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Relationship Between Growth and Serum Lactate Dehydrogenase Activity and the Development of Ascites in Broilers Subjected to Skip-a-day Feed Restriction

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Abstract: The present experiment was carried out to determine whether there is any relationship between the growth and the activity of serum lactate dehydrogenase (LDH) and the incidence of ascites in broiler chickens. Dietary treatments consisted of a control met NRC (1994) recommendations during 1-21 and 21-42d and a skip-a-day feed removal with 24h fasting on 9, 11 and 13d. The skip-a-day feed restriction resulted in reduced weekly body weights and decreased weight gain ($P<0.0015$) and feed intake ($P<0.0072$) over the realimentation period (14-42d). The skip-a-day feed removal enhanced the activity of serum LDH measured at 42 days of age ($P<0.026$). Our data demonstrated that there were no statistically significant differences between serum LDH activity and ascitic birds.

Key words: Broiler, lactate dehydrogenase, ascites

Introduction

Ascites is a syndrome which characterized mainly by hypoxemia, followed by a cascade of events: increased cardiac output; development of pulmonary hypertension; right ventricle hypertrophy; right heart valve insufficiency; central venous congestion; fluid exudation, mainly to the peritoneal cavity and pericardium; and finally death (Olkowski and Classen, 1998). Hypoxemia in ascitic broilers has been reported to coincide with significant increases in hematocrit and diminished oxygen saturation in the blood (Luger *et al.*, 2003).

Very limited studies have been addressed the relationship between the activity of lactate dehydrogenase (LDH), which plays a role in hypoxic conditions, and the incidence of ascites. A few numbers of studies have examined the changes in serum LDH activity of broilers died of sudden death syndrome (SDS) (Imaeda, 1999). The ascitic birds are expected to be hypoxemic and in oxygen debt as partial anaerobic stage of metabolism might exist in these birds. The present study was conducted to evaluate if the activity of serum LDH was sensitive to hypoxia and ascites and to determine the efficacy of a skip-a-day feed restriction in controlling ascites.

Materials and Methods

A total number of 180 male day-old broilers (Arbor Acre) were used in the experiment. The experiment was conducted in Shahrerorkord, Iran, an area with altitude of 2100m above the sea level in which the ascites was a common problem. Besides, in order to induce ascites, house temperature was reduced to 25 ± 1 , 20 ± 1 and 15 ± 1 °C on 7, 14 and 21d, respectively. All birds were fed a starter diet for 6d posthatching. Following an overnight

fast, birds were divided in 6 floor pens, each consisted of 30 birds. All floor pens had similar body weight at 7d ($83g \pm 2.43$). Three such pens were allotted to each dietary treatment.

Dietary treatments consisted of: 1) a control group which fed according to NRC (1994) in the starting and growing periods, and 2) a skip-a-day feed removal in which 24h fasting intervals were applied on 9, 11 and 13d. Experimental diets were based on corn and soybean meal including 12.96MJ/kg metabolizable energy and 223 and 194 g/kg CP in the starting and growing periods, respectively.

Pen body weight and feed consumption were recorded on weekly basis. Four birds from each pen were designated for blood collection via brachial vein on 28 and 42d. Sera were obtained by centrifuging the blood samples in 2500g for 10 minutes. The activity of serum LDH was measured by a spectrophotometric method (Mc Comb *et al.*, 1976).

All floor pens were checked daily for ascites mortality. In order to confirm the visual inspection, post-mortem examination was performed. All cases with the ratio of right ventricle to total ventricles (RV/TV) greater than 0.299 were considered as ascites (Walton *et al.*, 2001). Furthermore, blood samples of ascitic birds in the control group were collected for measuring serum LDH activity to make a comparison between healthy and ascitic birds.

Data from the experiment was analyzed in a t-test using SAS software (1997).

Results and Discussion

Weekly body weights throughout the experiment as influenced by dietary treatments are shown in Table 1.

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Table 1: Effects of the skip-a-day feed restriction on body weight of broilers throughout the experiment

	Body weight (g) at					
	9d	14d	21d	28d	35d	42d
Control	102.0	212.8 ^a	459.6 ^a	807.2 ^a	1255.6 ^a	1811.9 ^a
Skip-a-day	101.8	126.3 ^b	330.9 ^b	649.2 ^b	1069.5 ^b	1548.0 ^b
SEM	3.94	5.44	6.34	15.99	15.08	16.23
probability	0.735	0.0008	0.0001	0.0068	0.0067	0.0013

Within each column, means with different superscript are significant

Table 2: Effects of the skip-a-day feed restriction on weight gain, feed intake and feed conversion ratio of broilers during 14 to 42d

	Weight gain (g)	Feed intake (g)	FCR (g:g)
Control	1599.2 ^a	3394.1 ^a	2.12
Skip-a-day	1421.7 ^b	2933.0 ^b	2.06
SEM	16.15	64.60	0.022
probability	0.0015	0.0072	0.1283

Within each column, means with different superscript are significant

Table 3: Effects of the skip-a-day feed restriction on serum lactate dehydrogenase activity in broilers

	Activity of serum lactate dehydrogenase (IU/L)	
	At 28d	at 42d
Control	565.7	581.4 ^b
Skip-a-day	706.4	901.0 ^b
SEM	75.79	93.04
probability	0.205	0.0258

Within each column, means with different superscript are significant.

Table 4: Comparison of serum lactate dehydrogenase activity and RV/TV between healthy and ascitic birds on the control group (3-6 wk)

	Serum LDH activity (IU/L)	RV/TV
Healthy	850.4	0.275 ^b
Ascitic	691.3	0.391 ^a
SEM	88.15	0.0155
Probability	0.2115	0.0001

Within each column, means with different superscript are significant.

Body weight at 9d was recorded right before the first 24h fasting and is similar between the control and skip-a-day feed restricted groups as expected. Body weight at 14d was just recorded upon the completion of the last 24h fasting. The results show a 40.5% reduction in body weight as a consequence of 3 skip-a-day feed removal when compared to the control counterparts. Average body weights of chicks at 14d were 212.8 and 126.3g in the control and skip-a-day feed restricted groups,

respectively and the difference was highly significant ($P < 0.0008$). Birds subjected to skip-a-day feed restriction could not overcome the retarded growth up to 42d. Dozier *et al.* (2002) reported that 2 and 4 days fasting in a skip-a-day feed restriction program resulted in 29 and 35% reduction in body weight, respectively. The greater amount of reduction in body weight obtained in this experiment could be due to the cold stress. Cold exposure while limiting the access of birds to feed might put more distress (Luger *et al.*, 2001), which speculated in the greater reduction in body weight.

Effects of skip-a-day feed removal on weight gain, feed intake and feed conversion ratio during the realimentation period (14-42d) are shown in Table 2. In comparison with the control, skip-a-day feed removal significantly decreased feed intake ($P < 0.0072$) and weight gain ($P < 0.0015$) of broilers whereas it had no significant impact on feed conversion ratio. However, feed restricted chicks had numerically lower feed conversion ratio that might be associated with reduced maintenance requirements as indicated by Zubair and Leeson (1994).

Table 3 shows the changes in serum LDH activity as influenced by dietary treatments. Birds subjected to feed restriction had higher activity of serum LDH compared to their control counterparts. However, this difference was only significant at 42d ($P < 0.0258$). It is unclear why serum LDH activity was elevated in broilers experienced skip-a-day feed removal. Serum LDH activity was also compared between healthy and ascitic birds on the control diet during 3 to 6 wk (Table 4). The activity of serum LDH was higher in healthy birds compared to ascitic birds. This difference, however, was not significant ($P > 0.05$). Ascitic birds had higher ratio of right ventricle to total ventricles (Table 4). The total amount of mortality of ascites was 13.3 and 4.4% for the control and skip-a-day feed removal groups, respectively.

Early feed restriction enhanced the activity of serum LDH in one hand, and in the other hand, reduced the growth and mortality of ascites. The results of this study could not find any association between the activity of serum LDH and the incidence of ascites.

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