EFFECT OF RESTRICTED ACCESS TO WATER ON BROILER HOUSE CLIMATE AND PRODUCTIVITY OF BROILER CHICKENS

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SUMMARY

The aim of the experiment was to determine the effect of restricted access to water for 8 h/day on broiler house climate and productive results of broiler chickens.

The results obtained showed that restricting access to water for 8 h/day reduced litter and manure moisture compared to the control group, leading to lower ammonia levels in the air. The use of restricted access to water had no adverse effect on the final body weight of the chickens, feed conversion or results of carcass analysis.

It is concluded that restricting access to water for 8 h/day improves the climatic conditions of the broiler house without any significant effect on broiler performance.

Keywords: restricted access to water, broiler house climate, productivity, broiler chickens

INTRODUCTION

The high productivity of birds is conditional on an adequate supply of drinking water. It is involved in all life processes and accounts for 50–70% of the bird's total body weight (Chołocińska et al., 1997). According to North and Bell (1990), the daily amount of drinking water supplied to a broiler house should range from 0.3 to 0.5 l/bird. A higher demand for water is due to higher water consumption depending on bird's age, weight, sex, health, feed intake and composition, and type and technical condition of drinkers (Chołocińska et al., 1997; Miller et al., 1988; Bessei et al., 1999).

Under appropriate climatic conditions, high water intake is undesirable because of excessive respiratory evaporation and fecal and urinary excretion of water (Bennett and Leeson, 1989). In turn, excessive moisture in livestock buildings reduces the quality of litter and climate, especially by increasing the ammonia concentration in air (Chołocińska et al., 1997; Bessei et al., 1999; Sosnówka-Czajka et al., 2004). Many authors believe that increased levels of ammonia in livestock buildings influence the body's physiological processes and thus negatively affect production results and the quality of poultry products obtained (Kristensen and Wathes, 2000; Al-Homidan et al., 2003).

According to Chołocińska (1998), not only the birds' basic life processes but also their productivity can be regulated by the amount of water supplied.

Therefore, the aim of the experiment was to determine the effect of restricting access to water for 8 h per day on broiler house climate and productive results of broiler chickens.

MATERIAL AND METHODS

A total of 8000 day-old Hubbard chicks were assigned to 2 groups. Each group had 20 subgroups with a stocking density of 15 birds/m^2.

In group I (control), birds had free access to water throughout the experiment, and in group II (experimental), from 21 days of rearing, birds were given water for 16 h/day at 0900-1200, 1400–1700 and 2000–0600 h. Chickens were reared on litter to 42 days of age and fed *ad libitum* with standard diets.

During the experiment, individual body weight of birds, feed intake, water intake and mortality were monitored every week. At 21, 28, 35 and 42 days of rearing, air concentrations of NH_3 were measured using Dräger tubes at four points diagonally through the broiler house, 30 cm above litter. At 21, 28, 35 and 42 days of rearing, litter moisture and fecal dry matter content were also determined. On the last day of rearing, 20 birds with close to average body weight were selected from each group. After slaughter and cooling, they were subjected to a simplified carcass analysis.

The results were analysed statistically by way of one-way analysis of variance using Statgraphics plus 6.0.

RESULTS

A deterioration in the broiler house environment is associated with litter moisture and increased ammonia concentration in the air (Sosnówka-Czajka et al., 2004). In our study, restricting access to water for 8 h/day from 21 days of rearing significantly reduced ammonia concentration in the air at 28 and 35 days, and highly significantly on day 42 of the experiment (Tab. 1). The reduced level of ammonia in the air in the experimental group was associated with a greater dry matter content of litter ($p<0.01$) and a greater dry matter content of manure ($p<0.05$) during the final weeks of rearing (Tab. 2 and 3). Bessei et al. (1999) reported that restricting water intake by limiting water supply or the duration of access to water improved manure consistency, while according to Herbut (1997), ammonia volatilization from litter can be considerably reduced by rapid drying of excreta.

In the present study, restricting access to water did not reduce the final body weight of the birds (Tab. 4), despite the fact that at 21 and 35 days of rearing, chickens from the experimental group were characterized by a significantly lower body weight compared to the control birds. In the last week of the experiment, compensatory growth occurred in birds from the experimental group and at 42 days of rearing the body weight of birds from both groups was 2439 g. Similar results were obtained by Chołocińska (1988), who exposed broiler chickens to 12-, 18- and 24-hour water deprivation from 1 to 3 weeks of age. Likewise, Gerry (1980), Bennett and Leeson (1989) and Chamblee et al. (1989) did not find any decreases in birds' body weight after restricting access to water. However, Ross (1960) reported that both body weight and feed intake decreased in birds that had daily 30-minute access to water over a 6-week period of rearing.

According to the literature, there is a close relationship between the amount of water consumed and feed intake (Chołocińska, 1988; Miller et al., 1988; Ross et al., 1981). In our study, we observed slightly lower feed intake in birds from the experimental group, paralleled by a higher water intake per kg weight gain, but these differences were not significant (Tab. 5). A non-significant effect of water deprivation on feed intake by birds was also reported by Chołocińska (1988) and Miller et al. (1988). On the other hand, Watkins and Novilla (1994) found that

restricted access to feed and water caused a highly significant decrease in feed intake, weight gains and feed conversion, but unlike in our study, they failed to observe the effect of the experimental factor on the health of birds (Tab. 5).

Skomorucha et al. (2006) reported that restricted access of broiler chickens to water adversely affects meat quality. In our study, we did not find statistically significant differences between the groups in the results of carcass analysis (Tab. 6), although there was a tendency towards slightly higher dressing percentage and greater content of breast and leg muscles in birds from the experimental group. Birds from group II, in which water was restricted, were also characterized by a lower content of leg bones, abdominal fat and giblets.

CONCLUSION

The results obtained showed that restricting access to water for 8 h/day reduced litter and manure moisture compared to the control group, leading to lower ammonia levels in the air. Water deprivation had no adverse effect on the final body weight of the chickens, feed conversion or results of carcass analysis. It is therefore concluded that restricting access to water for 8 h/day improves the climatic conditions of the broiler house without any significant effect on broiler performance.

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Table 1. Ammonia concentration in air (ppm)

Day of rearing	Group	
	1	2
21	4.50 ± 0.50	2.75 ± 0.75
28	8.50 ± 1.19 a	4.00 ± 1.00 b
35	9.00 ± 1.35 a	5.25 ± 0.25 b
42	21.25 ± 1.25 A	10.00 ± 0.00 B

A,B – values in rows marked with different letters differ highly significantly
a,b – values in rows marked with different letters differ significantly

Table 2. Litter dry matter (%)

Day of rearing	Group	
	1	2
21	70.39 ± 1.65 A	58.42 ± 1.17 B
28	67.95 ± 0.92	64.57 ± 1.89
35	61.47 ± 1.73 A	73.14 ± 1.65 B
42	62.23 ± 1.60 A	71.34 ± 1.03 B

A,B – values in rows marked with different letters differ highly significantly

Table 3. Dry matter content of manure (%)

Day of rearing	Group	
	1	2
21	21.11 ± 0.61	22.15 ± 0.88
28	21.05 ± 0.27 a	22.42 ± 0.33 b
35	21.65 ± 0.34 a	23.73 ± 0.65 b
42	21.92 ± 0.24 a	23.33 ± 0.44 b

a,b – values in rows marked with different letters differ significantly

Table 4. Body weight of broiler chickens (g)

Day of rearing	Group	
	1	2
7	155.25 ± 1.43	151.32 ± 1.61
14	401.75 ± 8.04	398.00 ± 3.64
21	801.50 ± 7.53 a	776.25 ±6.59 b
28	1356.98 ± 10.01	1349.95 ± 9.17
35	1980.76 ± 16.88 a	1915.00 ± 19.16 b
42	2439.17 ± 26.84	2439.53 ± 28.56

a,b – values in rows marked with different letters differ significantly

Table 5. Feed and water conversion and broiler chicken mortality from 1 to 42 days of rearing

Item	Group	
	1	2
Feed conversion (kg/kg weight gain)	1.92	1.88
Water conversion (l/kg weight gain)	3.48	3.50
Mortality (%)	6.17 ± 0.91	7.12 ± 0.91

Table 6. Results of carcass analysis of 42-day-old broiler chickens

Item	Group	
%	I	II
Dressing percentage: • with giblets • without giblets	 77.22±0.52 73.87±0.46	 78.06±0.28 74.27±0.30
Muscles: • breast • leg	 23.99±0.34 18.96±0.28	 24.56±0.26 19.11±0.30
Leg bones	5.32±0.12	5.29±0.15
Abdominal fat	2.20±0.12	2.17±0.22
Liver	2.79±0.12	2.60±0.08
Giblets	4.47±0.13	4.38±0.08