loss is usually expressed as the amount of water evaporated from the broiler, referred to as “moisture production”. Evaporation uses broiler heat to change water state from liquid to vapor. The evaporation takes place inside the broiler as water passes over the wet surfaces of its respiratory system. Sensible heat loss refers to heat dissipated through heat transfer from the broiler to the surrounding air. If the air is cooler than the broiler’s surface temperature, heat flows from the broiler to the surroundings. If the air is warmer than the broiler’s surface temperature, broilers will not be able to dissipate heat and heat stress will occur. Stress is of major concern for poultry industry because it exerts deleterious effects on different parameters like feed intake, feed conversion ratio, weight gain and so on (Pawan *et al*., 2012). Therefore, this study tends to investigate whether stocking densities influence ambient temperature and relative humidity within the broiler chicken pens.

MATERIALS AND METHOD

This study was carried out on the Poultry Unit of the Teaching and Research Farm, Joseph Ayo Babalola University, Ikeji Arakeji, Osun State, Nigeria; located at latitude 07^o 51’ N and longitude 4^o 88’ E.Prior to the start of the experiment all chicks were individually weighed and randomly assigned to three groups of different stocking densities. Each pen was 1m^2. In each treatment, the chicks were kept in tagged pens under deep litter management system in a ventilated house. Ninety (90) day-old chicks of Arbor acre breed were used as experimental unit in the experimental trial that lasted eight (8) weeks. The birds were randomly assigned to three treatments of stocking densities S5, S10 and S15 of 5, 10 and 15 birds/m^2 respectively with three replicates per treatments. The birds were raised in deep litter system bedded with wood-shaving litter.

The meteorological data (Temperature and Relative humidity) within the pen were obtained using the Maxims thermocron i-button Temperature and Humidity sensors, which were programmed to measure at 10 minutes sampling interval. Each of the sensors were shielded and well positioned in each pen. Data on the daily ambient temperature and relative humidity were collected throughout the eight weeks duration of the study. The data obtained from the experiment were subjected to Analysis of Variance and the means were separated by Duncan Multiple Range Test (SAS Institute, 1987).

RESULTS AND DISCUSSION

The weekly mean values of weather parameters observed in the broiler chicken pens under the three stocking densities (5, 10 and 15 birds/m^2 tagged S5, S10 and S15 respectively) are presented in Table 1.

Table 1: Weather parameters of poultry pens at three different stocking densities from week 1 to 8

Week	Temperature			Relative Humidity		
	S5	S10	S15	S5	S10	S15
1	27.15±0.193	27.15±0.198	27.22±0.196	79.5±0.801	79.4±0.826	79.3±0.814
2	30.61±0.318	29.73±0.278	29.76±0.279	74.4±0.699	77.8±0.564	78.2±0.595
3	29.84±0.266	31.79±0.360	76.9±0.932	83.0±0.642	75.9±0.998	31.43±0.353
4	30.18±0.213	26.94±0.178	27.59±0.180	69.8±0.733	82.6±0.670	79.7±0.655
5	27.05±0.138	25.62±0.125	25.94±0.125	80.9±0.512	88.3±0.515	86.7±0.475
6	26.71±0.163	25.88±0.132	26.19±0.135	84.5±0.618	90.2±0.561	88.5±0.518
7	26.75±0.144	26.02±0.138	26.25±0.137	82.9±0.663	88.3±0.715	86.4±0.644
8	25.47±0.136	25.88±0.136	26.09±0.138	87.8 ± 0.639^{a}	88.5 ± 0.665^{b}	86.8 ± 0.598^{ab}

Mean± SEM S5 = 5 birds/m^2; S10 = 10 birds/m^2; S15 = 15 birds/m^2Means with different superscripts in the same row are significantly different (P<0.05).

The overview of the responses revealed no significant (P>0.05) influence of the stocking densities on weekly mean temperature and relative humidity of the poultry pens throughout the period of study except in week 8 for the relative humidity.The mean temperatures of the broiler chicken pens showed similar increasing trends from the first week to the third week with the peaks at 31.43±0.353^{o}C for treatments S5 (5birds/m^2), 29.84±0.266^{o}C for S10 (10birds/m^2) and 31.79±0.360^{o}C for S15 (15birds/m^2), and decreased thereafter. The increasing temperatures that got to their peak at week three for the different treatments was probably as a result of increasing body sizes of the broiler chicks that enhance increasing metabolic activities with the corresponding heat loss through the skin and breathing. However, the temperature that peaked on week three and decreased thereafter confirmed the fact that broiler chickens had limited physiological capacity to control body temperature at the early age (1-4 weeks) as reported by Maarten *et al*. (2015). Also, the differently peaked temperatures for the treatments could be attributed to the different stocking densities; showing that stocking densities is directly proportional to the temperature within the broiler pens. Therefore, increasing stocking densities could bring about increased ambient temperature according to the findings of Dawkins *et al*. (2004). However, recorded mean temperatures were not too far from the 30^{o}C crucial temperature for poultry, beyond which feed and energy intake declines to such an extent that birds are no longer able to compensate for it, thereby suffer rapid production decline and increase rate of mortality (Daghir, 2009).This tends to show that the birds experienced similar ambient atmospheric condition throughout the period irrespective of the different stocking densities. The significant (P<0.05) influence of the stocking density on the relative humidity among the treatments at the eighth week could be jointly associated with the relative differences in temperature at week 8 and the age related increase in metabolic activities that yielded more respiratory and faecal moistures that contributed into atmospheric moisture within the pens. Fortunately, mortality was not recorded throughout the duration of this study. This could be an indication that the weather conditions within and outside the broiler house during rainy season (between late May and early July) when the study was conducted had contributed favourably (good ventilation) to the inability of the stocking densities to influence the weather situation within the broiler pens significantly to the detriment of the broilers' welfare. This corroborated the report of Dawkins *et al*. (2004) that high environmental quality is far more important than density per se in maintaining good health, performance and welfare of broiler chickens. Therefore, irrespective of stocking density levels, adequate ventilation has the mediating potential against the fatality of weather modification in the broiler pens.

CONCLUSION

There was virtually no significant influence of the stocking densities on weekly mean temperature and relative humidity in the broiler chicken pens during the rainy season.

Recommendation

Irrespective of stocking density levels, rearing environment of broiler chickens should not compromise adequate ventilation.

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