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EFFECTS OF WALLOWING, SEX AND DAYTIME ON THE THERMOREGULATORY RESPONSE OF GEESE AT HIGH TEMPERATURE HUMIDITY INDEX

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ABSTRACT

24 geese (12 males and 12 females) were used to assess the effect of wallowing on the haematology and thermoregulatory response of geese at high temperature humidity index. The male and female geese were randomly divided each into 2 treatments which were the wallowed group and non- wallowed group and the experiment lasted for 5 weeks. The temperature, humidity, pulse rate, respiratory rate and rectal temperature were measured every alternate day for a period of 5 weeks while the blood samples of the animals was collected and analysed for haematological profile twice during the experiment: 2 weeks post wallowing and 4 weeks post wallowing. Significantly higher values were observed in the respiratory rate and pulse rate of non-wallowed geese than the wallowed geese for the wallowing effect. Sex did not have any significant effect on all the parameters. The values for their respiratory rate, rectal temperature and pulse rate ranged from 20.24±2.48-21.15±3.69 breaths/minutes, 40.42±0.35-40.43±0.45^{0}C and 152.74±22.32-156.33±17.43 beats/minutes respectively. Their respiratory rate and rectal temperature were also observed to be significantly higher in the afternoon and evening than in the morning. However, there was no significant difference in their pulse rate. Therefore, this study indicated that wallowing and daytime influenced the thermoregulatory response of the geese at high temperature humidity index.

Keywords: Thermoregulatory response, Respiratory rate, Rectal temperature, Pulse rate, Wallowing

DESCRIPTION OF PROBLEM

Heat stress is one of the critical stressors especially in hot regions of the world. Species of animal, physiological status of the animals, temperature, relative humidity, and degree of solar radiation are factors that determine animals' zone of thermal comfort. An animal must get rid of the excessive amount of metabolic heat produced into the environment to control their body temperature. The various ways by which an animal maintain it's body temperature is widely referred to as thermoregulation. This metabolic heat regulation can be achieved through different ways such as conduction, convection and radiation (1). However, the rate of heat exchange depends on the ability of the environment to accept heat and moisture and also on the status of the animal (2). Wallowing has however been found to help in the maintenance of body temperature, thermoregulation and homeostasis (3).

Exposure to heat stress leads to significant behavioural and physiological responses (4).Adaptation to heat stress requires the integration of many organs and systems such as the endocrine, cardiorespiratory and the immune system (5). One of the major challenges of the poultry industry is the occurrence of high ambient temperature, which persists for months in most agro-ecological zones of Nigeria and heat stress affects overall poultry production adversely in the tropics (6,7). The ability to maintain a high and constant body temperature allow birds to cope in a remarkable range of habitat. If temperature falls, birds raise their metabolic rate to prevent their internal temperature from falling. However, if the environmental temperature becomes too hot, birds mobilize water to lose heat through evaporative cooling. Birds have no perspiration

organs, therefore heat must be lost through the respiratory tract by panting, or in non-passerines by the rapid vibration of the upper throat and thin floor of the mouth (8).

There is dearth of information on the influence of wallowing on the thermoregulatory response of male and female geese during high temperature humidity index period. Hence, this experiment was designed to assess the effects of wallowing, sex and daytime on the thermoregulatory response of geese at high temperature humidity index period.

MATERIALS AND METHODS

Experimental Location: This study was carried out at the poultry unit, Teaching and Research Farm, University of Ibadan, Oyo state, Nigeria, Latitude 7° 26′ N and Longitude 3° 54′ E. **Experimental Animals and Management**: Twelve (12) males and twelve (12) females were used for this experiment. The geese were procured from a reputable farm in Jos, Nigeria. **Experimental design:** The experiment was designed in a 2x2x3 factorial arrangement in a completely randomised design.

Assessment and Wallowing: The data collected for the thermoregulatory response of each animal were pulse rate, rectal temperature and respiratory rate. The pen relative humidity and temperature were also recorded daily with the aid of a thermo-hygrometer. All the parameters measured were recorded three times daily every alternate day over a period of 5 weeks. This was done at regular daytimes in the morning (7-9am), afternoon (12 – 2pm) and evening (5-7pm). A wallow pool was made outside the pen, for the geese to wallow and wallowing was also done every alternate day over a period of 5 weeks between 1pm and 3pm each time.

Temperature-Humidity Index (THI) was calculated using the formular:

THI = Temperature - humidity index = t – [(0.31-0.31 x RH/100) (t – 14.4)]

Where: THI = temperature-humidity index

t = temperature

RH = Relative Humidity (9).

Statistical Analysis: Data were analysed using General Linear Model of SAS (2003) and means were separated using Tukey-Kramer Mean Separation Procedure

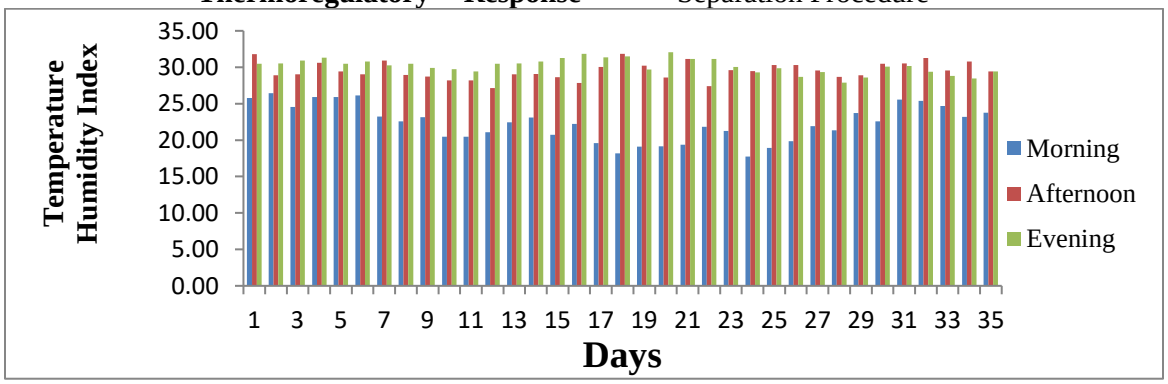

Figure 1: Temperature Humidity Index of the Experimental Pen

RESULT AND DISCUSSION

Tables 1, 2 and 3 show the main effect of wallowing, sex and daytime on the thermoregulatory response of geese during high temperature humidity index. Significantly ($p<0.05$) higher values were observed in the respiratory rate and pulse rate of non-wallowed geese than the wallowed geese. However, there was no significant difference ($p>0.05$) in their rectal temperature. Increase in the respiratory rate and pulse rate of non- wallowed geese compared to the wallowed group could be as a result of increased heat stress on the non -wallowed geese since they were not wallowed at all throughout the experiment despite that it was carried out during high temperature humidity index. From the study of (10), it was confirmed that the respiration rate increased with increased heat stress. This result is also in agreement with the findings of11, who also reported that respiration rate can be elevated through heat stress in

animals. Heat stress during summer is characterized by an increase in respiration rate (12). The pulse rate also increases on exposure to high environmental temperature (11).

However, sex did not have any significant effect ($p>0.05$) on all the parameters. The values for their respiratory rate, rectal temperature and pulse rate ranged from 20.24±2.48 - 21.15 ±3.69 breaths/minutes, 40.42 ±0.35 - 40.43±0.45^{0}C and 152.74±22.32 - 156.33±17.43 beats/minutes respectively.

Day time significantly influenced the respiratory rate and rectal temperature as they were observed to be significantly higher ($p<0.05$) in the afternoon and evening than in the morning. However, there was no significant difference in their pulse rate. The mean rectal temperature for the male and female were in line with the work of (13) who reported a range of 40.09 – 41.27^{o}C rectal temperature in three genotypes of the Nigerian indigenous chicken. Normally, the poultry body temperature is 41.5°C, but will fluctuate somewhat depending upon the temperature of its environment. Birds regulate the balance between heat production and heat loss to maintain their deep body temperature at approximately 40°C. Higher values of respiratory rate and pulse rate observed in the afternoon and evening than in the morning may be due to the higher environmental temperature recorded in those time of the day than in the morning.

TABLE 1: MAIN EFFECT OF WALLOWING ON THE THERMOREGULATORY RESPONSE OF GEESE DURING HIGH TEMPERATURE HUMIDITY INDEX

Parameters	Wallow Treatment	
	Non- wallowed geese	Wallowed geese
Respiratory Rate (Breaths/minute)	22.04 ±2.69 [a]	19.68 ±3.57 [b]
Rectal Temperature (^{0}C)	40.44 ±0.32	40.40 ±0.44
Pulse Rate (Beats/minute)	166.81 ±14.20[a]	143.55 ±15.86[b]

a,b means on the same row with the same superscript are not significantly different (p>0.05).

TABLE 2: MAIN EFFECT OF SEX ON THE THERMOREGULATORY RESPONSE OF GEESE DURING HIGH TEMPERATURE HUMIDITY INDEX

Parameters	Sex	
	Female	Male
Respiratory Rate (Breaths/minute)	21.15 ±3.69	20.24±2.48
Rectal Temperature (^{0}C)	40.42 ±0.35	40.43±0.45
Pulse Rate (Beats/minute)	156.33±17.43	152.74±22.32

TABLE 3: MAIN EFFECT OF DAY-TIME ON THE THERMOREGULATORY RESPONSE OF GEESE DURING HIGH TEMPERATURE HUMIDITY INDEX

Parameter	Day time		
	Morning	Afternoon	Evening
Respiratory Rate (Breaths/minute)	18.59±2.40[b]	21.52±2.96[a]	22.57±3.42[a]
Rectal Temperature (^{0}C)	40.07±0.34[b]	40.61±0.30[a]	40.60±0.21[a]
Pulse Rate (Beats/minute)	158.61±19.65	154.74±17.69	152.01±20.16

a,b- means on the same row with the same superscript are not significantly different (p>0.05).

CONCLUSION AND APPLICATION

1. This study showed that during high temperature humidity index, wallowing and daytime influenced the thermoregulatory response of the geese.
2. Also, sex did not affect their thermoregulatory response as the results obtained were similar irrespective of their sexes.

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