Current Research Journal of Biological Sciences 3(4): 388-392, 2011
ISSN: 2041-0778
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Received: May 07, 2011 Accepted: June 10, 2011 Published: July 15, 2011

Effect of Dietary Supplemented Canola Oil and Poultry Fat on the Performance and Carcass Characterizes of Broiler Chickens

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Abstract: This investigating was performed to examine the effect of different dietary fat source (canola oil and poultry fat) on broiler performance. 252 day-old broilers chicks (Ross 308) were randomly distributed in seven groups include 12 in each with 3 replicates and were fed with experimental diets for 3 weeks (21-42 d-old). The diets were as follow: 1) basal diet (control), basal diet with 3 or 6% canola oil, basal diet with 3 or 6% poultry fat, basal diet with mixed 1.5% canola oil +1.5% poultry fat and basal diet with mixed 3% canola oil +3% poultry fat. Feed intake, feed conversion ratio, daily weight gain and carcass characterizes were evaluated during rearing period. Significant different were observed for feed intake ($p<0.05$). Adding 3 % canola oil and poultry fat resulted in significant improvement in body weight ($p<0.05$) and better feed conversion ratio in fed groups 3 % canola oil and poultry fat than other groups observed ($p<0.01$). No significant different were found in liver, breast, thigh weights in between groups fed lipid in comparison with the control group. Addition of 6% poultry fat caused significant increasing on abdominal fat ($p<0.05$). Gizzard weight was significantly higher in control group in comparison with supplemented groups ($p<0.05$). These findings suggest that adding 3% canola oil or 3% poultry fat to the broiler diet based on corn and soybean meal can improve broiler performance and carcass quality in fed 6% canola oil than other groups was better, may be because of adequate mixture of fatty acids in supplemented canola oil.

Key words: Canola oil, poultry fat, performance and broiler

INTRODUCTION

The main objective of the poultry industry was to improve body weight and feed efficiency of the birds so feed intake is an important factor in formulating the diet. Regulating dietary energy by supplementing fat is believed to be one of the most effective ways to adjust feed intake of broiler chicks. Studies (Harms *et al*., 2000; Bryant *et al*., 2005) showed that increasing dietary energy or fat supplementing decreased feed intake and improved Feed Conversion Ratio (FCR) of broiler chicks (Bryant *et al*., 2005). The addition of fat to diets, besides supplying energy, improves the absorption of fat-soluble, vitamins, diminishes the pulverulence, and increases the palatability of the rations and the efficiency of the consumed energy. It reduces the passage rate of the digesta in the gastrointestinal tract, which allows a better absorption of all nutrients present in the diet. Nowadays, oils have commonly been used as energy sources in the diets for broiler chicks. One of alternative ingredients in broiler chick's nutrition is canola oil. canola oil has been recognized as adequate mixture of essential fatty acids, unsaturated fatty acids such a linolenic acid (C18:3) that can improve broiler performance, also linolenic acids can be converted to longer chain omega-3 fatty acids (Sim, 1990; Yang *et al*., 2000) that is an important factor in animal feeding and is for promote of health (Bezard *et al*., 1994) also dietary mono- unsaturated fatty acids (e.g., oleic acid) were very effective in lowing blood cholesterol concentration. It has been accepted that dietary canola oil is excellent supplement for commercial fish such as salmon (Huang *et al*., 2008). Combination of canola oil with animal fats is a new trend in animal husbandry and aquaculture for optimizing fatty acid profile of meat yield and carcass biochemical measures (Aghdam Shahriar *et al*., 2007; Higgs *et al*., 2006). Zannini *et al*. (2008) in a comparative study show that canola oil supplementation in broiler diet resulted in a decrease in lipid content in edible portions, specifically regarding that of saturated fat in breast meat and liver and in the content of monounsaturated fatty acids in thigh, breast, liver, and gizzard. With attention to past finding for canola oil as efficient dietary supplement for improvement of meat and organ nutritional quality and also performance optimizing, the objective of this experiment were to determine the effects of different dietary fat source on broiler performance and carcass characterizes.

MATERIALS AND METHODS

In present experiment that conducted on summer 2009 at Islamic Azad Univ. farms , 252 day- old broilers

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Table 1: Ingredients and nutrient Composition of experimental diets (%)

Treatment	Control	Co 3%	Co 6%	Pf 3%	Pf 6%	Co 1.5% + Pf 1.5%	Co 3% + Pf 3%
Corn	62.09	62.36	656.51	62.43	56.47	62.34	56.26
SBM (44%)	30.27	30.85	32.40	30.50	32.50	30.82	32.67
Canola oil	-	3	6	-	-	1.5	3
Poultry fat	-	-	-	3	6	1.5	3
Starch	4.14	-	-	-	-	-	-
Oyster mail	1.47	1.45	1.46	1.43	1.44	1.46	1.44
DCP	1.22	1.23	1.23	1.25	1.24	1.25	1.27
Lysine	0.049	0.055	0.065	0.055	0.070	0.077	0.075
Methionine	0.081	0.085	0.085	0.088	0.085	0.09	0.09
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Minera premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.21
Coccidiostat	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sand	-	0.22	1.50	0.497	1.446	0.213	1.433
ME (kcal/kg)	3000	3029	3050	3022	3052	3018	3020
Crude Protein (CP)	18.76	18.87	18.97	18.88	18.98	18.85	18.87
Ca %	0.90	0.90	0.90	0.90	0.90	0.91	0.90
P %	0.35	0.35	0.35	0.35	0.35	0.37	0.36
ME/CP	159.91	160	160.78	160	160.85	160	160

SBM = Soybean meal; DCP = Dicalcium phosphate; ME = Metabolizable Energy; [1]Vitamin premix provided the following per kilogram of feed: vitamin A, 4800 IU (retinyl acetate); cholecalciferol, 880 IU; vitamin E, 10 mg (dl-α-tocopheryl acetate); vitamin K (menadione sodium bisulfate), 1.2 mg; thiamin, 0.8 mg; riboflavin, 2.4 mg; pantothenic acid, 12 mg; niacin, 3 mg; vitamin B12, 0.006 mg; biotin, 0.04 mg; pyridoxine, 0.8 mg; choline chloride 100 mg; anti oxidant 4 mg; [2]Mineral premix provided the following per kilogram of feed: manganese, 40 mg; zinc, 24 mg; iron, 16 mg; copper, 2 mg; iodine, 0.4 mg; selenium, 0.08 mg; Ca, 280 mg and choline chloride 100 mg

chicks (Ross 308) were randomly distributed into seven groups with three replicates (12 chicks in each replicate/pen). The chicks were fed basal broiler starter diet from 1 to 21 days (starter period) based on Completely Randomized Design (CRD). Diets including: Basal diet (control), 3% canola oil (3% Co), 6% canola oil (6% Co), 3% poultry fat (3% Pf), 6% poultry fat (6% Pf), basal diet with 1.5% canola oil + 1.5% poultry fat (1.5% Co + 1.5% Pf) and basal diet with 3% canola oil + 3% poultry fat (3% Co + 3% Pf) throughout 21-d growth period .

Ingredients and nutrient composition of experimental diets were shown in Table 1. Diets were formulated according to NRC (1994). Feed intake, Body weight and feed conversion (FCR) were determined weekly. FCR was calculated as the ratio of the consumed feed to the total body weight of live birds. For evaluation carcass traits, two chicks were randomly selected from each pen and slaughtered. Breast, thigh, abdominal fat, liver and gizzard of birds were separated. Data were subjected to one-way ANOVA by using general liner model procedure in Statistical Analysis system (SAS Institute, 2000). Duncan's multiple range test was applied to identification of significance different ($p<0.05$).

RESULTS AND DISCUSSION

The performance (Feed intake, Weight gain and FCR) and carcass characterizes were presented in Table 2 and 3.

Feed intake: Results showed significant different were observed for feed intake ($p<0.05$). Feed intake was decreased in fed groups mixed 3 and 6% fat than other groups. Wongsuthavas *et al*. (2007) in research with dietary animal fats and soybean oil observed that these combinations hadn't any significant effects on final body weight or FCR of broilers. In present study, there is no

Table 2: Performance of broilers fed various level of canola oil and poultry fat supplemented rations

	Week			
	4	5	6	Total period (1-42 days)
Feed Intake (g)	×	×	ns	×
Control	608a	743a	990	3449a
Co 3%	588a	738a	985	3420a
Co 6%	603a	749a	990	3450a
Pf 3%	586a	735a	978	3368ab
Pf 6%	593a	739a	982	3422a
Co 1.5% + Pf 1.5%	541b	682b	967	3294b
Co 3% + Pf 3%	536b	678b	960	3254b
SEM	1.02	1.13	2.03	11.74
Weight gain (g)	××	××	×	×
Control	359b	386c	537b	1861c
Co 3%	392a	428b	565a	1965a
Co 6%	323c	417b	530b	1850c
Pf 3%	406a	464a	550ab	2000a
Pf 6%	375b	436b	550ab	1925b
Co 1.5% + Pf 1.5%	304d	361d	500b	1817c
Co 3% + Pf 3%	287d	353d	532b	1792cd
SEM	3.92	2.26	1.31	3.59
Feed Convention Ratio (FCR)	×	××	×	××
Control	1.69b	1.92a	1.84a	1.85a
Co 3%	1.49c	1.72c	1.74b	1.74c
Co 6%	1.87a	1.79b	1.86a	1.86a
Pf 3%	1.44c	1.58d	1.77b	1.70c
Pf 6%	1.65b	1.69c	1.78b	1.77b
Co 1.5% + Pf 1.5%	1.78ab	1.89a	1.93a	1.92a
Co 3% + Pf 3%	1.87a	1.92a	1.80ab	1.93a
SEM	0.01	0.01	0.003	0.02

Table 3: Carcass characterizes of broilers fed various level of canola oil and poultry fat supplemented rations at 42 d (% of carcass weight)

	Breast	Thigh	Liver	Gizzard	Abdominal fat
Control	29.43	29.12	2.04	2.07a	0.8c
Co 3%	27.45	28.73	1.97	1.43c	1.15bc
Co 6%	28.55	27.59	2.16	1.88ab	1.8b
Pf 3%	29.94	28.58	2.11	1.63bc	1.65a
Pf 6%	29.17	27.53	2.27	1.43c	1.7a
Co 1.5% + Pf 1.5%	29.21	28.29	2.22	1.38c	1.24b
Co 3% + Pf 3%	29.43	28.68	2.25	1.51bc	1.37b
SEM	0.55	0.49	0.15	0.01	0.03
p-value	ns	ns	ns	×	×

significant difference in feed intake between experimental groups in the comparison with control (Table 2). The results are in agreement with the results of other researchers (Wongsuthavas *et al*. 2007; Lesson and Summers, 2001). Most probably this is due to presence of the same Amount of energy in all supplemented diets and provided the same rate of metabolizable energy to protein in experimental and control diet from 21 to 42 days of study. In spite of these result, Rahimi *et al*. (2011) showed that use of canola seed in the broiler diet has the lowering effect on feed consumption. This might be due to the higher amount of metabolizable energy in canola oil and the highest capability of digestion and absorption of unsaturated fatty acids that exists in canola oil (as a high content) is the main factor that birds can keep their energy received with reduction of feed consumption. Rahimi *et al*. (2011) found supplementation of canola seed to broiler diet hadn't significant effects on feed intake or FCR.

Body weight: Body weight data (Table 2) showed a significant differences ($p<0.05$) in grower and whole experimental periods. Supplementation with canola oil led to heavier birds when compared with poultry fat. Birds fed canola oil had the highest body weight that birds fed poultry fat, also (Baiao and Lara, 2005) Reported significant effect of feeding canola oil on body weight.

Essential are the important factors in bird's nutrition. Canola oil as a source of free fatty acids, unsaturated fatty acids (such a linolenic acid) and omega-3 fatty acids compared with poultry fat has a main effect on optimum lipid metabolism and subsequent body weight (Taylor, 2000). In present study, addition of canola oil (6%) increase body weight due to the highest level of unsaturated fatty acids in canola oil which are converted by birds to omega-3 fatty acids.

Body weight was higher with adding 6% canola oil which is in agreement with the finding of (Taylor, 2000). However, our findings for body weight gain as opposite to Rahimi *et al*. (2011) that they had reports slight declining in body weight of broilers fed canola seed. It is seem that because of this difference, canola seed not canola oil without any combinative animal fat (Rahimi *et al*., 2011) couldn't improve final weight.

Feed Conversion Ratio (FCR): Our results are in agree with those shows the significant difference ($p<0.01$) between experimental and control groups during 21 to 42 days and whole experimental periods (1-42 days) Table 2. This result is in agreement with (Lesson and Summers, 2001; Baiao and Lara, 2005; Rahimi *et al*., 2011). The addition of 3% Co or 3% Pf has positive effect on feed conversion compared with other groups and similar FCR improvement has been seen in Rahimi *et al*. (2011) with adding 15% canola seed to broiler diet. The highest level of essential fatty acids, unsaturated fatty acids and malabsorption of fatty acids in canola oil can play a major role in FCR with reduces the rate of feed passage through the digestive system, which allows a better absorption of all nutrients present in the diet, also birds can keep their energy received In spite of lower feed consumption. This result has been similar with other results (Rahimi *et al*., 2011).

Carcass characterizes: A study conducted by Rahimi *et al*. (2011) the crude fat of breast and thigh meat was not affected by canola seed supplementation. However, birds fed with the control diet (without canola) deposited more lipids in breast muscle. In present study Abdominal fat pad content of birds has shown a significant interaction between treatments ($p<0.05$). 3 and 6% poultry fat fed birds had increased in abdominal fat pad when compared with other groups. The metabolizable energy in unsaturated fatty acids that exists in canola oil is higher than those saturated fatty acids that exist in poultry fat. It might be a factor for fat deposition (Pinchasov and Nir, 1992). Furthermore, it seems that the lower fat deposition was due to an increased rate of lipid catabolism and a decreased fatty acid synthesis (Sanz *et al*., 2000) that in present study was obtained with 3% canola oil and control group, and is according to Rahimi *et al*. (2011) reports with canola seed supplementation.

Omega-3 fatty acids present in canola oil, in other word docosahexaenoic (DHA) and eicosapentaenoic acids (EPA) can reduce fat deposition by reduction of circulating very low density lipoprotein (VLDL) levels and is effective for decrease of fat accretion in arteries, tissues and carcass (Yang *et al*., 2000). Supplementation with 6% canola oil resulted in lower abdominal fat weight because of high level of polyunsaturated fatty acids (Zolitsch *et al*., 1997). The similar result was reported previously (Lopez-Ferrer *et al*., 2001).

Gizzard weight was affected by diets and was significantly higher ($p<0.05$) in the control group which is in agreement with finding of Tabiedian *et al*. (2005). This might be due to decreasing the passage rate of food and gradually increasing gizzard function and finally gizzards muscular mass, that is the cause of gizzard muscular hypertrophy. Our findings are in agreement with Lopez-Ferrer *et al*. (2001) findings.

The breast and thigh weight did not differ between dietary treatments, significantly. In spite of those results, Supplementation with canola oil (3.6%) showed highest breast and thigh weight due to present of unsaturated fatty acids, free fatty acids, omega-3 fatty acids and their effects on absorption and digestion and also because of the highest metabolizable energy in canola oil in comparison with poultry fat (Lesson and Summers, 2001). Present finding shows that there is no significantly difference between experimental and control group.

CONCLUSION

It was concluded, dietary supplementation with 6% canola oil and 6% poultry fat can increase liver weight when compared to 3% canola oil and 3% poultry fat fed birds. Due to higher fat content in diet , the liver are subjected to produce energy, so its weight will be higher in comparison with other experimental groups which received lower fat content in the diet because of increasing liver function.

ACKNOWLEDGMENT

The authors would like to thank the Shabestar Branch, Islamic Azad University for granted to this study.

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