EFFECT OF DELAYED CHICK PLACEMENT AND VARIED REARING TEMPERATURES ON BROILER CHICKEN PRODUCTIVITY

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SUMMARY

The aim of the study was to determine the effect of a 24-hour delay in chick placement and varied rearing temperatures to 21 days of rearing on the productivity of broiler chickens. Both reduced and increased air temperature during the first period of rearing reduced the rate of growth, with clearer differences observed in the group of birds reared at lower temperature. However, growth compensation occurred at a later period and birds from all the groups achieved similar final body weights. Different thermal conditions of rearing did not affect feed conversion, carcass quality or bird survival. The results obtained suggest that chickens exposed to a 24-hour feed and water withdrawal can cope with both reduced and elevated temperatures of rearing, with no effect on the production results obtained.

Keywords: broiler chickens, housing time, thermal conditions, productivity

INTRODUCTION

The advancement of genetic progress in birds is paralleled by an increase in their productive value and reduced resistance to stress. Considering the welfare regulations that limit the quantity and quality of stressors, increasing importance in poultry practice is attached to the handling of chicks during the first hours after hatching. In theory, the time from hatching to the placement of chicks in a poultry house is very important. This concerns mainly hatchery and broiler house conditions and the time and conditions of chick transportation from the hatchery to the farm. Chicks hatched in the first stage are kept in difficult thermal and humidity conditions of the hatchery for around 24 or even 48 hours (Decuypere et al., 2001). Ton et al. (2003) reported that even chicks originating from one group do not hatch at the same time, which results in different chick quality. This time is extended by sorting (i.e. selection of birds), vaccination, preparation for transport and the transport itself (Pietras et al., 1990). These procedures may expose birds to stress reactions related mainly to social and thermal conditions (Herbut et al., 1993; Pietras et al., 1990) and to body dehydration, because during this period chicks have no access to water or feed. In the initial period of rearing, appropriate climatic conditions are particularly important because the thermoregulatory system of chicks is undeveloped and they are unable to compensate large heat losses in exceedingly low ambient temperatures or to lose excess heat in overheated facilities.

The aim of the study was to determine the effect of a 24-hour delay in chick placement and varied rearing temperatures to 21 days of rearing on the productivity of broiler chickens.

MATERIAL AND METHODS

After weighing and tagging, a total of 270 day-old Ross 308 broiler chicks were assigned to one of three groups (control group I and experimental groups II and III), with 90 birds group. Chicks from all the experimental groups were simultaneously removed from the hatchery and transported for approximately 2 hours to an experimental broiler house of the National Research Institute of Animal Production. Prior to placement, birds were subjected for 24 hours to cold stress (ambient temperature 22°C), high stocking density and withdrawal of water and feed.

In the next stage of the experiment, chickens from group I were kept in standard temperature. To 21 days of rearing, air temperature was reduced by 5ºC in group II and increased by 5ºC in relation to the recommended temperature on the same days in group III.

Chickens were reared in 6-tier batteries of heated cages to 21 days of age and in 4-tier batteries of unheated cages to 42 days of age. Birds were kept in tiers of 30 chickens (2 subgroups) at a stocking density of 15 birds/m^2 and fed *ad libitum* with concentrate-based standard diets. During rearing, light intensity of 5–15 lx (depending on chicken age) and standard lighting program were used. Throughout the study, basic parameters of climate (temperature, air humidity, dry cooling of air and air movement) were measured. Individual body weight, feed intake and mortality were recorded every week. At 42 days of rearing, 20 chickens (pullets and cockerels) of average body weight were selected from each group. After slaughter and cooling, they were subjected to a simplified slaughter analysis.

The results were analysed statistically by way of analysis of variance and significance of differences was estimated using Duncan's test.

RESULTS AND DISCUSSION

On the first day of rearing, chicks from the experimental groups were characterized by significantly greater body weight compared to the control birds [Tab. 1].

According to many authors, elevated and reduced air temperatures during rearing have a negative effect on weight gains and final body weights of broiler chickens (McGovern et al., 2000; Sokołowicz et al., 2000; Temim et al., 2000; Sosnówka-Czajka et al., 2001; Mashaly et al., 2004). In our study, elevated and reduced rearing temperature coupled with a 24-hour delay in placement also reduced the growth rate of broiler chickens. From 7 to 28 days of rearing, chicks from group II showed the lowest body weight ($p \leq 0.01$). Chickens from group III were characterized by lower body weight compared to the control group only on day 7 of the study ($p \leq 0.05$). However, in the subsequent period of the experiment, growth compensation occurred and to 35 days no differences in the body weight of chickens were found between the groups studied. This is consistent with the findings of Yahav and Hurwitz (1996) and Yahav and Plavnik (1999), who reported that reduced weight gains as a result of elevated air temperature are compensated in the later period of rearing and even exceed those of the control groups as a result of growth compensation. The process of growth compensation was also confirmed by Sokołowicz and Herbut (2001). Baarendse et al. (2006) reported that rearing chicks during the first five days of life at 28°C has a long-term negative effect on their further growth and development.

The use of a 24-hour delay in chick placement in the present study did not affect the final body weight of the birds because at 42 days of rearing they achieved an average of 2.4 kg body weight with feed intake of 1.9 kg/kg body weight, which is comparable with the results obtained by other authors (Herbut and Sokołowicz, 2004; Herbut et al., 2005).

In the present experiment, no effect of cold and heat stress on feed conversion by broiler chickens was found [Tab. 2], as confirmed by May and Lott (2000) and Sosnówka-Czajka and Herbut (2001). However, the scientific literature contains many papers that point to poorer feed conversion by broiler chickens exposed to thermal (cold or heat) stress (McGovern et al., 2000; Temim et al., 2000).

Thermal stresses applied in the present study did not affect bird mortality [Tab. 3]. Very low mortality in the first period of rearing could result from the good utilization of yolk sac stores and maternal antibodies, which had an effect on the health of broiler chickens. It is worth noting the favorable effect of conditioning chicks with high temperature in the first days of life on bird survival, as confirmed by the studies of Sokołowicz and Herbut (2001) and Sosnówka-Czajka and Herbut (2001).

According to many authors, thermal stress has a negative effect on the quality of broiler carcasses (Yalcin et al., 1999; Temim et al., 2000), but this was not confirmed by our study, where the experimental factors did not have a marked effect on carcass quality [Tab. 4]. Also Połtowicz and Sosnówka-Czajka (2005) found no effect of thermal stress on the quality of broiler carcasses and meat. However, improved carcass quality under cold or heat stress was reported by McGovern et al. (2000) and Sosnówka-Czajka and Herbut (2001, 2003).

CONCLUSIONS

Reduced and elevated air temperature during the first period of rearing reduced the rate of growth, with clearer differences observed in the group of birds reared at lower temperature. Growth compensation occurred at a later period and birds from all the groups achieved similar final body weights. Different thermal conditions of rearing did not affect feed conversion, carcass quality or bird survival.

The results obtained suggest that chickens exposed to a 24-hour feed and water withdrawal can cope with both reduced and elevated temperatures of rearing, with no effect on the production results obtained.

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Table 1. Body weight f broiler chickens (g)

Days of rearing	Group		
	I	II	III
1	40.25 ± 0.34 a	41.80 ± 0.34 b	41.87 ± 0.33 b
7	153.94 ± 1.41 Cc	133.58 ± 1.42 Aa	144.27 ± 1.38 Bb
14	410.81 ± 3.77 Bb	367.04 ± 3.80 Aa	401.60 ± 3.70 Bb
21	764.13 ± 7.83 Bb	711.97 ± 7.88 Aa	748.27 ± 7.67 b
28	1353.89 ± 16.15 Bb	1263.24 ± 16.26 Aa	1306.13 ± 15.82
35	1896.53 ± 24.01	1840.14 ± 24.18	1834.00 ± 23.53
42	2390.28 ± 34.43	2355.63 ± 34.67	2325.33 ± 33.73

A, B – values in rows marked with different letters differ highly significantly (p≤0.01)
a, b – values in rows marked with different letters differ significantly (p≤0.05)

Table 2. Feed conversion (g/kg weight gain)

Days of rearing	**Group**		
	I	**II**	**III**
1–7	864 ± 22.8	910 ± 22.8	916 ± 22.8
8–14	1498 ± 17.6	1536 ± 17.6	1490 ± 17.6
15–21	1766 ± 36.6	1616 ± 36.6	1684 ± 36.6
1–21	**1490 ± 16.1**	**1462 ± 16.1**	**1464 ± 16.1**
22–28	1670 ± 70.4	1796 ± 70.4	1804 ± 70.4
29–35	2032 ± 71.7	1972 ± 71.7	2090 ± 71.7
36–42	2522 ± 78.7	2420 ± 78.7	2442 ± 78.7
22–42	**2036 ± 25.8**	**2050 ± 25.8**	**2096 ± 25.8**
1–42	**1862 ± 18.6**	**1868 ± 18.6**	**1896 ± 18.6**

Table 3. Chicken mortality (%)

Days of rearing	**Group**		
	I	**II**	**III**
1–7	0	0	0
8–14	1.33	0	0
15–21	0	0	0
1–21	**1.33**	**0**	**0**
22–28	0	0	0
29–35	1.33	4.00	0
36–42	4.00	2.67	5.33
22–42	**5.33**	**6.67**	**5.33**
1–42	**6.67**	**6.67**	**5.33**

Table 4. Results of slaughter analysis in 42-day-old broiler chickens (%)

Item	**Group**		
	I	**II**	**III**
Dressing percentage:			
▪ **with giblets**	75.22 ± 0.55	75.51 ± 0.55	75.93 ± 0.55
▪ **without giblets**	71.39 ± 0.57	71.63 ± 0.57	72.23 ± 0.57
Muscles:			
▪ **breast**	24.56 ± 0.41	24.29 ± 0.41	25.17 ± 0.41
▪ **leg**	20.52 ± 0.34	20.57 ± 0.34	20.67 ± 0.34
Abdominal fat	2.49 ± 0.16	2.45 ± 0.16	2.31 ± 0.16
Giblets	5.09 ± 0.13	5.14 ± 0.13	4.89 ± 0.13
Liver	3.26 ± 0.10	3.32 ± 0.10	3.07 ± 0.10
Gizzard	1.18 ± 0.05	1.09 ± 0.05	1.09 ± 0.05
Heart	0.65 ± 0.03	0.74 ± 0.03	0.74 ± 0.03