

EFFECT OF GLYCEROL SUPPLEMENTED DIET FED DIFFERENT AGES ON GROWTH PERFORMANCE AND SOME BLOOD PARAMETERS IN JAPANESE QUAILS

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Abstract

480-day-old Japanese quails assigned randomly into four dietary groups. The diets containing no glycerol (control diet) and 5% glycerol were used in the experiment. Each group was divided into four replicates of 30 chicks each. The first group (Group I) was fed with the control diet. Group II between 1-35-day-old, group III between 1-21-day-old, and group IV between 21-35-day-old quails were fed with the diet containing 5% glycerol. At the same time, Group III and Group IV were consumed control diet in 22-35-day-old and 1-20-day-old, respectively. The experiment lasted 35 days. Glycerol supplementation did not significantly affect growth performance. Blood samples were collected from 128 quails (64 males+64 females) on 21st and 35th days. Blood parameters (glucose, triglyceride, cholesterol) were not affected by dietary glycerol on 21st day. However, triglyceride level was significantly reduced in female quails were fed with the diet containing 5% glycerol on 35th day.

Key words: Quail, glycerol, growth performance, blood parameters

1. INTRODUCTION

Renewable energy sources from vegetable oils production has increased rapidly in recent years. (Świątkiewicz and Koreleski, 2008; Koreleski et al 2011). Biodiesel is an alternative fuel produced by chemical reaction between vegetable oil or animal fat with an alcohol (usually methanol) and sodium methylate as a catalyst (Erol et al. 2009, Świątkiewicz and Koreleski, 2009). Crude glycerin is a co-product of biodiesel, gained in the process of transesterification of triacylglycerols of plant oils or animal fats (Świątkiewicz and Koreleski, 2009). Typically in this process, approximately 10% of the total volume of biodiesel produced corresponds to glycerine (Dasari et al., 2005). Crude glycerin generally contains glycerol (80 to 90%), water (10 to 20%), ash (mainly NaCl), free fatty acids, and traces of protein and methanol (Świątkiewicz and Koreleski, 2009). Glycerol is a precursor to the glyceraldehyde 3-phosphate, an intermediate in the gluconeogenesis, and can be converted to glucose for energy production (Erol et al. 2009; Świątkiewicz and Koreleski, 2009). The gross energy content of chemically pure glycerol is 4,310 kcal/kg. The metabolizability of energy in chickens is about 98%; thus, the content of AMEn in pure glycerol is 4,200 kcal/kg (Barteczko and Kaminski, 1999). Recently AMEn of crude glycerol was estimated to be 3805 kcal/kg for laying hens, 3684 kcal/kg for broilers and 4564 kcal/kg for quails (Dozier III et al. 2008; Lammers et al. 2008; Alverenga et al. 2012). Previously, glycerin has been a valuable ingredient for producing food, soaps, cosmetics and pharmaceuticals (Thompson and He, 2006; Da Silva et al. 2009). The poultry industry has a great demand for concentrated energy feeds (Alverenga et al. 2012). Thus, glycerol also has been used currently in animal diets as a energy source due to its high energy content (Min et al. 2010; Kroupa et al. 2011).

Although there were many studies which were used dietary glycerol as an energy source in livestock nutrition (Rosebrough et al., 1980; Kijora et al., 1995; Simon et al., 1996; Cerrate et al., 2006; Coşkun et al., 2007; Holtkamp et al., 2007; Waldroup, 2007; Lammers et al., 2008; Parsons et al. 2008; Schieck et al. 2010; Terré et al. 2010; Kroupa et al., 2011), studies demonstrating to relationship between dietary glycerol and the blood parameters were limited (Erol et al., 2009; Topal, 2009; Yalcin et al., 2010). Therefore, the aim of this study was to determine the effects of crude glycerol fed in different age on growth performance and some blood parameters of Japanese quails.

2. MATERIALS AND METHODS

Experimental procedures were approved by Institutional Animal Care and Use Committee of Adnan Menderes University.

2.1 Animals and Diets

A total of 480 one-day-old Japanese quail (*Coturnix coturnix japonica*) chicks was weighed and equally placed in sixteen cages (30 birds/cage). Cages were randomly divided into four groups of 120 chicks each. Each group was assigned to 4 replicates of 30 chicks each (4x4x30). The experiment lasted for 35 days. The diets containing no glycerol and 5% glycerol were used in the experiment. Group I was fed the diet containing no glycerol. Group II from 1 to 35 d of age, Group III from 1 to 21 d of age, and Group IV from 21 to 35 d of age were fed the diet containing 5% glycerol. At the same time, Group III and Group IV were consumed the control diet in 22-35-day-old and 1-20-day-old, respectively. The diets formulated to meet requirements of quail according to the NRC (1994) in Table 1.

The quails were given access to the feed and water ad libitum during the experimental period. The chemical composition of the diets was determined based on the methods of Association of Official Analytical Chemists (AOAC, 2000).

2.2 Measurement of growth performance

Body weight and feed intake of the groups were weighed at each week. Body weight gain, feed efficiency rate were calculated as g per feed intake per g body weight gain.

2.3 Biochemical Analysis

On d 21 and 35, 4 birds (2 male+2 female) were slaughtered by severing the jugular vein from each replicate (a total of 128 birds/ 21 and 35 d of age). Blood samples were immediately collected. Blood samples were centrifuged at 3000 rpm for 10 minutes and serum triglyceride, glucose and cholesterol were determined by a Vitros 350 auto analyzer (Vitros Chemistry Products, Ortho-Clinical Diagnostics, Johnson-Johnson Company, New York, USA).

2.4 Statistical Analysis

All data were statistically analyzed using the GLM procedure with SAS 8 software. The differences among the means were tested using Duncan's multiple range tests. All statements of significance are based on a probability of $P < 0.05$.

Table 1. Ingredients and nutrient composition of experimental diets, %

Ingredient, %	Control	Glycerol
Corn	42.8	37
Wheat	5	5
Wheat Bran	5	5
Soybean meal, 44% CP	38	38.6
Fish meal, 65% CP	3.8	4
Sunflower oil	3.58	3.58
DCP	0.3	0.3
Limestone	0.8	0,8
DL- Methionine	0.12	0.12
Glycerol	0	5
Salt	0.25	0.25
Vit – Min. Mix ¹	0.25	0.25
Coccidiostat	0.1	0.1
Chemical Composition, %		
Crude Protein	26.00	25.81
Ether Extract	5.99	5.64
Metabolizable Energy, kcal /kg	2908.1	2912.9

¹ Supplying per kilogram of diet: Vit A 12 000 IU, Vit D₃ 1500 IU, Vit E 30 mg, Vit K₃ 5 mg, Vit B₁ 3 mg, Vit B₂ 6 mg, Vit B₆ 5 mg, Vit B₁₂ 0.03 mg, Folic acid 0.75 mg, Ca D- pantotenat 10 mg, D - Biotin 0.075 mg, Cholin Chloride 375 mg, Nicotinamide 40 mg, Mg 80 mg, Fe 40 mg, Zn 60 mg, Cu 5 mg, I 0.4 mg, Co 0.1 mg, Se 0.3 mg and antioxidant 10 mg

3. RESULTS AND DISCUSSION

Effects of glycerol on growth performance and some blood parameters of quails were given in Table 2 and 3. There was no statistically difference on growth performance among the groups (Table 2). These data are consistent with the result of some studies (Cerrate et al., 2006; Min et al. 2008). Silva et al. (2012) reported that while body weight, body weight gain and feed intake increased with glycerol addition, feed conversion ratio did not change during the period of 1 to 7 days of age and 1 to 21 days of age. But growth performance did not change with glycerol treatment during the 1 to 42 days of age. In contrast these studies, Jung and Batal (2011) reported that body weight gain decreased with glycerol supplementation for all periods (except from 16 to 34 d of age). Feed intake decreased with 2.5, 5 and 7.5 % glycerol addition for all periods (except from 35 to 42 d of age and 2.5% glycerol addition). During 35 to 42 d of age, feed intake increased with 2.5% glycerol supplementation. Furthermore, no difference in feed efficiency was observed at any period and any levels of glycerol supplementation.

In the another study, effects of glycerol inclusion levels on broiler performance and nutrient digestibility parameters were examined. According to result of the research, body weight gain for 14-21 d of age and total body weight gain increased with 33, 67 and 100 g/kg glycerol inclusion levels. Glycerol supplementation did not significantly affect dry matter intake during the all periods. Better feed

conversion ratio was observed with glycerol inclusion. Higher dietary apparent metabolisable energy content was observed with glycerol inclusion. Total dry matter and starch digestibility were not affected by glycerol inclusion level (McLea et al., 2011).

Lima et al. (2012) conducted a study to determine the energy levels of three glycerol sources (glycerol from soybean oil, glycerol from the mixture of frying oil and lard, semi pure glycerol) and effects of these sources on performance of broiler at different ages. In all of the periods (8-10, 18-20, 28-30, 38-40), glycerol source did not significantly affect feed intake and final weight. The average AMEn values of glycerol decreased linearly with increasing age of the broilers. AMEn of mixture of glycerol is higher than other sources in all of the periods.

Lilja (1983) reported that species which has a high growth rate capacity, is characterized by a rapid early development of the digestive organs and the liver whereas that of the quail and the turkey, species which have low growth rate capacities, is characterized by a rapid early development of the pectorals and the feathers. In this regard, it is thought that the slow growth rate of quails reduced the effect of glycerol used as an energy source in the first week.

Table 2. The effects of glycerol supplementation on growth performance of quails.

	Control	Group II	Group III	Group IV	SEM	P
Body Weight, g						
Initial	8.18	8.32	8.11	8.37	0.07	0.95
21 days of age	93.88	92.49	93.19	93.77	6.12	0.99
35 days of age	164.60	171.91	169.21	169.76	2.55	0.08
Body Weight Gain, g						
1-21 d	85.70	84.17	85.08	85.39	6.13	0.99
21-35 d	70.73	79.43	76.02	75.99	5.40	0.48
1-35 d	156.42	163.60	161.10	161.39	2.55	0.09
Feed Intake, g/day						
1-21 d	222.41	223.06	217.56	222.95	9.43	0.92
21-35 d	303.71	315.32	305.47	323.23	8.17	0.11
1-35 d	526.12	538.39	523.03	546.18	10.11	0.13
Feed Efficiency, (g FI/g BWG)						
1-21 d	2.61	2.68	2.59	2.63	0.22	0.98
21-35 d	4.32	4.00	4.03	4.31	0.32	0.64
1-35 d	3.37	3.29	3.25	3.39	0.09	0.45

Group I: Control, Group II: Diet with glycerol between 1-35 d, Group III: Diet with glycerol between 1-21d, Group IV: Diet with glycerol between 21-35d.

The effects of dietary glycerol fed different age did not significantly affect serum glucose and cholesterol concentrations (Table 3). Serum triglyceride concentration of female quails decreased with glycerol supplementation at only 35th day ($P < 0.05$). Erol et al. (2009) reported that serum triglyceride

concentration decreased with inclusion of 5, 7.5 and 10% dietary glycerol, respectively. Cholesterol levels were not affected by glycerol inclusion. Another study reported that the inclusion of glycerol did not affect the serum glucose, triglyceride and cholesterol level of broiler (Topal, 2009) and laying hens (Yalçın et al., 2010).

Table 3. The effects of glycerol supplementation on some blood parameters of quails

		Group I	Group II	Group III	Group IV	SEM	P
Glucose, mg/dl							
21 d	Male	181.93	193.29	192.40	176.65	4.26	0.45
	Female	176.76	161.34	188.00	172.85	5.87	0.46
35 d	Male	286,33	306,35	285,41	237,43	10,70	0,12
	Female	288,90	267,21	246,75	264,33	9,56	0,44
Cholesterol, mg/dl							
21 d	Male	122.69	127.05	127.04	113.85	5.88	0.85
	Female	111.75	118.89	119.07	124.91	4.47	0.81
35 d	Male	141,01	144,90	165,99	152,75	4,70	0,28
	Female	122,65	130,09	111,34	133,30	7,46	0,75
Triglyceride, mg/dl							
21 d	Male	72,15	98,45	90,08	74,60	5,27	0,24
	Female	101,38	90,71	68,94	80,32	5,46	0,19
35 d	Male	92,17	99,84	73,35	72,20	4,78	0,09
	Female	160,75 ^a	146,50 ^{ab}	126,13 ^b	123,38 ^b	5,05	0,01

Group I: Control, Group II: Diet with glycerol between 1-35 d, Group III: Diet with glycerol between 1-21d, Group IV: Diet with glycerol between 21-35d.

^{a,b}: Means with the same superscript in the line are not significantly different.

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