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Effect of Relative Humidity on the Performance of Nera Black Hens in a Humid Tropical Environment

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

A total of seventy five Nera Black hens in their 4th week of lay were used in a study conducted to determine the effect of different relative humidity conditions on the performance of Nera Black hens under humid tropical environment. Hens were housed individually in separate cages. The hens were supplied with water ad libitum and fed on layers mash containing 16.5% crude protein and 2650 kcal/kg of metabolizable energy for 10 weeks. Relative humidity was recorded 3-hourly at time intervals of 0600 h, 0900 h, 1200 h, 1500 h, and 1800 h using a standard hygrometer and the mean daily relative humidity was noted. The climatic data taken during the period of the experiment showed that the study area had the natural day-length of 13 to 14 hours; mean maximum weekly indoor and outdoor temperatures of 27.90C to 29.20C and 26.80C to 30.50C, respectively; mean minimum weekly indoor and outdoor temperatures of 20.50C to 22.30C and 20.00C to 23.600C, respectively; mean weekly relative humidity of 74.4% to 76.4% and mean total monthly rainfall of 781.33 mm. Results showed that relative humidity significantly affected total egg production, average daily feed intake, egg weight, egg shell weight and Haugh unit. The results of the present

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study indicate that although relative humidity had effect on performance, Nera Black hens are adapted to humid tropical environment.

Keywords: Egg production; environment; feed intake; relative humidity; temperature.

1. INTRODUCTION

For many years, researchers have been investigating the effect of relative humidity on the performance of different poultry species, including young chickens [1], laying hens [2,3,4], turkeys [5], broiler breeders [6], broilers [7], and have found that variations in relative humidity from place to place affects productive performance.

Heat stress in poultry is prompted by combinations of environmental temperature and humidity that prevent the thermoregulatory processes of birds from effectively dissipating the heat produced during metabolism. Poultry birds are said to be thermally stressed when ambient temperature exceeds body temperature such that peripheral physiologic responses of the bird can no longer match the external changes [8]. During heat stress, the environmental parameters of relative humidity (RH) and ambient temperature (AT) in general and temperature humidity index (THI) in particular, have been reported to be an invaluable tool in the presumptive diagnosis of the animal state of health, and is also relevant in evaluating the adaptability of the animal [9,10].

High relative humidity and ambient temperature as reported by [11], increases heat stress and are responsible for the increase in rectal/body temperature. Chronic heat stress results in behavioural changes, depressed feed intake [12,13] and a wide range of metabolic activities [14], including elevation of body temperature as well as electrolyte, acid-base and hormonal imbalances [15]; and tissue damage [16]. Egg production and shell quality in laying hens are also depressed [17,18]. Excessively high relative humidity makes adaptation to extremes of temperature more difficult. An increase in relative humidity decreases loss of heat by evaporation at high temperatures and decreases thermal isolation of the animal at low temperatures [19].

2. MATERIALS AND METHODS

2.1 Location and Duration of Study

The study was carried out in the Poultry Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. It lasted for a period of ten weeks (1st July – 9th September, 2011). During this period, hens were observed daily and egg collection was done

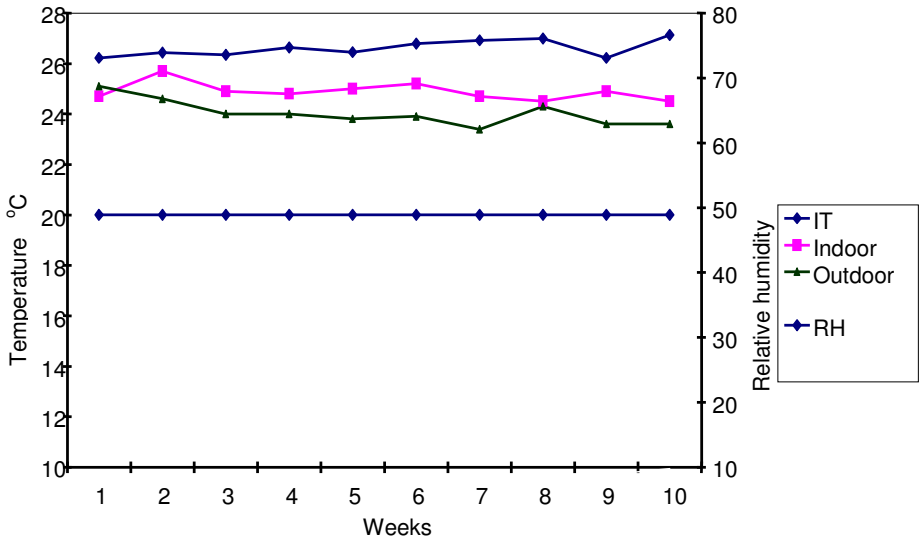

Fig. 1. Average weekly temperatures (indoor and outdoor) and relative humidity of the study area

hourly between 0600 h and 1800 h for eight weeks. The study was conducted in late rainy season.

2.2 Experimental Birds

The experiment was carried out in accordance with the provisions of the Ethical Committee on the use of animals and humans for biomedical research of the University of Nigeria, Nsukka (2006). Seventy five Nera Black hens in their 4th week of lay were used. The hens were selected from a flock of laying hens in the farm. Each bird was housed in individual battery cage.

2.3 Production Parameters

Total egg number, average daily feed intake (ADFI) and egg quality (egg weight, egg shell weight, egg shell thickness and Haugh units) were measured during the study. Sixteen (16) eggs per strain were selected at random weekly for egg quality analysis.

2.4 Relative Humidity

Relative humidity was taken 3-hourly (Fig. 1 above) at time intervals of 0900 h, 1200 h, 1500 h and 1800 h using a standard hygrometer (Harris, England) and the mean daily and weekly relative humidity noted.

2.5 Statistical Analysis

Data were subjected to analysis of variance (ANOVA) using the SPSS Package (2003) windows version 8.0. Significantly (*P=.05*) different means where separated using Duncan's New Multiple Range Test [20]. The statistical procedures used were as described by [21].

3. RESULTS AND DISCUSSION

3.1 Total Egg Production

Egg production has been reported to increase when relative humidity was 60-70% with decreased egg production for any RH regime outside that range [22]. The result is however at variance with that of the present study (Table 1). [11] reported that high ambient temperature and relative humidity increases heat stress and responsible for the increase in rectal/body temperature. [17] and [18] reported that egg production was depressed at high relative humidity, which agrees with the results of the present findings. Although relative humidity significantly affected total egg production in the present study (Table 1), highest total egg production was recorded at RH of 76.40%. This could be attributed to the differences in the environmental conditions of the different study locations, breed used and feeding regime.

3.2 Average Daily Feed Intake

[22] reported higher feed intake with decreasing relative humidity. [12] and [13] reported lower feed intake with increased relative humidity. In the present study, RH significantly (*P=.05*) affected ADFI. However, findings from the present study showed that relative humidity of 76.4% and 74.4% recorded the highest ADFI (91.3 g and 86.7 g respectively). The differences between the results of the present study and those of earlier reports could be attributed to the variations in relative humidity of the different study locations. Although variations in relative humidity significantly (*P=.05*) affected feed intake, the findings of the present study suggest that relative humidity affects average daily feed intake.

3.3 Egg Weight

[22] reported that egg weight increased with decreasing relative humidity. Ajakaiye et al. [18] also reported decreased egg production, which however does not agree with the findings of the present study. Highest egg weight of 66.2 g and 65.4 g were recorded when the RH was 76.00% and 76.40% respectively. The result however, does not agree with earlier reports. The reason could be attributed to the type of breed used and different study locations.

3.4 Egg Shell Weight

[17] reported that high relative humidity increases heat stress. Egg production and egg shell weight in laying hens have been reported to decrease under heat stress conditions [17,18]. In the present study however, relative humidity significantly (*P=.05*) affected egg shell weight of Nera Black hens. This could be due to differences in breed type and nature of feed used.

3.5 Haugh Unit

[23] reported higher haugh unit in birds exposed to high relative humidity above 50%. In the present study, relative humidity significantly (*P=.05*) affected Haugh units of Nera Black hens. The highest haught unit (89.0) was recorded under a mean relative humidity of 76.40%.

Table 1. Effect of relative humidity on performance of Nera Black hens

Parameters	1	2	3	4	5	6	7	8	SEM
	73.40	73.90	74.10	74.30	75.00	75.70	76.00	76.40	
Total egg production	54.0^{ab}	50.0^{bc}	47.9^{c}	48.9^{c}	50.7^{bc}	48.2^{c}	54.0^{ab}	56.7^{a}	0.63
Average daily feed intake (g/bird per day)	86.7^{ab}	78.7^{cd}	70.7^{e}	78.4^{cd}	79.1^{cd}	76.3^{d}	82.6^{bc}	91.3^{a}	0.94
Egg weight (g)	64.5^{ab}	63.8^{ab}	62.8^{ab}	60.9^{b}	62.8^{ab}	64.1^{ab}	66.2^{a}	65.4^{ab}	0.52
Egg shell weight (g)	8.0a^{b}	7.9^{b}	7.7^{d}	7.9^{b}	8.0^{ab}	7.8^{c}	8.0^{ab}	8.1^{a}	0.02
Haugh unit	88.9^{b}	87.2^{bc}	86.2^{d}	87.6^{b}	87.8^{b}	86.7^{cd}	88.0^{c}	89.0^{a}	0.16

*a,b,c,d,e: Mean values in a row with different superscripts are significantly different (P=.05); *(P=.05); SEM: Standard error of the mean*

4. CONCLUSION

It is concluded that if relative humidity is allowed to exceed normal ranges for laying hens, then egg production, egg size, and growth will be negatively affected. This environmental factor along with others affects the metabolism of birds, which is responsible for the output of eggs, meat, and body heat to maintain normal physiological processes and functions. High air humidity may affect the bird in an additive manner and this can negatively affect hen's egg production, feed intake and efficiency, and physiological status.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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