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Influence of Feed Withdrawal Period on Growth Performance of Broiler Chickens under High Ambient Temperature

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This experiment was conducted to evaluate the effect of feed withdrawal period on growth performance of broiler chickens. A total of 180 chicks at one day of age were randomly divided into three experimental groups with 6 replicates of 10 birds each. The first experimental group of chicks was fed basal diets (commercial broilers diets 23% crude protein as starter; 21% crude protein as grower and 19% crude protein as finisher, respectively, until 35 days of age) and served as the control group. The second experimental group was fed the same control diet but the feed withdrawal for one hour per day at night was performed. The third group fed the same control diets but the feed withdrawal for two hours per day and one hour at the afternoon and one hour at night (from 8-35 days of age) was performed. While feed consumption was not different among these three groups, both final body weight and body weight gain were higher in chicks treated with feed withdrawal for 2 h/d; however feed conversion ratio decreased. Feed withdrawal 2hr/d decreased abdominal fat compared with the control group, while, carcass, muscles, liver and gizzard weights were not affected. Furthermore, feed withdrawal decreased plasma total cholestrol, while neither glutamate oxaloacetate transaminase (GOT) nor glucose was affected. It could be concluded that feed withdrawal had positive effects on growth performance and plasma lipid profiles in broilers chickens.

Keywords: Feed withdrawal, Broilers, Growth performance, Plasma lipid profiles, Glucose, Abdominal fat, Cholesterol.

Introduction

Growing broilers in summer season in Egypt is a problematic owing to the direct effect of high ambient temperature. In broiler production farms, environmental temperature higher than 30°C resulted in heat stress which considered one of the most common stressors in poultry production. In Egypt, the open-sided farms cannot control the microclimate in the broiler house (Saleh et al., 2018). Metabolic heat production associated with feeding and digestion can be a significant contributor to heat stress on broilers, especially, during the afternoon and mid-day (Abdul Azis and Afriani, 2017). It has been shown that heat production is associated with feed consumption and metabolism. Thus, reduction feed intake can help birds withstand heat stress by decreasing their rate of heat production. For this reason feed withdrawal during summer days is recommended to address this heat stress problem and it has become a common management practice in different broiler producing areas (Ozkan et al., 2003). Moreover, feed restriction is a method of feeding in which the time or duration or amount of feed is limited. In general, the feed restriction is carried out by quantitative and qualitative feed restriction methods (David and Subalini, 2015). In broiler chickens, the feed cost encompasses more than 70% of the total production cost. Restricted feeding for the broiler chickens prevents the feed wastage and thereby minimizes the cost of production (Jalal and Zakaria, 2012). In addition, the fat deposition in the broiler chickens could be minimized through the restricted feeding (McMurtry et al., 1988). The broilers with heavy deposit of abdominal fat indicate poor finishing.

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Furthermore, the fat deposition reduces the carcass quality and feed efficiency leading to less demand by the consumers. Moreover, the fat deposition may cause the metabolic diseases leading to mortality in the broiler chickens (Clement et al., 2010). The aim of this study was to evaluate the effect of feed withdrawal period on growth performance, organs weight and blood parameters in broiler under high ambient temperature.

Materials and Methods

Birds and experimental design

This experiment was carried out in stratification with the guidelines of the Poultry Production Department, Faculty of Agriculture, Kafrelsheikh University, Egypt. A total of 180, one-day-old broilers (Ross 308) were housed in open system farm, and provided with water and commercial starter, grower and finisher diets (corn and soybean meal based diet containing 23% crude protein and 2950 kcal/kg ME for starter diet; 21%% crude protein and 3040 kcal/kg ME for grower and 19%% crude protein and 3140 kcal/kg ME for finisher, respectively) until 35 days of age. The birds were haphazardly divided into 3 groups with 6 replicates of 10 birds each to tie average of body weight in each group; the control group was fed the basal diets *ad libitum* fed birds. The second experimental group was fed the same control diets but the feed withdrawal for one hour per day at night was performed. The third group fed the same control diets but the feed withdrawal for two hours per day and one hour at afternoon and one hour at night, respectively (from 8-35 days of age). The nutrient compositions of the basal diets are shown in Table 1. The experiment was conducted in open door farm with 24 h light. The temperature of the animal room was optioned 26- 32 °C throughout the experiment. Body weight was recorded every week, and feed consumption was recorded daily during the experimental period. At the end of the experimental period, the birds were weighted and slaughtered by decapitation then dissected to measure the weights of carcass and organs. Blood samples were collected from neck into heparinized test tubes quickly centrifuged (3,000 rpm for 20 min at 5 ^{o}C) to separate the plasma. Plasma was stored at -20 ^{o}C pending analysis.

Biochemical analysis

Plasma total cholesterol, glutamic oxalacetic transaminase (GOT), and glucose concentrations were measured colorimetrically by using commercial kits (Diamond Diagnostics, Egypt) according to the procedure outlined by the manufacturer according to Saleh (2013).

Statistical analysis

The differences between the treatments and the control were analyzed with a General Liner model using SPSS Statistics 17.0 (Statistical Packages for the Social Sciences, released 23 August 2008). Tukey´s multiple comparison test was used to identify which treatments conditions were significantly different from each other at a significance level of $p < 0.05$.

Results

The effect of feed withdrawal period on body weight gain, feed intake, and feed conversion ratio were summarized in Table 2. Feed withdrawal for two hours per day increased final body weight and body weight gain significantly, while feed consumption was not differed in all experimental groups when compared to the *ad libitum* fed birds. Consequently, feed conversion ratio was significantly decreased. Table 3 shows that the response of the organs weights by feed withdrawal period. Abdominal fat weight was decreased significantly by feed withdrawal for two hours per day while; carcass, muscles, liver, gizzard, heart and spleen were not affected. Figure 1 shows plasma concentrations of glucose, total cholesterol and GOT. Plasma total cholesterol concentration was decreased, while, plasma glucose and GOT were not affected by feed withdrawal period.

Discussion

Results of the current experiment indicated that feed withdrawal increased final body weight and body weight gain, while, it reduced feed conversion ratio when compared to the *ad libitum* fed birds. Significantly similar improved in body weight gains in the feed restricted birds when compared to the *ad libitum* fed birds could be due to the improved feed efficiency in the feed restricted birds were reported in several previous studies (Fontana et al., 1992; Zhong et al., 1995; Zubair and Leeson, 1995; Clement et al., 2010). Another research study reported that the broiler chickens kept under feed withdrawal for 5 and 7 hours from 8th to 28th day, gained less body weight than those kept under *ad libitum* (Mahmood et al., 2007). Furthermore, the feed restricted birds obtained low weight than full-fed birds reported by Palo et al. (1995). However, the growth performance of the birds has been higher by the time duration of feed restriction in the current experiment.

TABLE 1. Ingredients and nutrient composition of the basal diets

Ingredients	Starter (g / kg)	Grower (g / kg)	Finisher (g / kg)
Yellow corn	548	595	650
Soybean meal, 46%	380	328	254
Corn gluten meal, 62%	13	14	27
Soy oil	19	25	30
Limestone	10	10	9.5
Dicalcium phosphate	17.5	15.5	15
Premix[1]	3	3	3
Sodium bicarbonate	1.6	1.5	1.8
Salt	3.5	3.5	3.5
L-Lys HCl	1	1.3	1.4
DL-Met	2.6	2.5	1.8
L- threonine	0.2	0.2	0.2
Potassium Carbonate	0.6	0.5	2.8
Nutrient composition[2]			
CP, %	23	21	19
ME, Kcal/Kg	2950	3040	3140
Ca, %	0.89	0.83	0.78
Total P, %	0.72	0.67	0.63
Na, %	0.20	0.20	0.20
CL, %	0.25	0.25	0.25

*Each 3 kg of vitamin-mineral premix contain: 6000000IU vit A, 900000 IU vit D_3, 40000mg vit E, 2000mg vit K, 2000mg vit.B1, 4000mg vit B2, 2000mg vit B6, 10mg vit B12, 50000mg Niacin, 10000 mg pantothenic acid, 50mg Biotin, 3000mg Folic acid, 250000 mg choline, 8500mg Mn, 50000mg Fe, 50000mg Cu, 200mg I , 100mg Se and 100mg Co.

TABLE 2. Effect of feed withdrawal period on performance of broiler chickens

	Control, Ad libitum	1hr/day feed withdrawal	2hr/day feed withdrawal
Initial Body weight, g	42.2±0.2	42.6±0.3	42.4±0.2
Final body weight, g/35day	2306±21b	2340±24ab	2481±17a
Body weight gain	2263.8± 18b	2297.4±21ab	2438.6±19a
Feed intake, g	3511.5±14	3348±15	3511.8±18
FCR	1.526±0.08a	1.435±0.05ab	1.416±0.04b

Values presented are means and their standard error (SE). [a,b] Mean values followed by different letters in the same row are significantly different (P <0.05).

TABLE 3. Effect of feed withdrawal period on organs weights of broiler chickens

	Control, Ad libitum	1hr/day feed withdrawal	2hr/day feed withdrawal
Carcass weight, g/100g bw	78.8±1.7	78.7±1.6	77.1±0.32
Breast muscle weight, g/100g bw	21.6±1.1	23.8±0.4	22.9±0.38
Thigh muscle weight, g/100g bw	16.5±1.2	16.4±0.6	16.7±0.51
Liver weight, g/100g bw	1.96±0.17	2.28±0.19	1.99±0.14
Gizzard weight, g/100g bw	1.11±0.04	1.14±0.02	1.24±0.07
Heart weight, g/100g bw	0.46±0.03	0.44±0.04	0.45±0.01
Spleen weight, g/100g bw	0.148±0.01	0.110±0.01	0.163±0.02
Abdominal fat weight, g/100g bw	1.69±0.21a	1.43±0.14ab	1.12±0.06b

Values presented are means and their standard error (SE). [a,b] Mean values followed by different letters in the same row are significantly different (P <0.05).

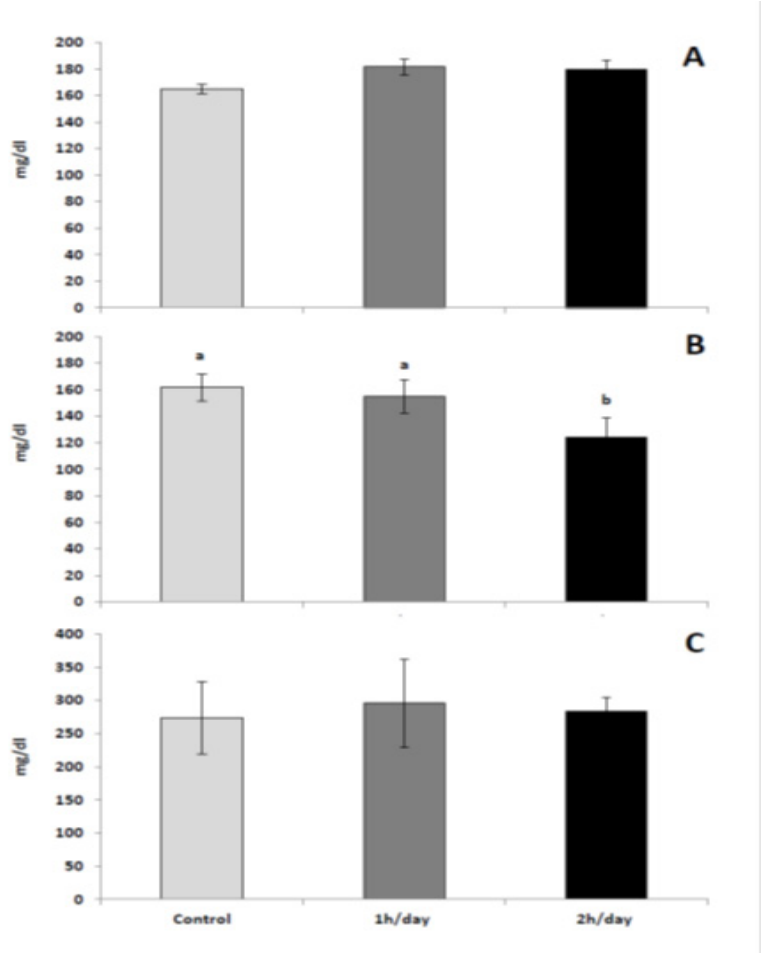

Fig. 1 . Effect of feed withdrawal period on blood parameters of broiler chickens. Plasma glucose (A), plasma total cholesterol (B) and plasma GOT (C). Values are expressed as mean ± standard error; mean values with different letters are significantly different from each other (P <0.05)

Feed withdrawal decreased abdominal fat in this study, while, carcass and organs' weights were not affected. This finding is supported by other previous experiments in broiler chickens (Ramlah et al., 1996) and growing rabbits (Tůmová et al., 2016; Saleh et al., 2013) which indicated that feed restriction reduced abdominal fat. Also, liver, heart and gizzard weights were in the normal weights after feed withdrawal. However, abdominal fat weight was reduced in feed withdrawal for 8 hours compared with control group reported by Petek (2000). Moreover, Demir et al. (2004) found that abdominal fat weight was decreased by 8 and 16 hours feed withdrawal.

Similar research study reported that no significant difference for the dressing percentage among the broiler chickens fed quantitatively restricted feed and the birds fed *ad libitum* (Jalal and Zakaria, 2012). However, another study reported that the dressing percentage of broiler chickens was significantly reduced by the restricted feeding (Saleh et al. 2005). In contrast, significantly increased dressing percentage was reported in broiler chickens fed restricted by feed withdrawal of 3 hours per day during day 21-42experimental period when compared to the full-fed birds (De Silva et al., 2012; Saleh et al., 2018). Sarica et al. (1995) found that no significant effect on gizzard weight, while liver and heart weights between 0-12 hours after feed withdrawal were significantly reduced.

No significant differences between treatments were observed on plasma glucose and GOT, while; plasma total cholesterol concentration was decreased by feed withdrawal for 2 hours. These results are in agreement with Fiky et al. (2008) who reported that presented the feed in two times per day, increased serum total protein and globulin significantly, while serum total lipids and total cholesterol were decreased . Also, Renema et al. (1999) and Rajman et al. (2006) found that plasma lipids and total cholesterol were decreased while glucose was not affected by feed restriction. Moreover, Ebeid et al. (2012) illustrated that feed restriction reduced plasma total cholesterol, triglycerides and non-esterifed fatty acids in growing rabbits.

Conclusion

It could be concluded that growth performance may be improved and abdominal fat might be decreased by feed withdrawal when compared with the birds fed *ad libitum* from 8-35 days of age.

Conflict of Interest Statement

This manuscript has no conflicts of interest.

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تأثير فترات سحب العلف علي الاداء الانتاجي لكتاكيت التسمين المرباة تحت ظروف درجات الحرارة العالية

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تمت هذة التجربة لدراسة تاثير فترات سحب العلف علي الاداء الانتاجي لكتاكيت التسمين تحت ظروف درجات الحرارة العالية. تم في هذة التجربة استخدام ١٨٠ كتكوت تسمين عمر يوم وتم تقسيمها الي ثلاثة معاملات تجريبية بحيث تنقسم كل معاملة الي ستة مكررات تحتوي كل مكررة علي ١٠ طيور. المعاملة الاولي بمثابة الكنترول وتتغذي علي العليقة التجارية التي تقدم للطيور علي ثلاثة مراحل مرحلة البادئ ثم النامي وتنتهي بعليقة الناهي علي عمر ٣٥ يوم بحيث تكون نسبة البروتين في العلائق الثلاثة (٢٣-٢١-١٩٪ علي التوالي). المعاملة الثانية تتغذي علي نفس علائق الكنترول ولكن يتم سحب العلف من امام الطيور لمدة ساعة يوميا وذلك خلال منتصف الليل وذلك بعد اليوم الثامن من العمر حتي نهاية التجربة . بينما المعاملة الثالثة يتم فيها سحب العلف لمدة ساعتان يوميا ساعة خلال فترة الظهيرة وساعة اخري خلال منتصف الليل. بينما استهلاك العلف لم يتاثر بفترات سحب العلف وزن الجسم النهائي ومعدل الزيادة الوزنية زاد بنسبة معنوية خلال المعاملة التي تم سحب العلف بها لمدة ساعتان يوميا وعليه تحسن معامل التحويل الغذائي. سحب العلف لمدة ساعتان خفض من نسبة الدهن المتراكم في البطن معنويا بالمقارنة بمعاملة الكنترول بينما وزن الذبيحة والقونصة والكبد لم تتاثر. علاوة علي ذلك, سحب العلف خفض ايضا من نسبة الكوليسترول الكلي في الدم بينما انزيمات الكبد ونسبة الجلوكوز لم تتاثر معنويا. ويمكن تلخيص النتائج ان سحب العلف لمدة ساعتان يوميا بداية من اليوم الثامن حتي نهاية دورة التربية له تاثير ايجابي علي النمو وكذلك تحسن من نوعية الدهون في الدم في كتاكيت التسمين.