INVESTIGATIONS ON THE EFFECTS OF ARTICHOKE (*CYNARA CARDUNCULUS* VAR. *SCOLYMUS*) EXTRACT ON 35 – 42 DAYS BLOOD LIPID PARAMETERS OF BROILER CHICKENS

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ABSTRACT

Pharmacological plants are developed as additive in animal feeds. These plants are very important for the improvement of the global poultry industry. This experiment studied the effects of artichoke extract on concentrations of triglyceride, cholesterol, very low lipoprotein (VLDL), high density lipoprotein (HDL) in broiler chickens at 35 and 42 days. The experimental designed was a randomized complete block design (RCBD) with 5 treatments (0, 100, 200,300 and 500 mg of artichoke extract per liter of water) and 4 replications. Each replication had 10 chickens, out of which 2 chicken were selected for the evaluation of the lipid profile at days 35 and 42. Fasting blood samples were collected for the analyses of triglyceride, cholesterol, very low lipoprotein, High density lipoprotein levels in the serum of the broiler chickens. The result showed that administration of artichoke extract had no effect on blood lipid components at 34 and 42 days. Comparison between concentrations of triglyceride, cholesterol, very low lipoprotein and high density lipoprotein were significantly different (p<0.05). High level of artichoke extract (500 mg/l) had no effect on blood parameters.

Keywords: Artichoke extract, Triglyceride, Cholesterol, High density lipoprotein, Very low lipoprotein, Broiler chicken

INTRODUCTION

In literature there is a linear relationship between serum lipid and coronary disease in animals. Concentration and type of lipid in broiler chicken has effect on the health status of the bird (Qureshi and Dinzz, 1983). Some components in plants decrease blood fat (Westendarp, 2005). Artichoke (*Cynara carduncul*us var. *scolymus*) is a pharmacological plant with hypolipidemic potentials (Ziae *et al.,* 2004). Artichoke is an ancient plant originally home to the Mediterranean, but currently distributed and cultivated worldwide because of pharmacological usage (Ziae *et al.,* 2004).

Phytochemical present in artichoke includes saponin, insulin, sinaropectin, synarine, carbohydrate, enzymes, cholorogenic acid and flavonoids. Therapeutically, artichoke extract has been used since 14 century in medical sciences for the treatment of cholestrolemia, trigelyceridemia and has hepatoprotective properties (Brand *et al.,* 1992; Zargari, 2003). Artichoke extract has protective activity in liver. Clinical study had shown that artichoke leaves extract decreases blood fats and thus useful for the treatment of arteriosclerosis (Safaikhorram *et al.,* 2010).

Active compounds in the leaf extract of artichoke inhibit cholesterol biosynthesis,

decrease blood glucose and have antioxidant properties (Qureshi and Dinzz, 1983). Applying artichoke leaves in feed stuff, increase total bile secretion and improves digestibility in human, and decreases cholesterol in hypercholesterolemia (Kraff, 1997). Using artichoke extract in rat feed, stimulated bile secretion. Stimulation of bile, improves digestion phases and energy utilization. This function is because of improvement of emulsifiers in intestine. Artichoke extract has positive effect on fat digestion (Seanz *et al.,* 2002). Artichoke extract inhibits synthesis enzyme that involves in cholesterol production, low density lipoprotein oxidation and arteriosclerosis (Radwan *et al.,* 2007). These beneficial activities of artichoke extract guided the current investigation on some parameters of blood cholesterol, triglyceride, HDL, VLDL and LDL in broilers. Whereby the parameters involved liver fat, arteriosclerosis and abdominal fats, measurement of them could be helpful in disease prevention, improved carcass quality in poultry industry and thus supply healthy lean poultry meat to members of the communities.

MATERIAL AND METHODS

Artichoke Extract

Samples of *Cynara cardunculus* var. *scolymus* were collected and authenticated at the herbarium of the Baridj Esans Company, Khorramabad, Iran. It was dried under shade at ambient temperature before extraction. Dried *C. cardunculus* plants (2.0 kg) were crushed to powder and boiled to tender in 2 liters of water. The cold solution was filtered and evaporated to dryness using a rotary evaporator. The extract was re-suspended in water before administration.

Experimental Animal

In this experiment 200 broilers chicken one day old (male and female) commercial strain Kap were used. Broilers were reared up to 21 days by usual rearing, then labeled wing number and located in pens. Four diet pre-starter, starter, grower and finisher were used, and rations were analyzed with the help of UFFDA software (Piotrowska *et al.,* 2011) and the details of feeds and their nutrients are listed (Table 1). The experimental design adopted was randomized complete block design (RCBD) comprising of five treatments with four replications each. Each replication had 10 broilers (male and female).

Blood Lipid Analyses

The treatments were 0 (control), 100, 200, 300 and 500 mg/liter of artichoke aqueous extracts. Artichoke extract was added at 21 – 35 days. After 24 hour, daily residual water was calculated at all of period experiment. At the end of 35 and 42 days two chickens were selected randomly from each of pen. After 4 hour fasting blood sample from wing veins were collected for analyses of blood lipid parameters. Blood samples were stored at room temperature for clotting and centrifuged at 3500 rpm for five minute for blood serum separation and collection. Blood parameters analyzed using autoanalyzer equipment (SELECTRA). For the estimation of triglyceride and cholesterol spectrophotometric method and Pars azmoon kits were used respectively. Boiorex kit with spectrophotometric method was used for estimation of HDL. Freidewald formula was used in calculation of the VLDL concentrations from triglyceride value thus: VLDL – c = TG/5 (Friedewald *et al.,* 1972).

Data Analysis

Experimental data were analyzed using SAS software and general linear model (GLM). Means comparison were calculated using multiple domains Danken (SAS, 2009). Statistical model used was: $Xijk = \mu + Ti + Bj + eijk$, where Xijk = observation, μ = mean of the population, Ti = treatment effect, Bj = replication effect and eijk = error of experiment.

RESULTS AND DISCUSSION

Effects of artichoke extract on some blood lipid parameters are presented in Table 2. There was no marked response on the effect of artichoke extract on the blood lipid metabolites consisting

of triglyceride, cholesterol, very low lipoprotein, high density lipoprotein in broiler chickens at 35 and 42 days. There was significant difference ($p<0.05$) in the concentration of blood lipid parameters at 42 days when compared to 35 days.

The current study clearly demonstrated the effect of artichoke extract on lipid metabolites in broiler chickens. This may be the first report related to the different concentrations 0, 100, 200, 300 and 500 mg/liter of artichoke extract in drinking water on broiler chicken lipid metabolism. The results showed that artichoke extract didn't influenced blood lipid parameters. Furthermore, in an early research, we found that chickens that drank water containing artichoke extract exhibited no significant difference in body weight and abdominal fat. This was in accordance with previous experiment. The level triglyceride in serum is important indicator of fat metabolism (Zhan *et al.,* 2006). Generally, triglycerides are broken down into fatty acids and glycerol as a source of metabolic energy (Sato *et al.,* 2006).

The no effects of artichoke extract on blood fat parameters may be as a result of low concentration of extract in the drinking water. Triglyceride concentration in poultry is affected by age, breed, sex, reproduction, nutrition and health. Serum cholesterol in poultry correlated with nutrition, heredity and age (Zendehrouh *et al.,* 1994). Concentration of cholesterol during 2 – 12 weeks was measured to be between 100 – 200 mg/dl in normal broiler chickens (Zendehrouh *et al.,* 1994). These concentrations were similar to present report. In another study, the application of artichoke extract plus choline chloride had no effect on triglyceride and cholesterol in broilers (Sandoval *et al.,* 2004). Contrarily to our report, the addition of synarine (component from artichoke extract) decreased triglyceride concentration significantly (Yargeldi and Abas, 2013) and the administration of 1.5% aqueous leaves extract of artichoke decreased cholesterol and triglyceride (Fallah *et al.,* 2013) in broiler chickens. In poultry, during lipids metabolism in the liver, lipids are converted into VLDL (Klasing, 2005). The quantity of VLDL concentration in poultry is between 3 – 44 mg/dl (Stevens, 1996).

HDL concentration eliminates free cholesterol in the blood circulation with the help of liver metabolism. Addition of artichoke extract in feed didn't affect HDL concentration in broilers (Fallah *et al.,* 2013), but in layers decreased the HDL concentrations (Radwan *et al.,* 2007).

In the present study, blood fat metabolism at 42 days decreased significantly compared to 32 days. Low quantity of triglyceride at period 42 days could be explained by lipase activity. Concentration of blood lipase could be increased in this period (end of growth phase). In blood vessel, triglyceride breakdown into glycerol and fatty acid with mediated lipase, so triglyceride concentration is decreased. Increasing of triglyceride at 35 days may relate to high activity of fat metabolism. Piotrowska *et al.* (2011) showed that triglyceride increased with age, furthermore lipase decrease blood VLDL concentration. High concentration of blood LDL at 42 days could be explained with decreasing LDL receptors or increasing lipase activity. In this study at 42 days, cholesterol concentration was increased compared to 35 days in broiler chickens. Cholesterol levels in birds increases with age (Zendehrouh *et al.,* 1994). Increasing of cholesterol with age may be due to cholesterol synthesis and high activity of acetyl CoA carboxylase (Gebhardt, 1998; Khan *et al.,* 2008). Szabo *et al.* (2005) reported high level of cholesterol in blood resulting from the release of cholesterol by liver (cholesterol biosynthesis) into the blood. It seems that at 42 days cholesterol metabolism was decreased. This may be the main factor for high concentration of cholesterol in blood. HDL and triglyceride concentration have reverse relationship. Unfortunately, mechanisms by artichoke extract on lipid blood parameters activity are still not clearly understood. Finally, the results of this study imply that no significant different were found on blood lipid parameters of broiler chickens.

Conclusion: Addition of artichoke extract up to 500 mg/liter in drinking water didn't affect fat metabolites in the blood of broiler chickens.

Table 1: Feed ingredient and nutrients in feeds used at different phases of broiler chickens development

Ingredients (%)	Super starter diet	Starter diet	Grower diet	Finisher diet
Corn	47.8	46.7	47.9	45.3
Soybean	23.6	26.9	33.9	34.8
Wheat	22	20	12	7
Corn gluten	-	-	-	6
[1]Concentrate	6.6	6.4	6.2	6.9
Nutrient composition				
[2]energy Metabolizabl	2993	2952	2880	2962
Crude protein	17.63	18.82	21.15	24.28
Calcium	1.00	1.00	1.00	1.10
Available phosphorus	0.50	0.50	0.50	0.55
Sodium	0.18	0.18	0.21	0.22
Lysine	0.88	0.95	1.09	1.29
Methionine	0.43	0.45	0.51	0.59
Cysteine +Methionine	0.68	0.72	0.80	0.93
Linolenic acid	1.30	1.29	1.30	1.27
Tryptophan	0.18	0.20	0.23	0.24

[1]Each kilogram of concentrate contains: Calcium Carbonate 174.06g, Dicalcium phosphate 313.63g, D-L-Methionine 49.26g, L-Lysine 21.35 g, Vitamin supplement 41.05 g, Mineral supplement 41.05 g, NaCl 57.47 g, Anti oxidants 41.05 g, Choline Chloride 20.53 g. [2]Kilocalories per kilogram

Table 2: Comparison of blood lipid metabolites of broiler chickens giving artichoke aqueous extract for 35 and 42 days

Factor/level of treatment (mg/l)	Triglycerides	Cholesterol	Very low density lipoproteins	Low density lipoproteins	High density lipoproteins
0	89.00	149.06	18.84	89.18	41.81
100	84.43	154.44	14.07	94.00	43.37
200	90.31	141.38	15.05	83.87	39.43
300	85.59	139.69	14.26	83.37	38.81
500	84.43	148.25	14.08	90.43	40.68
SEM	7.53	5.40	1.25	3.83	1.71
Time					
Day 35	155.63[a]	128.62[a]	19.28[a]	69.27[a]	36.07[a]
Day 42	57.87[b]	164.5[b]	9.64[b]	107.08[b]	45.57[b]
SEM	4.44	2.71	0.74	1.97	0.85
Probability					
Treatment	0.9698	0.3104	0.97	0.257	0.3531
Time	>0.0001	>0.0001	>0.0001	>0.0001	>0.0001

SEM = Standard error of mean; a, b= significantly different

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