THE EFFECTS OF USING CHICKEN GRILL OIL INSTEAD OF THE SUNFLOWER OIL ON PERFORMANCE, BLOOD PARAMETERS, CHOLESTEROL AND FATTY ACID COMPOSITION OF EGG YOLK IN LAYING JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*)

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ABSTRACT

This study was carried out to determine the effect of using chicken grill oil instead of the sunflower oil in laying Japanese quail diets on egg production, feed intake, feed conversion ratio, egg quality, blood parameters, cholesterol and fatty acid composition of egg yolk. A total of 192, thirteen week old Japanese quail were allocated to four groups with six replicates containing eight quail each. The diets were isonitrogenous and isocaloric and included 20 % crude protein and 2900 kcal/kg ME. The diets contained 5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2). Experimental diets and water were provided *ad libitum* throughout the 9 weeks. There were no significant differences in initial body weight among groups, but there were highly significant ($p<0.001$) differences in final body weight among groups: 296.62, 286.62, 308.24, 276.35 g for SO1, CO1, SO2 and CO2 respectively. Higher egg production ($p<0.001$) was obtained for quail fed the CO1 and the CO2 diet (5% and 7.5% chicken grill oil respectively) than for quail fed the SO1 or the SO2 (5% and 7.5% sunflower oil). The cholesterol content in blood serum (195.61, 197.12, 157.37 and 176.49 mg/dl respectively) was not statistically significant. At the end of the study cholesterol content of the egg yolk (49.70, 49.54, 45.55 and 44.06 mg/g egg yolk respectively) was lowest in ($p<0.05$) the laying quail fed the CO2 diet. All blood parameters including haemoglobin, heamotocrit, serum cholesterol and serum glucose were not affected by diets except serum triglyceride and serum protein $p<0.01$). Dietary chicken grill oil had no adverse effect on egg weight, cholesterol and fatty acid composition of the egg yolk and feed conversion ratio. Therefore, chicken grill oil can be use up to 7.5% of the laying quail diets.

Key words: blood parameter, egg, oil, performance, quail,

INTRODUCTION

Metabolic rates and metabolic energy requirements of poultry are very high. Therefore poultry diets should be rich in energy. Oils are important in the diet of poultry as concentrated sources of energy. Use of fats for animal feed has many advantages such as source of energy, increase growth rates, increase feed efficiency, source of essential fatty acid, increase palatability of feeds and lower heat increment during heat stress which keeps caloric intake up etc. (REID, 1985; SENKOYLU, 1990; OZDOĞAN AND SARI, 2001). Because of the high prices, oils being used as a supplement and increases the total cost of diets. Therefore cheaper alternative of by-products from oil industry have been started to be use (CETINGUL and INAL, 2009). The objective of this study was to investigate the effects of using chicken grill oil instead of sunflower oil on feed conversion ratio, cholesterol and fatty acid composition of egg yolk, egg weight of laying quail. Further, the study should contribute to the reduction of environmental pollution.

MATERIALS AND METHODS

In this study a total of 192, thirteen week old Japanese quail were divided into four groups with six replicates containing eight quail each. The diets were isonitrogenous and isocaloric and included 20 % crude protein and 2900 kcal/kg ME. Diets contained 5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2). Firstly, in this study a local ethics committee report was taken. Experimental diets and water were provided ad libitum throughout the nine weeks.

The nutrient compositions of diets were determined according to the AOAC (1984). The analysis of serum and egg yolk total cholesterols and triglyceride were measured on spectrophotometer (Shimatzu UV-1601 Model) by using commercially available kits. During the experiment, egg yolk cholesterol analysis was performed 3 times. Serum protein and glucose levels were estimated by the method of the Biuret (Karagul et al., 2000) and Feteris (1965) respectively. Haemoglobin (Tietz, 1987) and haematocrit were also determined. Fatty acid profiles of experimental fats and egg yolks were determined using QP 5050 GC /MS.

Statistical analyses of data were performed by computer. Differences between obtained values were carried out by analysis of variance (ANOVA) and the significance of mean differences was tested by the Duncan's test (Ozdamar, 1997).

RESULTS AND DISCUSSION

In this study, there were no significant differences in initial body weight among the groups, but there were highly significant ($p<0.001$) differences in final body weight among the groups: 296.62, 286.62, 308.24, 276.35 g for SO, CO1, SO2 and CO2 respectively. On the other hand, according to ATAKISI *et al.* (2009), Omega- 3 fatty acids had no effects on the body weights, or egg and egg yolk weights. In our study, a decrease has been observed in the egg weight at the end of the experiment with CO2 (7.5% chicken grill oil) diets according to CO1, SO1 and SO2 (sunflower oil) diets ($p<0.05$) (*Table 1*).

Table 1. Cholesterol levels (mg/g) in egg yolk of quail fed diets with different amounts sunflower oil and chicken grill oil.

Items	Groups				P-value
	SO1	CO1	SO2	CO2	
Egg weigh (1), g	13,8848	13,3484	13,8478	13,4484	0.392
Boiled egg yolk weight (1), g	4,2872^{ab}	4,0808^{ab}	4,3972^{b}	4,0113^{a}	0,063
Egg yolk cholesterol (1), mg/g	39,6058^{ab}	38,2708^{a}	39,9000^{ab}	41,3892^{b}	0,144
Egg weigh (2), g	12,9737^{a}	13,1628^{a}	14,1508^{b}	13,3680^{a}	0.013
Boiled egg yolk weight (2), g	4,1570	4,3372	4,5855	4,5494	0.337
Egg yolk cholesterol (2), mg/g	44,6533	44,1717	44,9317	45,1783	0.917
Egg weigh (3), g	13,5771^{b}	13,3431^{ab}	12,9227^{ab}	12,7033^{a}	0.048
Boiled egg yolk weight (3), g	4,4290^{b}	4,2327^{b}	4,2641^{b}	3,9007^{a}	0.016
Egg yolk cholesterol (3), mg/g	49,7042^{b}	49,5383^{b}	45,5450^{ab}	44,0550^{a}	0.016

$p<0.05$, Different superscripts ^{a,b} in the same row indicate significant differences between groups. 5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2)

Higher egg production ($p<0.001$) was obtained for the quail fed CO1 and CO2 diet (5% and 7.5% chicken grill oil respectively) than for the quail fed the SO1 and SO2 (5% and 7.5% sunflower oil) (*Table 2*). Contrary to our results CELEBI AND UTLU (2006) reported that the highest egg production was obtained from sunflower oil containing high level of linoleic acid. The highest FCR1 and FCR2 (feed conversion ratio) were obtained from SO2 (7.5% sunflower oil). The addition of 5% and 7.5% chicken grill oil has positive effect on FCR compared with other groups (5% and 7.5% sunflower oil). SHAHRYAR ET AL. (2011) reported that the addition of 3% canola oil or 3% poultry fat has positive effect on feed conversion compared with other groups.

Table 2. The effects of sunflower oil and chicken grill oil on performance of laying

	Groups				P-value
Items	SO1	CO1	SO2	CO2	
Feed intake (g feed/quail/day	40.61^{b}	42.76^{c}	40.64^{b}	38.75^{a}	<0.001
FCR1* (g, feed/dozen egg)	566.05a	555.98a	680.22b	528.20a	<0.001
FCR2 (kg feed/kg egg)	3.44a	3.28a	4.29b	3.30a	<0.001
Egg production, %	87.15^{b}	92.91^{c}	73.42^{a}	90.26^{bc}	<0.001

*FCR; Feed Conversio Ratio, *** $p<0.001$, 5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2). Different superscripts ^{a,b,c} in the same row indicate significant differences between groups.

The cholesterol content in the blood serum (195.61, 197.12, 157.37 and 176.49 mg/dl for SO1, CO1, SO2 and CO2 respectively) was not statistically significant. However, the findings of this experiment do not agree with those found by CELEBI AND UTLU (2006) who observed a reduction of serum total cholesterol when quail were fed diets with different oil (119.17, 138.66, 136.67, 86.50, 82.67 mg/dl for control, tallow oil, a mixture of tallow and flaxseed oil, sunflower oil and flaxseed oil, respectively, ($p<0.05$)). This findings are different from QURESHI ET AL. (2004), who reported the serum cholesterol values were significantly higher ($p<0.05$) in chickens fed animal fat than fed vegetable fat. On the other hand, at the end of the study cholesterol content of yolk (49.70, 49.54, 45.55 and 44.06 mg/g egg yolk for SO1, CO1, SO2 and CO2 respectively) was lower ($p<0.05$) in laying quail fed the CO2 diet (7.5%chicken grill oil) (*Table 1*). FILARDI ET AL. (2005) reported that the concentrations of saturated, monounsaturated, and PUFA in the egg yolks were significantly affected by the addition of different fat sources to diets. MAZALLI ET AL. (2004) reported that cholesterol content in eggs was significantly ($p<0.05$) higher for hens fed the control diet than for hens fed the various oil treatments.

Blood parameters including haemoglobin, haematocrit, serum cholesterol, serum glucose were not affected by diets except for serum triglyceride and serum protein $p<0.01$) (*Table 3*). Similarly GROBAS ET AL. (2001) reported positive effects from the intake of monounsaturated fatty acid on health, with reduce triglyceride concentration in blood. But ATAKISI ET AL. (2009) reported that omega-3 fatty acids reduced egg and plasma cholesterol as well as plasma glucose level and no change was observed in triglyceride levels with the supplementation in quails. Similar to our results, PAL ET AL. (2002) reported that the type of fat added to the diet did not affect the glucose levels and omega-3 fatty acids changed the effects of insulin and glucagon on the plasma glucose.

Table 3. The effects of sunflower oil and chicken grill oil on blood parameters of laying quails

	Group				P-value
	SO1	CO1	SO2	CO2	
Haemoglobin, g/dl	21,2117	21,9400	18,1867	20,2250	0,094
Haematocrit, %	37,8333	39,3333	41,3333	39,1667	0,164
Serum Cholesterol, mg/dl	195,6100	197,1283	157,3667	176,4850	0,073
Serum TG, mg/dl	831,1600^{b}	820,3783^{b}	519,1300^{a}	695,5917^{b}	0.002
Serum glucose, mg/dl	220,7100	217,9567	259,0583	224,5917	0.280
Serum protein, g/dl	4,4033^{b}	4,4350^{b}	3,3000^{a}	4,1867^{b}	0.002

$p<0.01$, 5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2). Different superscripts ^{a,b,} in the same row indicate significant differences between groups

Table 4 shows the effects of dietary fats on yolk fatty acid composition. The stearic acid in egg yolk for quails fed the SO1 diet was higher than those fed the diets (CO1, SO2, and CO2). CEYLAN ET AL. (2011) reported fatty acids profile of the egg yolk was significantly altered by type and level of diatary fat, but cholesterol content of yolk was unchanged. JIANG *et al.* (1991) reported that the high linoleic acid content of sunflower seed diet increased the level of stearic acid in yolk. Similarly, CELEBI AND MACIT, (2008) reported that the fatty acid composition of egg yolk lipids were significantly affected by dietary fatty acid composition. In this study, the fatty acid content of chicken grill oil is 0.46% C14:0, 20.29% C16:0, 1.95% C16:1, 6.63% C18:0, 30.63% C18:1, 1.68% C18:1(n-7), 35.11% C18:2, 2.81% C18:3. FILARDI ET AL. (2005) also reported that there was no effect of the fat sources on the concentration of n-3 fatty acids in the yolk. But a significant effect was observed on the level of n-6 fatty acids with the lowest concentration determined by the addition of canola oil in the feed as compared with the other sources (cotton oil, soybean oil, lard, sunflower oil).

Table 4. Fatty acid composition of chicken grill oil and egg yolk as influenced by quail diets containing sunflower oil (SO) and chicken grill oil (CO).

Item		Chicken grill oil	SO1	CO1	SO2	CO2
C14:0	Myristic	0.46	0.20	0.43	0.40	0.42
C16:0	Palmitic	20.29	27.09	28.28	26.10	27.66
C16:1	Palmitoleic	1.95	1.09	2.63	1.00	1.95
C18:0	Stearic	6.63	18.12	11.64	13.24	13.21
C18:1	Oleic (Omega 9)	30.63	32.38	43.24	39.10	37.61
C18:1(n:7)	Omega 7	1.68	1.10	2.01	1.10	1.40
C18:2	Linoleic Omega 6	35.11	16.42	9.58	17.00	15.24
C18:3	Linolenic	2.81	0.15	0.10	0.10	0.12
C20:4	Arachidonic (omega 6)	-	3.10	1.80	1.83	1.89

5% sunflower oil (SO1), 5% chicken grill oil (CO1), 7.5% sunflower oil (SO2), 7.5% chicken grill oil (CO2).

As a conclusion, this study showed that if chicken grill oil was collected and stored properly, dietary chicken grill oil had no adverse effect on egg weight, cholesterol and fatty acid composition of egg yolk and feed conversion ratio. Chicken grill oil can be use up to 7.5% of the laying quail diets.

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