EFFECT OF ENVIRONMENTAL TEMPERATURES AND ENERGY OR PROTEIN RESTRICTION ON BROILERS CHICKENS GROWTH

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Background

An important objective of the poultry science is to improve the growth of the broiler chicken, particularly the skeletal tissue (protein) and, the poultry industry, has obtained success in improving the chickens growth in the last 35 years (HARVENSTEIN *et al.*, 1994), producing heavier and younger chickens. However, this faster growth has been accompanied by an increased occurrence of skeletal problems, such as leg weakness and tibial dyschondroplasia (LEACH & LILBURN, 1993). Management techniques have been used to reduce the risk of leg disorders. One of these procedures involves early feed restriction (second week of life), with subsequent compensatory growth allowing the birds to reach the heavy market weights needed for deboning (LILBURN, 1994). AUCKLAND & MORRIS (1971), stated that broiler chicken, with its relative short cycle of life, would not have time to present growth compensation after the feed restriction. However, PLAVNIK & HURWITZ (1985) showed a compensatory gain in chickens submitted to short periods of feed restriction in a early age. Studies of ZUBAIR & LEESON (1994) also suggested compensatory gain in birds after a period of feed restriction. However, it must be observed some factors that influence the broiler compensatory gain as: restriction period and level of feed restriction (YU & ROBINSON, 1992).

Objectives

The present experiment was conducted to evaluated the effect of energy or protein restriction from 8th to 14th days of age, on broilers chickens growth raised at different environmental temperatures.

Methods

A total of 900 day-old, male chickens from Ross strain were reared in three environmentally controlled rooms where ambient temperature was maintained at 18, 25 and 33°C up 42 days of age. The desired environmental temperatures were achieved using electric heaters and controlled air coolants. The chamber air renewal was made through two fans and two exhaust fans. The environmentally controlled rooms had 16 boxes (2.50 m of length x 1.10 m of width) in a floor pens. For each temperatures chicks were fed *ad libitum* until 7 days of age. At day 8, chicks were assigned to one of three feeding groups: *ad libitum* (2850 kcal ME/kg of ration and 20% of crude protein from 1 to 21 days and 3040 kcal ME/kg and 17% of crude protein from 22 to 42 days) or energy restricted (2565 kcal ME/kg and 20% of crude protein) or protein restricted (2850 kcal ME/kg and 15% of crude protein). Feed restriction was applied during the second week post-hatching (8-14 days). Before and after the feed restriction period, the birds were fed *ad libitum* with control diets until the end of the experiment (42 days). Feed was continuously available to the animals in the *ad libitum* group. The rations used in the experiment were based on corn and soybean meal and their compositions are shown in Table 1. On the 14th, 21st, 28th and 42nd days of age, all birds of each treatment were weighed to evaluate the chickens growth. For each temperature, a split-plot design was used with the feed program (control, energy or protein restriction) as the main plot and age as the sub-plot. Data were subjected to statistical analysis using the General Linear Model procedure (GLM) of SAS (SAS Institute, 1998). Differences between means were tested using Tukey test.

Results and Discussion

The influence of feeding program, environmental rearing temperature on broiler chicken growth are presented in Table 2. It was observed that in ambient temperatures of 25°C and 33°C, the protein or energy restrictions had not influenced the birds corporal weight at 14 days of age, however, in ambient temperature of 18°C, the protein restriction revealed itself more severe ($P<0.05$) in reducing the chickens weight, when compared with control one. On the other hand, the energy restriction provided similar weight to those presented by the controlled group and under protein restriction. The proteins are basic in the nutritional and metabolic aspect for the chickens, and related to the organism processes as the formation of structural tissues (muscle). However, the protein turnover (synthesis and degradation) of the skeletal muscle can be influenced by the nutritional level. In this direction, the reduction verified in the corporal weight would be related with the lack of growth of the muscular mass (lesser protein synthesis), which depends directly on the fulfillment in the protein requirements for the broiler chicken growth, which probably, harmed due to the high relation E:P (190.00). Our results suggested that in ambient temperatures below of the thermal zone (18°C), changes of relation E:P seem to be more effective in modifying the body weight gain that when in the thermoneutral temperature (25°C) or heat (33°C). On the other hand, the findings had also shown that the increase of relation E:P is more effective to modify the body weight gain in cold environment when compared with the reduction of this relation. Thus, the amino acid availability for the growth is a limited factor for the broiler chickens development when submitted to qualitative feed restriction. One week after the feedback had not been observed differences of the body weight of the animals with the protein restriction in relation to the controlled group, this effect was observed until the end of the experiment (42 days), indicating compensatory gain for the birds that had been submitted to the protein alimentary restriction to 18°C. Similar results were observed by GIACHETTO *et al.* (1998), however contrary to finds of FURLAN (1996). PLAVNIK *et al.* (1986), had described compensatory gain in restricted birds after two weeks of refeeding ad libitum however, CALVERT *et al.* (1987) had reported that after the feed restriction the birds showed a deficit in the corporal weight.

Conclusions

The results showed that, irrespective of ambient temperature, the qualitative energy or protein restriction did not affect the broiler growth at 42 days of age, indicating that broilers kept a compensatory gain ability at different ambient temperatures.

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Table 1 - Feeding program

Age (days)	Feeding program						
	Nutritional level	Control	E:P[1]	Energy restriction	E:P	Protein restriction	E:P
1 - 7	ME (Kcal ME)	2850	142.50	2850	142.50	2850	142.50
	CP (%)	20		20		20	
8 - 14	ME (Kcal ME)	2850	142.50	2565	128.25	2850	190.00
	CP (%)	20		20		15	
15 - 21	ME (Kcal ME)	2850	142.50	2850	142.50	2850	142.50
	CP (%)	20		20		20	
22 - 42	ME (Kcal ME)	3040	178.82	3040	178.82	3040	178.82
	CP (%)	17		17		17	

[1]E:P - energy: protein relation

Table 2 - Body weight (g) of broiler chickens. Each value represents means ± SEM

Temperature	Treatment	Age (days) 14	21	28	42
		Body weight (g)			
18°C	C[2]	302 ± 8.5[a1]	628 ± 21.5[a]	979 ± 38.4[a]	1957 ± 37.9[a]
	RE[3]	289 ± 3.3 [ab]	599 ± 8.2[a]	940 ± 9.9[a]	1910 ± 46.5[a]
	RP[4]	264 ± 6.2[b]	570 ± 13.5[a]	896 ± 28.7[a]	1844 ± 37.3[a]
	CV (%)[5]	15.81	11.12	14.87	14.97
25°C	C	294 ± 8.7[a]	595 ± 12.3[a]	939 ± 36.7[a]	1917 ± 32.1[a]
	RE	295 ± 12.1[a]	611 ± 18.7[a]	965 ± 32.1[a]	1904 ± 71.5[a]
	RP	299 ± 9.1[a]	601 ± 4.2[a]	946 ± 22.3[a]	1909 ± 33.8[a]
	CV (%)	15.30	14.00	12.39	14.49
33°C	C	283 ± 11.4[a]	527 ± 18.7[a]	783 ± 24.7[a]	1419 ± 79.4[a]
	RE	270 ± 6.9[a]	542 ± 20.2[a]	819 ± 10.9[a]	1366 ± 57.8[a]
	RP	264 ± 11.2[a]	512 ± 20.9[a]	766 ± 23.8[a]	1395 ± 53.4[a]
	CV (%)	14.60	15.97	10.50	11.50

[1] Means within a column for each temperature followed by different letters differ ($P<0.05$) by Tukey test; [2] Control group; [3] Energy restriction; [4] Protein restriction; [5] Coefficient of variation.