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Effect of Quantitative Feed Restriction on Carcass Characteristics and Some Blood Parameters in Broiler Chickens

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Abstract

This experiment was conducted to examine the effect of feed restriction on the carcass characteristics of broiler chicks. In this study 420 day-old male broiler chickens (Cobb-500) were randomly divided into 7 treatments (A, B, C, D, E, F, G) each in 4 replicates of 15 birds per pen. Group A was fed ad libitum throughout the experiment and other six groups were fed restricted as B(8h/day in 7-14 days of age), C(16h/day in 7-14 days of age), D (8h/day in 14-21 days of age), E (16h/ day in 14-21 days of age), F (8h/ day in 21-28 days of age) and G (16h/ day in 21-28 days of age). At the end of the experiment two chickens from each pen were randomly selected and slaughtered to determine carcass and some blood parameters and then data were analyzed. Results revealed that there was no significantly difference in live weight, carcass weight, breast weight, thighs weight, heart weight, abdominal fat weight, liver weight and gizzard weight ($p>0.05$). There were significantly differences ($p<0.05$) in breast crude fat and breast dry matter parameters. The date obtained showed there were not differences in hematocrit, hemoglobin and RV/TV but there is significantly difference in Ascites mortality parameter ($p<0.05$).

Keywords: Broiler, Feed restriction, Performance, Carcass characteristics.

Introduction

Broiler chickens by continuous genetic selection and improvement in nutrition have a very fast growth rate and generally are fed ad libitum throughout their rearing period. On this condition, incidence of metabolic disorder such as Ascites[1] and Sudden Death Syndrome (SDS) and high mortality, fat deposition and high incidence of skeletal diseases may be increased[2-4]. These unwanted circumstances are closely related to higher nutrient intake and high metabolic rate because of the increase in food consumption. Ascites syndrome is defined as a circuit of events between the cardiovascular and pulmonary systems responsible for metabolic demands[5]. The association of ascites with cardiopulmonary capacity and its genetic background has been clearly demonstrated[6,7]. Feeding restriction programs have been suggested to minimize these losses and improve production efficiency. Feeding restriction programs can be in the form of limiting the time of the feed access, skip day feeding[8], reduces nutrients intake by means of diet dilution[9,10], limiting quantity of food offered to the birds daily[11-13] or meal feeding[14].

It should be noted that, there are problem in the implementation of dietary restriction. It was reported quantitative food restriction frequently results in abnormal behaviors such as stereotypic peching at nonfood objects, polydipsia (overdrinking) and increased pacing[15]. Quantitative restriction is for limiting the amount of feed daily given to the animal whereas qualitative restriction is related to nutrient dilution in the diet[16].

Quantitative restriction of food intake aims at avoiding rapid growth and high body weights which are associated with pathological conditions such as ascites mortality and poor reproductive results, such as low fertility, the occurrence of double yolks and low egg yields[17]. Early growth restriction induced by feed restriction has resulted in improved feed efficiency, because of the decrease in energy requirements for maintenance, and improved carcass quality resulted from the decline in fat deposition. Implementation of feed restriction during the early growth stage of broiler shows improvement of feed efficiency and reach body weight similar to the body weight of birds which are fed ad libitum at the time of slaughter[18]. Some research showed that when the feed restriction is removed, a rate of growth is greater than those similar animals of the same age[19,20]. Furthermore early feed restriction programs used to reduce carcass and abdominal fat in broiler chickens growth to produce market body weight similar to control groups[21]. In the some study it was indicated that even though feed restricted birds had lower fat content in their carcass, they showed similar feed efficiency as those birds fed ad libitum[22,23]. It was demonstrated feed restricted birds have been shown to have lower carcass fat content than birds fed ad libitum[24]. This study was conducted to find out the effect of different methods of feed restriction on the birds performance and carcass future.

Materials and Methods

A total of 420 one-day-old male broilers of Cobb 500 were used for the study. All experiment birds were completely randomized design into 7 treatment groups with 4 replicates of 15 birds per pen. Seven treatments were used as follow: (A) a group was fed ad libitum throughout the experiment, (B) agroup had no access to feed (8 h/day) in 7-14 days of age. (C) a group had no access to feed (16 h/day) in 7-14 days of age, (D) a group had no access to feed (8 h/day) in 14-21 days of age, (E) a group had no access to feed (16 h/day) in 14-21 days of age, (F) a group had no access to feed (8 h/day) in 21-28 days of age and (G) a group had no access to feed (16 h/day) in 21-28 days of age. The experiments lasted for 6 weeks and during this experiment house temperature was controlled with thermometer. Broilers were feed diets formulated to supply the requirements recommended by NRC[25] in the starter (1-21 days)and grower (22-42 days) periods (Table-1). Through the experiment water was provided ad libitum and light program was 23 hours light and 1hour dark photoperiod. At the end of the experiment 2 birds from each replicate were selected randomly weighed and slaughtered for determined the carcass and some blood parameters. All the collected data were analyzed through the SAS[26] software.

Results and Discussion

The results with respect to carcass characteristics of broiler chicks are presented in Table-2. The results of this experiment indicated the feed restriction have not significantly effects ($p>0.05$) on broiler carcass parameters.

There are not significant differences between all treatment groups in carcass percent and breast weight parameters but carcass percent was numerically greater in control group and breast weight was numerically greater in group E. The result obtained from this experiment was similar with some study those reported that the feed restriction cannot affect live weight[27,9]. In the some study it was reported that the feed restriction cannot affect breast weight and thigh weight in broiler chickens[9,24]. The result from this experiment indicated feed restriction hasn't any significant effect on the heart weight, liver weight and gizzard weight (1-42 d). These results are consistent with some studies[27-31]. In the table 2 it can be seen there is not significantly differences in broiler chick's abdominal fat (%) at the end of experiment. Similar observations were reported for abdominal fat weight of broiler chicken[32,15]. In the some experiments that was reported the feed restriction can exert negative effects on the breast weight[33] and body weight at marketing age in broiler chicken[34].

Mean carcass composition of the chickens has been shown in Table-3. The date obtained from this study indicated feed restriction cannot effect on thighs dry matter, thighs crude fat, thighs crude protein and breast crude protein ($p>0.05$) but thighs crude protein and breast crude protein was numerically higher in group B. There is significantly difference ($p<0.05$) inbreast dry matter and breast crude fat between experimental groups and the lower breast dry matter and breast crude fat can be seen in E and B groups respectively.

Table-1
Composition of the experimental diets (%) in different stages

Ingredients	Starter (1-21 days)	Grower (22-42 days)
Corn	56.9	63
Soybean meal	33.5	28.17
Corn gluten	2.9	1.77
Inert	0	0.4
Oyster shell	1.1	1.1
Dicalcium Phosphate	2	1.7
Salt	0.3	0.3
Vitamin Premix 1	0.25	0.25
Mineral Premix 2	0.25	0.25
DL-Methionine	0.1	0.03
L-Lysine	0.0	0.03
Animal fat	2.65	3
Vitamin E	0.10	0.10
Total	100	100
Calculated Nutrient Content		
Crude Fat	0.06	0.06
Dry matter	89.03	89
Moisture	10.97	11
ME (kcal/Kg)	3000	3050
Protein (%)	21.5	19.5
Calcium	0.81	0.83
Available P	0.40	0.41
Lysine	1.19	1.18
Methionine	0.48	0.49
Methionine + Cysteine	0.81	0.73

1- For each kg of the diets; Vitamin A, 9000IU; Vitamin D3, 2000IU; Vitamin B1, 1.8 mg; Vitamin B2, 6.6 mg; Vitamin B3, 1 mg; Vitamin B6, 3 mg; Vitamin B12, 0.01 mg; Vitamin E, 18 mg; Vitamin K3, 2 mg; Vitamin B9, 1 mg; Folic acid, 0.05 mg; Biotin, 0.05 mg; Choline chloride, 500, mg. 2- Mn, 100 mg; Zn, 85 mg, Fe, 50 mg, Cu, 10 mg, I, 1 mg; Se, 2 mg.

Table-2
Effects of feed restriction on carcass characteristics of broiler chicks on day 42

Parameters	Treatment							SED	P
	A	B	C	D	E	F	G		
Live weight (g)	1717.13	1633.88	1738.75	1650.63	1646	1669.13	1591.5	52.24	0.49
Carcass (%)	60.26	61.21	60.62	58.61	61.23	61.00	58.80	0.8	0.11
Breast (%)	19.61	19.32	19.74	18.76	19.98	19.88	18.78	0.59	0.64
Thighs (%)	23.66	24.39	23.33	24.31	24.17	24.02	22.23	0.52	0.08
Heart (%)	0.842	0.837	0.765	0.807	0.826	0/802	0.834	0.05	0.95
Abdominal fat (%)	1.78	1.83	1.97	1.7	1.75	1.88	1.58	0.16	0.71
Liver (%)	2.94	2.71	2.53	2.54	2.82	2.70	3.16	0.17	0.18
Gizzard (%)	1.36	1.25	1.33	1.39	1.97	1.43	1.30	0.22	0.36

Experimental treatments: control (A) and other six groups were fed restricted as: B (8 h/day in 7-14 days of age), C (16 h/day in 7-14 days of age), D (8 h/day in 14-21 days of age), E (16 h/day in 14-21 days of age), F (8 h/day in 21-28 days of age), G (16 h/day in 21-28 days of age)

Table-3
Effect of feed restriction on carcass composition in broiler chicks on day 42

Parameters	Treatment							SED	P
	A	B	C	D	E	F	G		
Breast dry matter	31.46^{ab}	32.39^{ab}	36.29^{a}	30.58^{b}	29.35^{b}	33.37^{ab}	32.13^{ab}	1.15	0.011
Thighs dry matter	31.10	30.06	33.33	29.95	33.64	30.32	29.49	1.56	0.364
Breast crude fat	9.50^{ab}	5.73^{b}	11^{a}	8.83^{ab}	7.24^{ab}	7.33^{ab}	7.81^{ab}	0.95	0.020
Thighs crude fat	14.45	12.15	17.16	16.75	16.74	14.08	14.89	1.67	0.354
Thighs crude protein	85.77	87.68	85.42	85.57	84.78	85.37	86.34	1.55	0.895
Breast crude protein	72.01	79.51	77.24	74.50	78.41	77.80	76.95	1.78	0.103

^{a,b}: Mean in same row with different superscript letters are significantly different ($p<0.05$). Experimental treatments: control (A) and other six groups were fed restricted as: B (8 h/day in 7-14 days of age), C (16 h/day in 7-14 days of age), D (8 h/day in 14-21 days of age), E (16 h/day in 14-21 days of age), F (8 h/day in 21-28 days of age), G (16 h/day in 21-28 days of age).

Table-4
Effect of feed restriction on some blood parameter, RV/TV and Ascites mortality in broiler chicks

Parameters	Treatment							SED	P
	A	B	C	D	E	F	G		
Hematocrit (%)	32	35.81	36.25	35.12	32.73	32.37	35.87	2.174	0.632
Hemoglobin (g/100ml)	5.53	6.48	6.03	6.05	5.45	5.40	5.55	0.28	0.087
RV/TV	0.275	0.232	0.243	0.273	0.242	0.259	0.273	0.01	0.279
Ascites mortality	21.66^{a}	4.99^{b}	4.99^{b}	3.33^{b}	9.99^{ab}	6.66^{b}	11.66^{ab}	2.81	0.002

^{a,b}: Mean in same row with different superscript letters are significantly different ($p<0.05$). Experimental treatments: control (A) and other six groups were fed restricted as: B (8 h/day in 7-14 days of age), C (16 h/day in 7-14 days of age), D (8 h/day in 14-21 days of age), E (16 h/day in 14-21 days of age), F (8 h/day in 21-28 days of age), G (16 h/day in 21-28 days of age).

The results with respect to some blood parameters and RV/TV are presented in Table-4. No significant effect ($p>0.05$) for amount of blood hematocrit, hemoglobin and RV/TV parameters. But there is significantly differences ($p<0.05$) in Ascites mortality parameter and the greater ascites mortality was in control group.

It is reported that feed removal in different cloak do not have any significant differences between the trial groups[31]. In an experiment it was explained that feed restriction reduced as cites syndrome in broiler chickens[35]. In another study it was concluded that exert of feed restriction has significant effect ($p<0.05$) on erythrocyte, hematocrit and hemoglobin content in broiler chickens[36]. The result of another experiment showed that exert of feed restriction in broiler chicks did not have significant affect ($p>0.05$) on hematocrit and hemoglobin content[37].It was demonstrated in an experiment that exert of feed restriction in rabbits have a significant effect on ($p<0.05$) hematocrit content[38].

In another study it was observed that feed restriction did not change blood hemoglobin and hematocrit content[39]. The as cites mortality, RV/TV and hematocrit parameters can be changed with feed restriction and they were higher in control group than the other groups[40].Result obtained from this study indicated that feed restriction has a significant affect ($p<0.05$) on ascetic mortality. Birds with feed restriction in different ages showed lower ascetic mortality than the control group.

Conclusion

The date obtained from this study showed, feed restriction didn't have any effects on carcass characteristics ($p>0.05$). The date obtained from this study suggested feed restriction could be differences effect on breast dry mater and breast crude fat content ($p<0.05$). The results with respect feed restriction didn't have any differences on hemoglobin and hematocrit content, but it can affect significantly differences on Ascites mortality in broilers chickens ($p<0.05$).

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