EFFECT OF FEEDING CANOLA AND SOYBEAN OILS ON SERUM LIPID PROFILE IN COMMERCIAL LAYERS

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ABSTRACT

The purpose of this study was to assess the effect of canola oil and soybean oil on production performance and serum lipid profile in layers. In this study 15 experimental units (8 layers per experimental unit) were randomly allotted to 5 different dietary treatments viz control (A), containing 2.5 % canola oil (B), 5% canola oil (C), 2.5% soybean oil (D) and 5% soybean oil (E) for a period of 9 weeks. Effects of five treatments on production parameters including egg production, egg quality, weight gain and serum lipid profile: serum cholesterol, triglycerides, low-density lipoprotein and high-density lipoprotein were monitored. Serum lipid profile was determined 0, 31 and 63 days from start of experiment. Significantly ($P<0.05$) less serum cholesterol was found in treatment C (295.1 mg/dl) as compared with treatment A (321 mg/dl). Low density lipoprotein cholesterol (LDL) was significantly ($P<0.01$) less in treatment C (131.7 mg/dl) as compared with treatment A, (161 mg/dl) and high density lipoprotein cholesterol (HDL) was significantly ($P<0.01$) high in treatment C (31.76 mg/dl) as compared with treatment A (25.42 mg/dl) and triglyceride (TG) was found significantly ($P<0.01$) less in treatment E (907.3 mg/dl) as compared with treatment A (960 mg/dl). The results suggested that as the percentage of oils increased in the diet, serum lipid profile showed a positive trend.

Key words: Layers, serum lipoproteins, canola oil, soybean oil

INTRODUCTION

The high level of cholesterol present in the eggs has been a contributory factor to decreased consumer's acceptance to eggs (Anonymous, 1986) because the risk of death from coronary heart disease is determined by a number of factors including high blood pressure, diabetes and most importantly high total cholesterol and low density lipoprotein cholesterol (LDL-C) concentrations. Both saturated fat and cholesterol in the overall diet can increase cholesterol concentrations in the blood. Numerous clinical trials documented that when individuals are fed egg yolks, their blood cholesterol levels rise. Adding two egg yolks to an otherwise low cholesterol and low saturated fat diet causes a 10% increase in blood cholesterol levels. This corresponds to an increase in heart disease risk of 20%. (Anonymous, 2001).

Monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFA) when substituted for dietary. Saturated fatty acids (SFAs) can have favourable effects on serum lipid profiles. Research has confirmed that MUFA reduce LDL-C levels and do not lower high density lipoprotein-cholesterol (HDL-C) levels. In addition, MUFAs do not appear to raise serum triglyceride (TG) levels as has been reported following low fat, high carbohydrate diets (Grundy 1989).

The blood lipid lowering effects of dietary n-3 PUFA are well demonstrated in chickens, rats and humans. Roosters fed Max- EPA (menhaden oil high in n-3 PUFA) had decreased very low density lipoprotein (VLDL), TG secretion rates and a trend toward decreased plasma TG levels. In broiler chickens, feeding menhaden oil reduced the amounts of TG in the plasma VLDL and low density lipoprotein (LDL) and fraction (Phetteplace and Watkins, 1992). Human subjects given n-3 PUFA had lower amounts of plasma TG and cholesterol compared with those consuming n-6 PUFA (Harris, 1989). Elevating the polyunsaturate to saturate ratio (P:S) in the diet was found to reduce plasma TG and cholesterol concentrations in humans having normal levels of plasma lipids (Shore *et al.*, 1983).

Canola and soybean have the best fatty acid ratio: these are low in SFA (which increase blood LDL cholesterol levels), high in MUFA (which may lower blood LDL cholesterol levels) and PUFA which also lower blood LDL cholesterol levels. Canola oil has the lowest level of saturated fat. This study was planned to investigate possible effects of rations containing canola

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oil and soybean oil on production performance and serum lipid profile in commercial layers.

MATERIALS AND METHODS

This study was conducted at the Poultry Research Center. University of Agriculture Faisalabad. Rations were formulated according to NRC (1994) nutrient requirements of laying hens. The feed was analyzed for its proximate composition (AOAC. 1990).

One hundred and twenty layers of approximately same weight (av.1605 gm) and age (41 weeks) were divided into 15 experimental units (8 layers per replicate) and were randomly allotted to 5 different dietary treatments A. B. C. D and E (Table 1). with 3 replicates per treatment for a period of 9 weeks. Egg production and egg mass were calculated daily. Feed intake was calculated weekly and body weight of layers was determined after every two weeks. From the start of experiment. two hens per replicate were randomly selected at 0. 31 and 63 days for determination of serum lipid profile. About 5 ml blood was collected from the brachial vein of layers. allowed to clot and serum was separated by centrifugation. Serum lipid profile was determined by kit methods: Serum total cholesterol was determined by enzymatic CHOD-PAP method (Liebermann. 1985) using the kit manufactured by Diagnostic Systems International (DiaSys). Serum triglycerides were determined by enzymatic GOP-PAP method (Trinder. 1969). HDL cholesterol was determined by enzymatic CHOD-PAP method of Schettler and Nussel. (1975) and LDL cholesterol was determined by calculation method with the help of formula reported by Friedewald *et al.* (1972):

LDL cholesterol (mg/dl)

$$= \text{Total cholesterol} - \frac{\text{Triglycerides}}{5} - \text{HDL cholesterol}$$

Table 1: Composition of experimental rations (%)

Ingredients	A	B	C	D	E
Maize	27	27	27	27	27
Wheat	8.5	8	8	8	8
Wheat bran	0	7	13	7	13
Rice	18	12	6.5	12	6.5
Rice polishing	8	5.5	2	5.5	2
Canola meal	6	6	5.5	6	5.5
Soybean meal	15	15	15	15	15
Corn gluten 30%	3	2.5	3	2.5	3
Molasses	5	4.5	4.75	4.5	4.75
Dicalcium phosphate	1.5	1.5	1.5	1.5	1.5
Limestone	7.75	8.25	8.5	8.25	8.5
Canola oil	0	2.5	5	0	0
Soybean oil	0	0	0	2.5	5
Methionine	0.25	0.25	0.25	0.25	0.25
Total:	100	100	100	100	100
Calculated nutrient analysis					
Crude pretein (%)	16.13	16.18	16.16	16.18	16.16
ME (kcal/kg)	2733	2731	2736	2731	2736
Crude fat (%)	2.6	2.5	2.2	2.5	2.2
Crude fibre (%)	4.7	4.9	4.8	4.9	4.8

Statistical analysis

The data collected were analyzed by completely randomized design with factorial arrangements (Steel and Torrie. 1980). The Least Significant Difference test was used to determine significant differences between mean values obtained from different testaments.

RESULTS AND DISCUSSION

Production parameters

Effects of canola and soybean oils on egg production. egg mass. feed conversion ratio and weight gain in layers were non-significant. The results in the present study corroborate with work of Eder *et al.* (1998). Roth-Maier *et al.* (1998) reported that egg production. egg mass and feed conversion were not influenced by the inclusion of fat source. An-Bk and Kang (1999) reported a non-significant difference between live weight gain in layers fed sunflower. linseed and fish oil. Similar results have been shown by Baucells *et al.* (2000).

Physical properties of egg

The results showed that effects of inclusion of canola and soybean oils on egg weight, shell thickness, albumin quality and yolk index were non-significant. The results in the present study corroborate with findings of Eder *et al.* (1998) and Roth-Maier *et al.* (1998) who showed that dietary oils did not influence egg quality characters.

Serum triglycerides

The results showed that inclusion of canola and soybean oils in layer ration reduced their serum triglyceride level. Feeding of 5% canola oil reduced serum triglyceride significantly ($P<0.05$) to 907.33 mg/dl as compared with 960 mg/dl in controls.

These findings in the present study are in agreement with those reported by Mattson and Grundy (1985), Grundy (1989) and Lewis *et al.* (2000), who concluded that inclusion of MUFA and PUFA in diets of humans decreased their serum triglyceride level significantly. But An-Bk and Kang. (1999) showed that sunflower and fish oil increased liver triglyceride level of layers.

Serum total cholesterol

The present study revealed that inclusion of canola and soybean oils in layer rations decreased serum total cholesterol level. Feeding of diet containing 5% canola oil resulted in lowest ($P< 0.05$) serum total cholesterol level (295.1 mg/dl) as compared to control (321 mg/dl). While treatment B, D and E resulted in 314.3, 314.6 and 310.2 mg/dl serum cholesterol respectively.

The presence of high percentage of monounsaturated fatty acids (MUFA) and PUFA in canola and soybean oil has inhibitory effect on synthesis of cholesterol in liver. Vegetable oils containing high levels of PUFA, such as soybean oil, are known to inhibit lipogenesis (Leveille *et al.*, 1975). So synthesis of cholesterol in the liver is decreased which ultimately results in lower serum cholesterol.

The findings of the current study are in agreement with studies of Rays *et al.* (1998) and An-Bk and Kang (1999), who reported that serum cholesterol level decreased by inclusion on MUFA and PUFA in layers diet. Similarly, Grundy (1989) and Lewis *et al.* (2000) reported that inclusion of MUFA and PUFA in human diets decreased their serum cholesterol level significantly. But Shafey (1998); Botsolglou *et al.* (1998) and Meluzzi *et al.* (1998) reported that yolk cholesterol and lipoproteins were not affected by dietary oils.

Serum HDL cholesterol

Inclusion of canola oil increased serum HDL-C significantly ($P< 0.01$). The treatment C yielded 31.76 mg/dl HDL as compared with 25.42 mg/dl in control. These results are in agreement with previous work of Mensink and Katan (1987), Grundy (1989), Mattson (1989) and Morgan *et al.* (1997) who showed that oils high in MUFA and PUFA did not reduced the HDL-C.

Serum LDL cholesterol

Inclusion of canola and soybean oils decreased serum LDL-C significantly ($P<0.01$). The control group showed 161 mg/dl LDL-C as compared to 131.7 mg/dl resulted by inclusion of 5 % canola oil in layer ration.

The LDL lipoproteins are the principal carriers of cholesterol in the blood stream (Grundy, 1987). The LDL receptor activity is increased by MUFA (Mattson and Grundy, 1985). The plasma cholesterol ester transfer activity is decreased by MUFA (Kurushima *et al.* 1995). Since liver and serum cholesterol are decreased by inclusion of vegetable oils (Grundy, 1989), serum LDL cholesterol may also be decreased.

The results of the current study corroborate with studies of Rays *et al.* (1998) and An-Bk and Kang (1999) who reported that serum cholesterol decreased by inclusion of MUFA and PUFA in layers diet.

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