

Effect of *Emblica officinalis* on Serum Lipid Profile in Birds

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Abstract: Elevated levels of plasma Total Cholesterol (TC) and Triglycerides (TG) have been implicated as causative factors in development of atherosclerosis and Coronary Heart Diseases (CHD). *Emblica officinalis* commonly called as Indian gooseberry has been reported to possess hypolipidemic effect. The study was conducted on 24 healthy coloured dwarf birds of 42 week's age. Birds were randomly divided into two groups with twelve birds in each group. Group T₁ was kept as a control while group T₂ was supplemented with fruit pulp powder of *E. officinalis*. Supplementation was done at the rate of 2% in the feed of birds. Blood samples were collected from birds on day 0, 14, 28 and 42 of the experiment. Serum was separated and used for the estimation of total lipids (mg dL⁻¹), cholesterol (mg dL⁻¹), triglycerides (mg dL⁻¹), HDL cholesterol (mg dL⁻¹), LDL cholesterol (mg dL⁻¹) and VLDL cholesterol (mg dL⁻¹). Parameters were calculated in terms of mg dL⁻¹ of serum on day 0, 14, 28 and 42 of the experimental period. Untreated control did not show any significant change in serum total lipids, cholesterol, triglycerides, HDL cholesterol, LDL cholesterol and VLDL cholesterol whereas group of birds with dietary supplementation of herbs revealed significant reduction post treatment. The mean values of serum total lipids, cholesterol, triglycerides, LDL cholesterol and VLDL cholesterol in dietary group of birds supplemented with 2% *E. officinalis* was 477, 100.93, 289.5, 8.98 and 57.9 mg dL⁻¹, respectively. The percent reduction was calculated to be 36.5, 40.5, 34.2, 82.3 and 34.2%, respectively for the treatment group on day 42 post treatment. On the contrary, there was a significant increase in serum HDL level. Dietary herbal supplementation with *E. officinalis* exhibited a significant reduction in the lipid profile.

Key words: *Emblica officinalis*, cholesterol, triglycerides, total lipids, gooseberry, India

INTRODUCTION

In recent years, much prominence has been given to the association of abnormal levels or values of lipid profile (e.g., total cholesterol, LDL, VLDL and triglycerides) with atherosclerosis and Ischemic Heart Disease (IHD). Treatment of hyperlipidemia is preferably by the dietary factors accompanied by other natural regimes. Drug therapy is reserved for more intractable conditions (Evans, 2005). Thus, foremost in the development and management of atherosclerosis is the reduction of serum cholesterol levels. Individuals (men or women) with 33-44 years of age, the total cholesterol levels of 256 mg dL⁻¹ or over have a 5 times greater risk of developing coronary arterial disease than those whose levels are below 220 mg dL⁻¹ (Murray and Pizzorno, 1991). It is further reported that lipoproteins (Fat-carrying proteins) can increase this risk to show that the serum levels of Low Density Lipoproteins (LDL) and

Very Low Density Lipoproteins (VLDL) are directly related to risk in both men and women while High Density Lipoproteins (HDL) are protective against atherosclerosis. Reduction of LDL results in a decrease in progression of atherosclerosis in humans and other primates. The association of hyperlipidemia with the development of atherosclerotic lesion has promoted widespread search for plant based compounds which safely and effectively control the lipid profile (level of cholesterol and triglycerides) in the blood and tissues with least or no toxic effect. Though, a number of plants have so far been screened, evaluated and tested against various cardiovascular disease including hyperlipidemia but very few of the findings have been presented or transformed into a suitable dosage form for proper use either alone or in the form of compound herbal preparation with the exception of one or two, particularly in this part of the world. A couple of compound herbal medicines are available in the local market but most of them have a very broad and expanded indications keeping in view of

socio-economic structure, there seems to be a need rather than the desire to investigate more and more indigenous sources, specially plants for the development of useful product which can help people in reducing and maintaining their lipids (cholesterol, triglycerides, LDL and HDL) with least or no toxic manifestation.

Emblica officinalis commonly called as Indian gooseberry, amla and amlaki is an extensively used herb in making ayurvedic medicines because of its miraculous actions. Amla is one of the most often used herbs in ayurveda. It has a reputation as a powerful rejuvenating herb. The amla fruit is reputed to have the highest content of vitamin C than any other naturally occurring substance. *E. officinalis* juice is an effective hypolipidemic agent (Mathur *et al.*, 1996) and can be used as a pharmaceutical tool in hyperlipidemic subjects. The tissue lipid levels including serum cholesterol, triglycerides, phospholipids and LDL showed a significant reduction following *E. officinalis* juice administration. Keeping this in view, indigenous medicinal plant, *E. officinalis* (Amla) was evaluated for its efficacy on blood lipid profile in coloured dwarf birds.

MATERIALS AND METHODS

The study was conducted on 24 healthy coloured dwarf birds of 42 week's age. Birds were randomly divided into two groups with twelve birds in each group. Group T₁ was kept as a control while group T₂ was the treatment group. Birds were maintained at A.I.C.R.P. on poultry breeding farm, Adhartal, Jabalpur. Birds were kept in individual cages under standard managerial conditions. Fruits of *Emblica officinalis* were dried, crushed, powdered and used for supplementation in the diet of birds. Control diet consisted of basal diet without any herbal supplements. The treatment diet consisted of basal diet along with herbal supplement. Group T₁ was kept as a control while group T₂ was supplemented with dried fruit powder of *Emblica officinalis*. Supplementation was done at the rate of 2% in the feed of birds. *Ad libitum* feed and water was provided to the birds.

Blood lipid profile: Blood samples were collected from wing vein of all the experimental birds in a sterile vial on day 0, 14, 28 and 42 of the experiment. Serum was separated and used for the estimation of the following parameters:

- Total lipids (mg dL⁻¹)
- Cholesterol (mg dL⁻¹)
- Triglycerides (mg dL⁻¹)
- HDL cholesterol (mg dL⁻¹)

- LDL cholesterol (mg dL⁻¹)
- VLDL cholesterol (mg dL⁻¹)

Determination of total lipids was done by the method of Frings *et al.* (1972) using the Helios double beam spectrophotometer while as the diagnostic reagent kits were used for *in vitro* determination of cholesterol, triglycerides and HDL cholesterol in serum by employing methods as suggested by Roeschlau *et al.* (1974), McGowan *et al.* (1983) and Burstein *et al.* (1970), respectively. The estimation was done using semi auto-analyzer (ERBA CHEM-5). Serum VLDL cholesterol was estimated by Friedwald equation (Friedewald *et al.*, 1972):

$$\text{VLDL cholesterol (mg dL}^{-1}\text{)} = \frac{\text{Triglyceride}}{5}$$

Serum LDL cholesterol was again estimated by Friedwald equation:

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

The research plan was screened by the Institutional Animal Ethics Committee and was approved.

Statistical analysis: Data analysis was performed using the Statistical Package for the Social Sciences software (SPSS, version 11.0). Descriptive statistics were adopted to display data in means and SEM. The statistical method of One Way Analysis of Variance (ANOVA) was used to compare the mean values obtained among the different groups. Differences were considered significant whenever $p < 0.05$.

RESULTS AND DISCUSSION

Effect of *E. officinalis* on serum total lipids: The mean of serum lipid values as influenced by dietary supplementation of *E. officinalis* on total lipid values in laying hens have been shown in Table 1. Total lipids were calculated in terms of mg dL⁻¹ of serum on day 0, 14, 28 and 42 of the experimental period in different groups of birds. Untreated control (group I) did not show any significant change in serum total lipids and was 747.25 mg dL⁻¹ yolk on day 42 whereas group of birds with dietary supplementation of herbs revealed significant reduction post treatment. The mean values of serum total lipids in dietary group of birds supplemented with 2% *E. officinalis* (group II) 477 mg dL⁻¹ as compared to 752 on day 0. The percent reduction was calculated to be 36.5% for group II on day 42 post treatment.

Table 1: Efficacy of dietary supplementation with *E. officinalis* on serum total lipids in birds (mg dL⁻¹)

Groups	Inclusion level	Serum total lipids (mg dL ⁻¹)							SEM	CD at p<0.01
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28	Day 42		
T ₁ (Control)	-	747	739	735	747.25	-	-	-	5.83	17.97
T ₂ (<i>E. officinalis</i>)	2%	752 ^a	660 ^b	570 ^c	477.00 ^d	12.2	24.2	36.5	4.36	13.45

Table 2: Efficacy of dietary supplementation with *E. officinalis* on serum cholesterol in birds (mg dL⁻¹)

Groups	Inclusion level	Serum cholesterol (mg dL ⁻¹)							SEM	CD at p<0.01
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28	Day 42		
T ₁ (Control)	-	163.00	167.23	166.72	168.00	-	-	-	0.62	NS
T ₂ (<i>E. officinalis</i>)	2%	169.70 ^a	142.00 ^b	126.96 ^c	100.93 ^d	16.3	25.1	40.5	1.06	3.12

Table 3: Efficacy of dietary supplementation with *E. officinalis* on serum triglycerides in birds (mg dL⁻¹)

Groups	Inclusion level	Serum triglycerides (mg dL ⁻¹)							SEM	CD at p<0.01
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28	Day 42		
T ₁ (control)	-	428.00	358.35	440.33	440.33	-	-	-	36.11	NS
T ₂ (<i>E. officinalis</i>)	2%	440.00 ^a	392.02 ^b	356.48 ^c	289.50 ^d	10.9	18.9	34.2	4.09	12.08

Table 4: Efficacy of dietary supplementation with *E. officinalis* on serum HDL in birds (mg dL⁻¹)

Groups	Inclusion level	Serum HDL (mg dL ⁻¹)							SEM	CD at p<0.01
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28	Day 42		
T ₁ (Control)	-	29.73	29.73	30.41	30.23	-	-	-	0.51	NS
T ₂ (<i>E. officinalis</i>)	2%	30.76 ^a	30.96 ^a	32.78 ^b	34.05 ^c	0.65	6.5	10.6	0.44	1.29

Table 5: Efficacy of dietary supplementation with *E. officinalis* on serum LDL in birds (mg dL⁻¹)

Groups	Inclusion level	Serum LDL (mg dL ⁻¹)							SEM	CD at p<0.01
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28	Day 42		
T ₁ (Control)	-	48.70	51.11	50.72	50.27	-	-	-	1.25	NS
T ₂ (<i>E. officinalis</i>)	2%	50.94 ^a	32.64 ^b	22.87 ^c	8.98 ^d	35.9	55.1	82.3	0.89	2.64

Values are mean of twelve observations; the mean values with different alphabet as superscript differ significantly from each other at 0.01 level of significance; SEM: Standard Error Mean; CD: Critical Difference; NS: Non Significant

Effect of *E. officinalis* on serum Cholesterol (CHO): The findings with regards to the effect of *E. officinalis* on serum CHO have been shown in Table 2. Group I did not show any significant change in serum CHO and was 168 mg dL⁻¹ on day 42 whereas group of birds with dietary supplementation of herbs revealed significant reduction post treatment. The mean values of serum CHO in dietary group of birds supplemented with 2% *E. officinalis* (group II) was 100.93 mg dL⁻¹ as compared to 169.70 on day 0. The percent reduction was 40.5%.

Effect of *E. officinalis* on serum Triglycerides (TG): The mean of serum triglyceride values in control group were 428 and 440.33 mg dL⁻¹, respectively on day 0 and 42 and did not show any significant change (Table 3). However, birds supplemented with 2% *E. officinalis* (group II) showed a significant reduction on day 42 which was 289.5 mg dL⁻¹ as compared to 440 mg dL⁻¹ on day 0 showing a reduction of 34.2%.

Effect of *E. officinalis* on serum High Density Lipoprotein-Cholesterol (HDL-CHO): The mean serum HDL-CHO values as affected by supplementation of *E. officinalis* have been shown in Table 4. In control group, HDL-CHO value was estimated to be 30.23 mg dL⁻¹ on day 42 of the experiment and did not show any significant variations. However, in treatment group, there was significant increase in HDL-CHO values after dietary herb supplementation during 6 weeks of experimentation.

Effect of *E. officinalis* on serum Low Density Lipoprotein-Cholesterol (LDL-CHO): The mean of serum LDL-CHO values as influenced by dietary supplementation *E. officinalis* have been shown in Table 5. Serum LDL-CHO values were calculated in terms of mg dL⁻¹ of serum on day 0, 14, 28 and 42 of the experimental period in two groups of birds. Group I did not show any significant change in serum LDL-CHO and was 50.27 mg dL⁻¹ on day 42 whereas group of birds with

Table 6: Efficacy of dietary supplementation with *E. officinalis* on serum VLDL in birds (mg dL⁻¹)

Groups	Inclusion level	Serum VLDL (mg dL ⁻¹)						SEM	CD at p<0.01	
		Pre treatment (Day 0)	Post treatment			Reduction (%)				
			Day 14	Day 28	Day 42	Day 14	Day 28			Day 42
T ₁ (Control)	-	85.60	85.89	88.07	88.00	-	-	-	1.00	NS
T ₂ (<i>E. officinalis</i>)	2%	88.00 ^a	78.40 ^b	71.30 ^c	57.90 ^d	10.9	18.9	34.2	0.82	2.41

Values are mean of twelve observations; the mean values with different alphabet as superscript differ significantly from each other at 0.01 level of significance; SEM: Standard Error Mean; CD: Critical Difference; NS: Non Significant

dietary supplementation of herbs revealed significant reduction post treatment. The mean values of serum LDL-CHO in dietary group of birds supplemented with 2% *E. officinalis* (group II) was 8.98 on day 42 post treatment with a reduction of 82.3%.

Effect of *E. officinalis* on serum Very Low Density Lipoprotein-Cholesterol (VLDL-CHO): The mean values corresponding to serum VLDL-CHO in the two groups of birds have been shown in Table 6. The VLDL-CHO values of control group did not show any significant change and was 88 mg dL⁻¹ on day 42. However, 2% *E. officinalis* (group II) showed a significant reduction in serum VLDL-CHO levels. Value on day 42 post treatment was 57.9 mg dL⁻¹ with a considerable reduction of 34.2%. The present investigation was undertaken to evaluate the hypocholesteremic activity of indigenous plant, *Emblica officinalis* (Amla) on serum lipid profile in birds. Birds were maintained at All India Coordinated Research Project on Poultry Breeding, Department of Poultry Science, College of Veterinary Science and Animal Husbandry, Adhartal, Jabalpur. Hypocholesteremic activity of *Emblica officinalis* was elucidated in terms of lipid profile in blood of birds. Blood lipid profile included the estimation of total lipids, cholesterol, triglycerides, HDL cholesterol, LDL cholesterol and VLDL cholesterol. The experiment was conducted in the month of April and May, 2010 during the summer season having ambient temperature ranging from 40-42°C. Birds were kept in individual cages under identical managemental conditions along with *ad libitum* drinking water.

Emblica officinalis used in the present study has also been suggested for hypolipidemic activity in rats. The study of Anila and Vijayalakshmi (2002) reported hypolipidemic effect of *Emblica officinalis* in serum and tissues of hyperlipidemic rats. Mathur *et al.* (1996) showed the hypolipidemic effect of fresh juice of *Emblica officinalis* at the dose of 5 mL kg⁻¹ body weight for 60 consecutive days in hyperlipidemic rabbits which caused significant decrease in serum cholesterol, triglycerides and LDL cholesterol levels by 66, 82 and 90%, respectively. Similarly, Mini and Kumar (1995) reported that supplementation of *Emblica officinalis* fruit pulp to rabbits at the dose of 1 g kg⁻¹ body weight caused 69.75

and 79.32% reduction in plasma cholesterol and triglycerides, respectively on day 75 post treatment. The similar hypolipidemic trend was also reported by Kim *et al.* (2005) who studied the influence of *Emblica officinalis* on hypercholesterolemia and lipid peroxidation in cholesterol-fed rats and reported that the administration of ethyl acetate extract of *Emblica officinalis* at the dose of 10 and 20 mg kg⁻¹ body weight daily for 20 days to hypercholesteremic rats significantly reduced total, free and LDL cholesterol levels in a dose-dependent manner. The synthesis of cholesterol is a dynamic process involving a series of biochemical reactions including hepatic 3-Hydroxy-3-Methylglutaryl-Coenzyme A (HMG CoA) reductase activity. Several drugs and indigenous herbs like *Emblica officinalis* have been considered to act by inhibiting HMG CoA reductase and thereby hypocholesteremic effect is induced (Antony *et al.*, 2006). Anila and Vijayalakshmi (2002) published a report indicating hypocholesteremic activity of *Emblica officinalis* in serum and tissues in rats and suggested a significant inhibitory effect on HMG CoA reductase activity leading to decreased synthesis of cholesterol.

CONCLUSION

Dietary herbal supplementation with *Emblica officinalis* exhibited a significant reduction in levels of serum cholesterol of birds. The lipid profile pertaining to total lipids, triglycerides, LDL, VLDL were also decreased gradually and significantly. Thus, the result of the present study demonstrates that *Emblica officinalis* may have a beneficial effect on the blood lipid profile in birds.

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