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Effect of Heat Stress (HS) on Production of Hy-Line Layers

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Abstract: For many years, researchers have been investigating the effect of high environmental temperature on the performance of different poultry species including turkeys, young chickens, broilers, broiler breeders and laying hens and have found that high environmental temperatures have deleterious effects on productive performance. The objective of this study was to assessment of effect of heat stress on production of Hy-line layers. A total of 200 Hy-line hens were selected for this study and divided into the 2 identical groups. Group 1 was kept in the environment at temperature 32-36°C and other one was kept in 27°C. Data showed that there is a significant difference among two groups in point of production rate ($p<0.01$). It can be concluded that heat stress has a marked effect on chickens especially layers as shown in present study and must kept in temperature range of 27°C to obtain maximum production rate.

Key words: Heat Stress (HS), production rate, hens, Hy-line

INTRODUCTION

In hot climates, periods of high temperatures have a negative effect on the health and performance of domestic animals. Poultry farming is no exception and the effect of stress caused by elevated temperatures can result in heavy economic losses from increased mortality and reduced productivity (St-Pierre *et al*., 2003). For birds to perform at their optimum capacity they need to among other factors to be in homeostasis with their environment through the maintenance of thermobalance. Thermobalance is the equilibrium between the heat produced and the heat given out by living organism and this is at its maximal physiological level within the thermoneutral range of any given specie. Birds, like mammals are homoeothermic, they produce heat to maintain a relatively constant body temperature and may permit certain variations within their temperature range without significant perturbation (St-Pierre *et al*., 2003).

Normally, the chicken's body temperature is 41.5°C but will fluctuate somewhat depending upon the temperature of its environment (Sottnik, 2002) while the established thermoneutral zone for birds reared in the tropical regions ranges between 18-24 Holik (Holik, 2009). Maintaining a constant body temperature is not a problem when air temperature is at least 10-15 degrees less than body temperature. But, air movement is critical. A bird can only give off heat to its environment if the temperature of that environment is cooler than the bird. If heat produced by the birds is not moved away from them and out of the poultry house quickly, it will be more difficult for them to avoid heat stress (Sottnik, 2002).

The changes in the biomass as result of the continuous global warming has a deleterious effect on domestic animals in general and birds in particular. Ambient Temperature (AT) above 25 is stressful for birds but more stressful is the fluctuations caused by this environmental thermal changes, especially when it is accompanied by high Relative Humidity (RH) as this unleash various pathophysiological response in birds (Sritharet *et al*., 2002; Simon, 2003). Furthermore, it has been demonstrated that this response induces heat stress in chickens and thus lead to disturbance in production (Estrada-Pareja *et al*., 2007). The objective of this study was to assessment of effect of heat stress on production of Hy-line layers.

MATERIALS AND METHODS

A total of 200 Hy-line hens were selected for this study and divided into the 2 identical groups. Group 1 was kept in the environment at temperature 32-36°C and

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other one was kept in 27°C. All hens were in 50 weeks old and production level and were fed with same diet, light program and intensity conditions. Egg production rate, weight of produced eggs, feed and water consumption, losses rate due to heat stress, broken eggs and cheap fractions were recorded during the study.

All data were analyzed by SPSS Ver. 17 and for comparison of data we used of independent t-test and $p<0.05$ considered as significant.

RESULTS AND DISCUSSION

After measurement of parameters, statistical analysis and comparison of data among 2 groups were done and data given in Table 1 and 2.

Based on data obtained from t-test, it has been revealed that there is a significant difference among two groups in point of production rate ($p<0.01$).

Also, it revealed that there is a significant difference among two groups in point of losses due to heat stress and total losses ($p = 0.001$ and $p = 0.003$, respectively).

The dry and wet-bulb temperatures for inside and outside the pen house were higher than the recommended thermo neutral zone of 18-24°C that (Holik, 2009) established for poultry in the tropical regions. Likewise, the THI in this experiment were outside the normal zone of ≤70 that (Tao and Xin, 2003) established for poultry. The response of chickens at high temperatures differs with different relative humidity. It has been reported that high temperature accompanied by high humidity is more detrimental to layer performance than high temperature with low humidity. At the same time, constant high temperature of 30-32°C is more deleterious to birds than cyclic or alternating temperatures of 30-32°C by day and 25°C by night. Feed conversion in broilers is subject to significant fluctuations because of seasonal as well as ambient temperature changes.

All studies indicate that high temperatures reduce the efficiency of utilizing feed energy for productive purposes. Layers not only eat less at high temperature but also produce less per unit of intake, especially at temperatures >30°C. The single or combined dietary supplementation with vitamin C and E of laying chickens exposed to heat stress significantly improved production performances of feed consumption, conversion and egg/bird/day. Supplementation, of vitamin E alone into diets appeared to be more beneficial for laying hens during heat stress, probably due to its concurrent function as fertility factor (Sahin *et al*., 2002).

Eggs from hens housed in the hot chamber weighed significantly less than eggs from the cyclic chamber and eggs from the cyclic chamber weighed significantly less than eggs from the control chamber throughout the 5 weeks experiment. These results agree with those of De Andrade *et al*. (1976, 1977), Emery *et al*. (1984) and Kirunda *et al*. (2001) who found that either high environmental or cyclic temperatures decrease egg weight. This finding could be due to the reduction in feed consumption as reported by De Andrade *et al*. (1976). The adverse effect of high environmental temperature

Table 1: Data obtained from hens were subjected to heat stress

Age (wk.)	Production rate (%)	Losses due to HS	Total losses	Average of body weight	Average of egg weight	Broken eggs	Cheap fractions in eggs	Duration of HS (h)	Daily feed consumption (kg)	Daily water consumption (L)
50	84	1	1	1.55	62.5	-	2	8	110	230
51	82	1	2	1.55	62.5	-	3	8	110	250
52	79	1	1	1.53	62.2	1	5	8	108	260
53	77	2	3	1.51	62.0	2	5	8	105	260
54	77	2	4	1.50	61.7	2	7	8	102	265
55	75	3	2	1.50	59.5	3	6	8	101	265
56	75	2	3	1.50	59.5	2	6	8	101	271
Mean±SD	78.42±3.45	1.71±0.75	2.29±1.11	1.52±0.02	61.41±1.33	1.57±0.97	4.86±1.77	8	105.29±4.07	257.29±13.65

Table 2: Data obtained from normal hens in normal temperature

Age (wk.)	Production rate (%)	Losses due to HS	Total losses	Average of body weight	Average of egg weight	Broken eggs	Cheap fractions in eggs	Duration of HS (h)	Daily feed consumption (kg)	Daily water consumption (L)
50	84.0	-	-	1.55	62.5	-	1	-	110	225.00
51	84.0	-	1	1.55	62.5	-	1	-	110	228.00
52	83.0	-	-	1.55	62.5	1	2	-	110	227.00
53	82.5	-	1	1.54	62.0	1	2	-	110	230.00
54	82.0	-	1	1.56	61.5	-	2	-	110	228.00
55	82.0	-	-	1.52	61.5	1	1	-	110	231.00
56	81.0	-	1	1.54	61.5	1	2	-	110	234.00
Mean±SD	82.64±1.10	-	0.57±0.53	1.54±0.01	62.00±0.5	0.57±0.53	1.86±1.06	-	110	229.0±2.94

on eggshell quality has been well documented (De Andrade *et al*., 1976, 1977; Mahmoud *et al*., 1996; Balnave and Muheereza, 1997; Odom *et al*., 1986). Eggshell thickness and specific gravity of eggs from the cyclic hens were less than the control but greater than the heat-stressed hens in the first 2 weeks of the experiment ($p<0.05$). However, during 3-5 weeks no difference in shell thickness or specific gravity was observed between the control and cyclic groups whereas eggs from the heat-stressed group were always significantly less. The decrease in shell quality in the current study may be partially due to a reduction in plasma calcium. It has been reported that plasma calcium level was significantly decreased in laying hens (Mahmoud *et al*., 1996) and in turkeys (Kohne and Jones, 1976) when the birds were exposed to high temperatures. In addition, it has been shown that calcium use (Odom *et al*., 1986) and calcium uptake by duodenal epithelial cells (Mahmoud *et al*., 1996) are decreased by exposure to high environmental temperatures. Finally, eggs from birds housed in the hot chamber, in general had significantly higher Haugh units than those from birds in either the control or cyclic chambers. This finding is contrary to the findings of Kirunda *et al*. (2001) who reported that Haugh units of eggs from heat-stressed birds were reduced after heat exposure. An explanation could be that the reduced egg production of the heat-stressed hens imparted greater quality to fewer eggs (Patterson *et al*., 1988).

CONCLUSION

Finally, it can be concluded that heat stress has a marked effect on chickens especially layers as shown in present study and must kept in temperature range of 27°C to obtain maximum production rate.

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