Research Journal of Poultry Sciences 2 (3): 63-66, 2008
ISSN: 1993-5285

Effect of Canola Oil on Liver's and Blood's Cholesterol and Triglyceride Contents in Broiler Chicks

P. Fouladi, R. Salamat Doust Nobar and A. Ahmadzade
Department of Animal Science, Islamic Azad University,
Shabestar Branch, Shabestar, Iran

Abstract: This experiment was conducted to evaluation usage different levels of Canola Oil (CO) (0, 2 and 4%) in the basal diet (corn and soybean meal) and effects on the broiler chicks liver and blood chemical parameters include cholesterol and triglyceride contents. A total of 90 Ross 308 strain were randomly divided in to 3 experimental treatments with 3 replicates (10 chicks per pen) and arranged in a completely randomized design. The experimental period lasted 6 weeks and during this period, the birds had free access to feed and water. Experimental diets consisted of: Basal diet 0% canola oil, basal diet with 2% canola oil and basal diet with 4% canola oil. These diets were isonitrogenous and isoenergetic were given to broiler chickens throughout a 42 day growth period. Data was analyzed with one way ANOVA and means compared with Duncan test. Result for liver chemical analyses showed canola oil in levels of 4 and 2% (T3 and T2, respectively) decrease the cholesterol and triglyceride contents numerically and blood chemical analyses showed treatment of 3 and 2 (contain 4 and 2% canola oil, respectively) decrease the cholesterol and triglyceride contents significantly ($p<0.05$), too Canola oil could increase significantly high density lipoprotein cholesterol (HDL) content in blood ($p<0.05$), but no significantly affected on blood Low Density Lipoprotein cholesterol (LDL) content. Canola oil was decrease LDL content in blood numerically.

Key words: Broiler, canola oil, liver, blood, cholesterol and triglyceride

INTRODUCTION

Oils have commonly been used as energy sources in the diets for broiler chicks especially in grower and finisher period. Addition of canola oil to the diet was clearly beneficial. Dietary saturated fatty acids are an independent risk factor associated with coronary heart disease; their negative effects on low density lipoprotein cholesterol (American Heart Association, 1988), therefore attention to consumption canola oil in diet is very important. A number of studies were conducted with the aim of enhancing the human dietary intake of polyunsaturated fatty acids (PUFA) and the specific aim of conferring beneficial effects to human health and resistance to disease. Canola oil has been recognized as rich plant source of (PUFA = 54%). Unsaturated Fatty Acids (UFA) are found in products derived from plant sources, such as vegetable oils, nuts and seeds. There are two main categories: polyunsaturated fatty acids (which are found in high concentration in sunflower, corn, soybean and canola oils). In studies in which polyunsaturated fatty acids were eaten in place of carbohydrates, these good fats decreased LDL levels and increased HDL levels (American Heart Association, 1988). Cholesterol in the bloodstream is what's most important. High blood cholesterol levels greatly increase the risk for heart disease. Canola oil not only contains optimal levels of PUFA and MUFA but also contains an appreciatable amount of the omega-3 fatty acid Alpha-Linolenic Acid (ALA). ALA is one of two essential fatty acids (EFAs). The aims of this study, are the measured amounts of the cholesterol, triglyceride contents in blood and liver and HDL and LDL levels in blood with consumption of dissimilar canola oil in diet.

MATERIALS AND METHODS

Animals and diets: A total of 90 one-day old broiler chicks of a commercial strain (Ross-308) from mail sex were placed in 9 pens of 2×2 meters with ten birds per each pen. Feed and water were provided ad libitum. The experimental design consisted in a completely randomized design with 3 treatments [T1 Control (soybean + corn), T2 (2% CO) and T3 (4% CO)] with three replication. The treatment diets of were isonitrogenous and isoenergetic.

Corresponding Author: Peyman Fouladi, Departement of Animal Science, Islamic Azad University, Shabestar Branch, Shabestar, Iran

Table 1: Percentage composition of experimental diet in starter period

Ingredients	(%)
Corn	53.50
Soybean	34.00
Canola oil	0.50
Starch	8.00
Wheat bran	0.00
DL-Methionine	0.54
Lysine	0.00
DCP	1.38
Oyster	1.33
Vitamin	0.25
Mineral	0.25
Salt	0.25
Coccidiostat	0.00
Sand	0.00
	100.00
Calculated nutrient content	
ME kcal/kg	2920.00
Crude protein (%)	21.00
Calcium (%)	0.94
Available P (%)	0.43
ME/CP	139.70
Ca/P	2.10

1:Vitamin content of diets provided per kilogram of diet: vitamin A, D, E and K.2: Composition of mineral premix provided as follows per kilogram of premix: Mn, 120,000 mg; Zn, 80,000 mg; Fe, 90,000 mg; Cu, 15,000 mg; I, 1,600 mg; Se, 500 mg; Co, 600 mg.

Table 2: Percentage composition of experimental diet in grower period

	Experimental diets		
Ingredient	T1	T2	T3
Corn	64.00	60.00	55.00
Soybean	27.40	28.00	27.10
Canola oil	0.00	2.00	4.00
Starch	3.74	2.06	1.22
Wheat bran	1.00	2.00	5.50
DL-Methionine	0.00	0.00	0.00
Lysine	0.00	0.00	0.00
DCP	1.13	1.14	1.16
Oyster	1.50	1.48	1.46
Vitamin	0.25	0.25	0.25
Mineral	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Coccidiostat	0.15	0.15	0.15
Sand	0.33	2.42	3.66
	100.00	100.00	100.00
ME kcal kg^{-1}	2920.00	2920.00	2920.00
Crudeprotein (%)	18.20	18.20	18.20
Calcium (%)	0.90	0.90	0.90
Available P (%)	0.35	0.35	0.35
ME/CP	160.10	160.80	160.70
Ca/P	2.50	2.50	2.50

1:Vitamin content of diets provided per kilogram of diet: vitamin A, D, E and K.2: Composition of mineral premix provided as follows per kilogram of premix: Mn, 120,000 mg; Zn, 80,000 mg; Fe, 90,000 mg; Cu, 15,000 mg; I, 1,600 mg; Se, 500 mg; Co, 600 mg

Diets were formulated by adding 0, 2 and 4% canola oil be based diet (corn and soybean meal) that met requirement recommended by the National Research Council (1994). The control diet, which was not enriched with canola oil and was administered throughout the 21 days of experimental period (starter). The levels of canola oil were replaced with corn in diets during 2 different periods (grower and finisher). Ingredient composition and nutrient analysis for each treatment is described in Table 1-3.

Table 3:Percentage composition of experimental diet in finisher period

	Experimental diets		
Ingredient	T1	T2	T3
Corn	66.500	57.500	56.00
Soybean	24.100	25.850	24.00
Canola oil	0.000	2.000	4.00
Starch	3.810	4.340	1.94
Wheat bran	0.000	5.000	6.00
DL-Methionine	0.440	0.450	0.45
Lysine	0.043	0.015	0.08
DCP	0.890	0.920	0.89
Oyster	1.380	1.360	1.31
Vitamin	0.250	0.250	0.25
Mineral	0.250	0.250	0.25
Salt	0.250	0.250	0.25
Coccidiostat	0.150	0.150	0.15
Sand	1.937	1.665	4.43
	100.000	100.000	100.00
Calculated nutrient content			
ME kcal kg^{-1}	2920.000	2920.000	2920.00
Crude protein (%)	16.500	16.40	16.50
Calcium (%)	0.790	0.79	0.77
Available P (%)	0.300	0.30	0.30
ME/CP	176.800	177.40	176.60
Ca/P	2.600	2.60	2.60

1:Vitamin content of diets provided per kilogram of diet: vitamin A, D, E and K.2: Composition of mineral premix provided as follows per kilogram of premix: Mn, 120,000 mg; Zn, 80,000 mg; Fe, 90,000 mg; Cu, 15,000 mg; I, 1,600 mg; Se, 500 mg; Co, 600 mg

At the age of 8 week, all birds slaughtered after bleeding and liver frozen in -21°C. Blood and liver sample translated to lab for analyses of cholesterol and triglyceride contents. One gram the liver tissue is cut and homogenized in the TRISS dilution and determined cholesterol and triglyceride content in autoanalyser system.

Statistical analyses: Data were analyzed in a complete randomized design using the GLM procedure of SAS version 12 (SAS Inst. Inc., Cary, NC, 2000).

$$Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

Where:

Y_{ij} = All dependent variable.
μ = Overall mean.
α_i = The fixes effect of oil levels (i = 1, 2, 3).
ε_{ij} = The random effect of residual.

Duncan multiple ranges used to compare means.

RESULTS AND DISCUSSION

Liver chemical analyses: Result for liver chemical analyses shown in Table 4. Result shows that with usage

Table 4: Least square means for liver and blood chemical analyses

	Treatment				
	T1	T2	T3	SEM	p>F
Liver cholesterol	0.63a	0.60a	0.58a	0.243	0.0001
Liver triglyceride	3.07a	3.03a	3.00a	0.321	0.0001
Blood cholesterol	1.4622b	1.0046ab	0.3929a	0.050233	0.0011
Blood triglyceride	3.2311b	2.6822ab	1.8925a	0.040638	0.0002
Blood-HDL	17.611c	19.056b	25.333a	0.404577	0.0295
Blood-LDL	14.9828a	14.5234a	14.0018a	0.390	0.2061

high levels of canola oil in experimental diet (T3 = 4% CO and T2 = 2% CO, respectively) the contents of cholesterol in liver tissue decrease numerically in relationship to control treatment (T1 = without oil) and too with usage high levels of canola oil in experimental diet a little decrease in liver triglyceride content for treatment T3 and T2 (with 4 and 2% CO, respectively) in relationship with control treatment, but no significant. In the some experiments, the presence of canola oil produced a decrease amount of harmful cholesterol and triglyceride contents in the liver tissue (Mensink and Katan, 1989; Katan, 1995; Ascherio and Willett, 1997). But ours finding not support these research's result significantly. Canola oil as a good contains significant amounts of vitamin E and phytosterols. Phytosterols (plant sterol) are structural analogs of the cholesterol found in animals and humans. It has seem the phytosterol have a main effect on the decrease the liver cholesterol and triglyceride contents (Awed and Fink, 2000) and too vitamin E has a anti oxidant effect on the fat metabolism in the live body, so it has seem, decrease the liver cholesterol and triglyceride contents in some research's intercommunication the vitamin E anti oxidants roles. Also genetic, age and pharmacology agents are known to affect blood, liver and production (egg and meat) cholesterol deposition (Hargis, 1988; Halle, 1996, 2001).

Blood chemical analyses: Result for blood chemical analyses shown in Table 4. Treatment content with 4% canola oil is the highest effect on the triglyceride and cholesterol contents in blood as significantly decrease bloods triglyceride and cholesterol contents. In same study has shown the saturated fat effects of canola oil could affected blood cholesterol and triglyceride contents significantly. That with usage different levels of canola oil in experimental diet the contents of cholesterol in blood significantly ($p<0.05$) decrease and from 1.4622 for treatment without oil reached to 1.0046 and 0.3929, respectively for T2 and T3, too contents of triglyceride in blood significantly ($p<0.05$) decrease from 3.2311 for T1 (without oil treatment) reached to 2.6822 and 1.8925, respectively for T2 and T3. Result shows canola oil is the highest effect on the High Density Lipoprotein cholesterol (HDL) in relationship to control treatment (T1), so that with usage different levels of canola oil in experimental diet (T3 = 4% CO and T2 = 2% CO) the contents of High Density Lipoprotein cholesterol (HDL) in blood significantly ($p<0.05$) increase and from 17.611 for treatment without oil (T1) reached to 19.05 and 25.33, respectively for T2 and T3. But bloods Low Density Lipoprotein cholesterol (LDL) contents a little decrease for treatment T3 and T2 (with 4 and 2% CO, respectively) in relationship with control treatment, but no significant. In the some experiments, the presence of canola oil produced an increase amount of harmful LDL-Cholesterol in the blood and liver and decrease beneficial HDL-Cholesterol levels in blood and liver (Mensink and Katan, 1989; Katan, 1995; Ascherio and Willett, 1997). Ours findings corresponding with these results. In studies in which polyunsaturated fatty acids were eaten in place of carbohydrates, these good fats decrease LDL-Cholesterol and triglyceride levels and increase HDL-Cholesterol levels (American Heart Association, 1988). Canola oil is an excellent source of monounsaturated fat, contains intermediate amounts of the precursor omega-6 and omega-3 polyunsaturated fatty acids, linoleic acid and alfa-linoleic acid, respectively and is very low saturated fat (Baiao and Lara, 2005; Balnav, 1970; Diane and Marris, 2005). Canola oil as a source of phytosterols. The consumption of phytosterols has been shown in numerous studies to lower blood cholesterol levels and may therefore help reduce the risk of cardiovascular disease (Awed and Fink, 2000). In this study, may be canola oil effects on blood chemical parameters (triglyceride, cholesterol and HDL) in communication with high level phytosterol and very low content of cholesterol in canola oil. Health recommendations have encouraged a reduction in the consumption of total lipids, saturated fatty acid and cholesterol but to increasing the proportion of mono unsaturated and polyunsaturated fatty acids in human diets (Walsh *et al*., 1975; Temple, 1996; Grundy, 1980, 1997) found that dietary mono unsaturated fatty acids (e.g., oleic acid) were very effective in lowering blood cholesterol concentration and may be important in preventing coronary heart disease. Also genetic, age and pharmacology agents are known to affect blood, liver and production (egg and meat) cholesterol deposition (Hargis, 1988; Halle, 1996, 2001). The found in little

research that were showing total serum cholesterol was lower ($p<0.05$) in broiler fed canola oil in compared with control diet (Zanini *et al*., 2006) which this finding in correspondent with the objective of this research.

ACKNOWLEDGMENT

Financial support for this study (Islamic Azad University, Shabestar Branch) was provided. The authors are also grateful to them valuable support and to oorumieh jahad university for their skilled technical assistance throughout the experimental analyses.

REFERENCES

American Heart Association, 1988. Dietary guidelines for healthy American Adults: A statement for physicians and health professionals. Arteriosclerosis, 8: 221.

Ascherio, A. and W.C. Willet, 1997. Health effects of Trans fatty acids. Am. J. Clin. Nutr., pp: 1006-1010.

Awed, A.B. and C.S. Fink, 2000. Phytosterols as anticancer dietary components: Evidence and mechanism of action. J. Nutr., 130: 2127-21230.

Baiao, N.C. and L.J.C. Lara, 2005. Oil and fat in broiler nutrition, Braz. J. Poult. Sci., 3: 129-141.

Balnav, D., 1970. Essential fatty acids in poultry nutrition. World's Poult. Sci. J., 26: 442-459.

Diane, H. Marris, 2005. Canola is a good plant source of omega-3 fatty acids. The National Academies, 3: 11-1-11-88.

Grundy, S.M. 1997. What is the desirable ratio of saturated, polyunsaturated and monounsaturated fatty acids in the diet. Am. J. Clin. Nutr., 66: 988-990.

Grundy, S.M., 1980. Comparison of mono unsaturated fatty acids and carbohydrates for lowering plasma cholesterol. New England J. Med., 314: 745-748.

Halla, I., 2001. Effect of dietary fish oil and linseed oil on performance, egg component and fatty acid composition of egg yolk in laying hens. Arc. Fur. Gef., 65: 13-21.

Halle, I., 1996. Effect of dietary of egg yolk in laying hens. Arc. Fur. Gef., 60: 65-72.

Hargis, P.S., 1988. Modifying egg yolk cholesterol in domestic fowl-a review. World's Poult. Sci. J., 44: 17-29.

Katan, M.B., 1995. Commentary on the Supplement trans fatty acids and Coronary heart disease risk. Am. J. Clin. Nutr., 62: 518-519.

Mensink, R.P. and M.P. Katan, 1989. Effect of a diet enriched with monounsaturated or polyunsaturated fatty acids on levels of low density and high density lipoprotein cholesterol in healthy men and women., New England J. Med., 321: 436-441.

Mensink, R.P. and M.P. Katan, 1989. Effect of monounsaturated fatty acids versus complex carbohydrates on high density lipoproteins in healthy men and women, 11: 122-125.

National Research Council, 1994. Nutrient requirements of domestic animals. 3rd Edn. National Academy of Science, Washington, D.C.

SAS Institute, 2000. SAS Institute Inc., Cary, NC.

Temple, N.J., 1996. Dietary fats and coronary heart disease. Biomed. Pharmacother., 50: 261-268.

Walsh, R.J., M.F. Day, F.J. Fenner, M. McCall. E.G. Saint, T.W. Scott, M.V. Tracey and E.J. Underwood, 1975. Diet and Coronary Heart Disease. Rep. No. 18, Canberra. Aust. Acad. Sci., 18: 328-329.

Zanini, G.L., B.M. Calnago, S. Pessotti and M.R. Bastos, 2006. Body fat of broiler chickens fed diets with 2 fat sources and conjugated linoleic acid. Int. J. Poult. Sci., 5 (3): 241-246.