EFFECT OF DIETARY SUPPLEMENTATION OF LECITHIN ON SERUM LIPID PROFILE OF LARGE WHITE YORKSHIRE PIGS FED HIGH FAT DIET

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ABSTRACT

The experiment was conducted to assess the effect of dietary supplementation of lecithin on serum lipid profile of pigs fed high fat diet. Thirty two weaned Large White Yorkshire piglets were randomly divided into three groups and allotted to three dietary treatments, T1 (control ration as per NRC, 1998), T2 (control ration plus 5 per cent animal fat) and T3 (T2 plus 0.5 per cent lecithin). Blood samples were collected for lipid profile estimation. The serum triglycerides, total cholesterol, HDL, LDL cholesterol, LDL: HDL ratio and total cholesterol: HDL ratio of pigs maintained on three dietary treatments ranged from 36.62 to 46.12 mg/dl, 74.56 to 101.10 mg/dl, 35.30 to 47.77 mg/dl, 31.94 to 44.10 mg/dl, 0.89 to 1.08 and 2.11 to 2.16, respectively. The animals in T2 had higher ($p<0.01$) level of all serum lipid parameters observed in the study except HDL cholesterol where it shows similar effect with T3. The control group (T1) shows lower value of all lipid parameters studied. Elevated serum lipid profile observed for fat added group can be significantly reduced by dietary incorporation of lecithinalong with fat in pigs.

Keywords: Animal fat, lecithin, lipid profile, supplementation

INTRODUCTION

Feed cost plays a major role in determining profitability of swine production and feed itself contributes 65 to 75 per cent of total cost of production (Shurson *et al*., 2015). Energy is considered as an important nutritional component for swine and cereal grains eventhough expensive, constitutes the largest part of dietary energy in most swine diet. The major goal of nutritionist or swine producer should be to supply the nutrients at right time at feasible cost in animal's life. Many alternative energy sources potentially cost effective and useful in swine ration are produced by various industries. One such is animal fats which is a by-product of rendering process that include lard, choice white grease, beef tallow, poultry fat is said to contain 2.25 times metabolisable energy as compared to cereal grains (Lauridsen *et al*., 2007). India produces 0.02 million MT of lard and 0.14 million MT of tallow per year (FAO, 2010). Many researches indicate that addition of 1 to 5 per cent fat improve growth rate, increase palatability, carcass fat, reduce dust and bacterial particles in air, decrease production of pro-inflammatory cytokines,

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wear on feed processing equipment as well as reduce weaning stress to piglets.

For proper utilization of fat by animals they should be digested and absorbed well in gastrointestinal tract. Because fat are insoluble in water and difficult to handle in liquid medium, emulsification is required for their digestion. Lecithin, a phospholipid, extracted from soybeans is used as an exogenous emulsifier to enhance utilisation of dietary fat. It has a fatty acid profile that is high in linoleic and other unsaturated fatty acids and contains phosphatidyl choline and other phospholipids. The addition of phospholipids (in the form of vegetable lecithin) to diets of piglets improved fat digestibility due to their emulsifying property. Blood cholesterol concentration is an important risk factor for the development of atherosclerosis, and soy lecithin has hypocholesterolemic properties in animals and humans.

In the modern world increased consumption of unbalanced fat rich food has led to increased incidences of hyperlipidemia, hypercholesterolemia, and cardiac problems in human beings. The results obtained in this study can be extrapolated to human beings since their physiological systems are similar. The present experiment was conducted to assess the effect of dietary supplementation of lecithin on serum lipid profile in Large White Yorkshire pigs fed high fat diet.

MATERIALS AND METHODS

Thirty two weaned female Large White Yorkshire piglets of two months of age were selected and randomly divided into three dietary groups with four replicates in each group (two piglets per replicate in control group and three piglets per replicate in supplementary groups). All piglets were maintained under uniform management conditions throughout the experimental period of 98 days. All piglets were fed twice daily. Restricted feeding were followed by allowing them to consume as much as possible within the period of one hour and balance feed, if any, were collected and weighed after each feeding. Daily feed intake was recorded. Each piglet were fed with standard grower and finisher ration containing 18 and 16 per cent of crude protein (CP) and 3265 kcal of metabolizable energy (ME) per kg of feed, respectively. The three groups of piglets were allotted to three dietary treatments as follows: T1 (control ration as per NRC, 1998), T2 (control ration plus 5 per cent animal fat), T3 (T2 plus 0.5 per cent lecithin). Ingredient composition of experimental grower and finisher rations are presented on Table 1. The animal fat used for the study was a mixture of beef fat (tallow), pig fat (lard) and a little of poultry fat. At the end of the experiment, blood sample were collected from all the experimental animals in each group.

Serum was separated immediately by centrifugation at 3000 rpm for 10 minutes and subjected for lipid profile estimation. Serum total cholesterol (CHOD-PAP Method, Agappe Diagnostics), triglycerides (GPO-POD method), and high density lipoprotein cholesterol (DGKC, SCE, Kinetic Method, Agappe Diagnostics) were analysed using standard kits by semi-automated blood analyser- Mispa plus. LDL cholesterol (using formula from

total cholesterol, HDL cholesterol and triglyceride values), ratios of LDL: HDL, total cholesterol: HDL were also calculated.

Data collected on various parameters were statistically analysed by Completely Randomized Design (CRD) method as described by Snedecor and Cochran (1994). Means were compared by Duncan Multiple Range Test (DMRT) using Statistical Package for Social Studies Software (SPSS).

RESULTS AND DISCUSSION

Average initial serum lipid profile of experimental piglets recorded at the beginning of the feeding trail were 32.37 mg/dl for triglycerides, 72.02 mg/dl for total cholesterol, 33.16 mg/dl for HDL cholesterol, 32.39 mg/dl for LDL cholesterol, 0.99 for LDL:HDL ratio, 0.99 for total cholesterol: HDL ratio, respectively. The serum lipid profile and their ratios in blood collected from pigs maintained on three experimental treatments are given in Table 2.

The three groups on average had 74.56 to 119.35 mg/dl total cholesterol, 36.62 to 59.91 mg/dl triglycerides, 35.30 to 49.83 mg/dl HDL cholesterol, 31.94 to 57.54 mg/dl LDL cholesterol, 0.89 to 1.08 LDL/HDL ratio and 2.11 to 2.16 total cholesterol/HDL ratio. The values recorded in the present study falls within the normal range reported for the species (Cowell, 2004).The animals in T1 had lower ($P<0.01$) levels of all plasma lipid parameters observed in the study. Gallardo *et al*. (2008) recorded similar values for total cholesterol (77.46 to 125.81 mg/dl), HDL cholesterol (30.60 to 51.95), LDL cholesterol (38.19 to 63.42 mg/dl) and triglycerides (43.25 to 50.04 mg/dl) in blood of pigs. Elanchezhian *et al.* (2013) also recorded values of 37.20 to 59.20 mg/dl for triglycerides, 78.60 to 147.40 mg/dl for total cholesterol, 37.20 to 56.60 mg/dl for HDL cholesterol, 33.96 to 78.96 mg/dl for LDL cholesterol, 1.12 to 1.63 for LDL: HDL ratio and 2.12 to 2.63 for total cholesterol: HDL ratio in female large white Yorkshire pigs fed diet incorporated with animal fat.

Statistical analysis of data presented on Table II revealed that supplementary groups (T2 and T3) shows higher ($P<0.01$) value for all lipid parameters studied than control group (T1). Comparing T2 and T3 groups, animal fat supplemented group (T2) showed increased ($P<0.01$) level of serum total cholesterol, triglycerides and LDL cholesterol in pigs except HDL cholesterol where it had similar effect with T3.An elevated plasma lipid profile in response to fat supplementation was reported by Baldner-Shank *et al.* (1987) (tallow at 15.6 per cent) and Cera *et al.* (1989 b) (tallow at eight per cent), respectively. Piao *et al*. (2000) had observed improved serum triglyceride (56.40 to 67.35 mg/dl) and total cholesterol (69.12 to 98.58 mg/dl) by incorporating five per cent animal fat in the diet of pigs. In contrary to this, Jones *et al.* (1992) stated that inclusion of 10 per cent tallow in the feed of pigs did not cause any differences in serum total cholesterol, triglycerides, HDL and LDL cholesterol. Rodas *et al*. (2004) had observed reduced serum triglyceride level (48.07 to 46.97 mg/dl) for lecithin fed group along with four per cent animal fat compared to control. Todoravo *et al*. (2011) suggested that

addition of lecithin at one per cent along with basal diet reduced serum cholesterol level in pigs compared to control.

CONCLUSION

By this experiment, it can be concluded that elevated serum lipid profile (total cholesterol, triglycerides and LDL cholesterol) observed for fat supplemented group can be significantly reduced by dietary incorporation of lecithin at 0.5 per cent along with animal fat in LWY pigs.

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Table 1- Ingredient composition of experimental grower and finisher rations, %

Ingredients	Experimental grower rations			Experimental finisher rations		
	T1	T2	T3	T1	T2	T3
Yellow maize	70	70	70	74	74	74
Wheat bran	1.5	1.5	1.5	3.6	3.6	3.6
Soyabean meal	26.25	26.25	26.25	20.5	20.5	20.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.9	0.9	0.9	0.65	0.65	0.65
Calcite	0.85	0.85	0.85	0.75	0.75	0.75
Total	100	100	100	100	100	100
To the above mixture following ingredients were added						
Animal fat (kg)	0	5	5	0	5	5
Lecithin[1] (kg)	0	0	0.5	0	0	0.5
Hyblend AB_2D_3K[2], g	25	25	25	25	25	25
Becon-DS BE[3], g	25	25	25	25	25	25
Zinc oxide[4], g	45	45	45	30	30	30
Rovimix E-50[5], g	10	10	10	10	10	10

[1]Jubidol (Jubilant Life science Ltd, Block 133, Village SamlayaTaluk- Sauli, Vadodara, Gujarat) contains optimal blend of lysophospholipids and phospholipids

[2]Hyblend AB_2D_3K (Virbac Animal Health India Pvt. Ltd., Mumbai) contains Vitamin A- 82,500 I.U., Vitamin B_2- 50 mg, Vitamin D_3- 12,000 I.U., Menaphthone Sodium Bisulphite- (Vitamin K-Stabilised) -10 mg

[3]Becon-DS BE (Varsha® multi tech, KengeriHobli, Bangalore) contains Vitamin B1-8 mg, Vitamin B6-16 mg, Vitamin B12- 80 mcg, Vitamin E- 45 mg, Cal.Pantothenate- 30 mg, Niacin- 120 mg, Active Live yeast- 600 mu, Lactobacillus- 20 ms, Folic Acid- 2 mg, Elemental Calcium- 130 mg, Elemental Phosphorus- 6 mg.

[4]Zinc Oxide (Nice Chemicals Pvt. Ltd., Kochi) containing 81.38% of Zn.

[5]Rovimix E-50 adsorbate (DSM Nutritional Products Ltd., Mumbai) contains 52.3% α-tocopheryl acetate.

Table 2 - Serum lipid profile of pigs maintained on the three experimental rations

Lipid profile	Treatments[1]			
	T1	T2	T3	P value
Total cholesterol, mg/dl	74.56 ±0.70[a]	119.35 ±1.05[c]	101.10 ±2.39[b]	0.00**
Triglycerides, mg/dl	36.62 ±0.08[a]	59.91 ±2.14[c]	46.12 ±0.38[b]	0.00**
HDL cholesterol, mg/dl	35.30 ±0.68[a]	49.83 ±1.07[b]	47.77 ±1.12[b]	0.001**
LDL cholesterol, mg/dl	31.94 ±0.03[a]	57.54 ±0.96[c]	44.10 ±2.34[b]	0.001**
LDL/HDL ratio	0.91 ±0.02	1.08 ±0.05	0.89 ±0.06	0.34[ns]
Total cholesterol/ HDL ratio	2.11 ±0.02	2.12 ±0.06	2.16 ±0.07	0.98[ns]

[1]Mean of four observations with SE

a,b,c- Means with different superscripts within the same row differ significantly **(P<0.01); ns- Non significant (P>0.05)