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Effects of Whole Flaxseed on Lipids Profile and Liver and Kidney Function of Broiler Chickens

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Abstract
This experiment was conducted to determine the effects of whole flaxseed on broiler chickens' lipids profile and liver and kidney function. 200 straight-run one-day-old Ross 308 broiler chicks were divided randomly into two groups (100/group) with five replicates. The control treatment (CON) was fed a corn-soybean diet. The second treatment fed the flaxseed-corn soybean (FCS) diet by using flaxseed 75 kg/ton in the starter and grower and 100kg/ton in the finisher diet. The cholesterol, triglyceride, LDL, and VLDL were decreasing significantly (P 0.05) in the (FCS) compared with the (CON). However, HDL was increased significantly (P 0.05). Liver and kidney enzyme activity were improved in the (FCS). The serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activity and creatinine and urea concentration were decreased significantly (P 0.05) in the (FCS) compared with the (CON). In conclusion, replacing corn with 7.5 whole flaxseed in the starter and grower and 10 in the finisher broiler chicken diet led to improved growth performance. Additionally, reducing using oil, and soybean in the diet.

Keywords: Broilers, performance, Whole flaxseed, Omega-3, Lipid profile, Liver, and kidney function.

Introduction

Because of its contribution to linolenic acid over the past few years has been used in feeding full fat (whole flaxseed) to generate meat enriched with linolenic acid. The most omega-3 fatty acids among vegetable oils—50% of linolenic acid (18:3w3)—are found in flax oil. According to recent research [1], 18:3w3 and its desaturation products, docosahexaenoic acid and eicosapentaenoic acid, are crucial for maintaining human health, especially in people who are at risk of developing chronic heart disease. Additionally, omega-3 in diets lowers the cholesterol in broiler meat [2] and is crucial for broiler performance and immunological response [3].

Lecithin, fibre, vitamins, and minerals are also present in flaxseed [4; 5]. Crude protein content ranges from 20 to 30% on average and includes all essential amino acids. As a result, it is regarded as a source of energy and protein. Flaxseed has 20.3 g of protein, 37.1 g of fat, 24.5 g of total dietary fibre, 28.9 g of carbs, and 530.0 calories per 100 g. In addition, flaxseed has a variety of vitamins and minerals as well as phenolic compounds that have antioxidant and anticancer properties [6].

Additionally, soluble, and insoluble dietary fibre is abundant in flaxseed. Mucilage, a type of soluble fibre, helps control blood sugar levels and lower cholesterol [7]. Additionally, flaxseed has all of the necessary amino acids needed to produce proteins that control and uphold correct cellular function [8]. Flaxseed can replace traditional protein and energy sources in diets while boosting profitability. However, when utilized in high concentrations in chicken diets, flaxseed contains biologically active chemicals typically referred to as anti-nutritional factors [9]. According to this study, flaxseed contains 35% oil. Replacement of corn 2.5% oil with flaxseed 35% oil (100 kg/ton) results in meat loaded with omega-3 and improves the health of the meat. This research aims to examine how whole flaxseed affects the lipid profile, and liver and kidney function in broiler chickens.

Materials & methods:

Experiment design:

In straight runs, 200 Ross 308 one-day-old broiler chicks were randomly split into two groups, each with 100 chicks. The control group (CON) consumed an essential diet of corn and soybeans without any additional ingredients. The second group of chicks received a basal diet from one day to 35 days of age, substituting whole flaxseed with 75 kg per ton in the starter and grower diets and 100 kg per ton in the finisher diet. Table 1 displays the nutritional content of diet items.

Table 1. Diet ingredients and nutrients composition of broilers.

Ingredients%	**Starter**	**Grower**	**Finisher**	**Starter**	**Grower**	**Finisher**
Corn	51.9	55.6	59.6	49.2	53.1	54.5
Soy-bean	40.8	37	32.5	37.5	33.7	29
Flaxseed	-	-	-	7.5	7.5	10
Soybean oil	2.9	3.5	4.3	1.4	2.1	2.9
MCP[1]	0.9	0.5	0.5	0.9	0.5	0.5
Limestone	1	0.9	0.6	1	0.9	0.6
Premix[2]	2.5	2.5	2.5	2.5	2.5	2.5
Nutrients						
Energy	3000	3000	3200	3000	3100	3200
CP%	23	21.5	20	23	21.5	20
Calcium	0.98	0.87	0.77	0.98	0.88	0.74
Av. Phosphorus	0.50	0.40	0.40	0.5	0.40	0.40
Av. Lysine	1.23	1.14	1.04	1.15	1.06	0.95
Av. Methionine	0.51	0.49	0.47	0.50	0.47	0.45
Av.TSAA	0.80	0.77	0.73	0.77	0.72	0.68
Av. Threonine	0.75	0.70	0.63	0.71	0.64	0.58

MCP1 GREENPHOSP/22.7%(Mono Calicium phosphate) cal 16% from BAF (An MCP1 GREENPHOSP/22.7%(Mono Calicium phosphate) cal 16% from BAF(Animal feed company) ,ADANA,Turkey imal feed company) ,ADANA,Turkey

Composition of Premix2: vitamin, 6,000,000 IU; vitaminD3,1,500,000 IU; vitamin E, 15,000mg; riboflavin, 3,00mg; pantothenic acid, 7,000mg; nictonic acid, 25,000mg;folic acid,500mg; vitamin B12,15,000mg(Vit-VORM 6/1.5, supplid by Animedica, Horb, Germany). 4 composition of trace elements premix supplid per

kilogram of premix: Mn, 120,000 mg; Zn, 80,000 mg;Fe, 90,000; Cu,15,000 mg;I, 1,600 MG;Se, 500 mg(Spu"rElevor SGI, supplid by Animedica, Horb, Germany).

Blood sampling:

Twenty (20) birds' wing veins were used to collect all blood samples at day 35 of age, and the samples were placed in a test tube without any anticoagulant. After allowing the tubes to clot, they were centrifuged for 10 minutes at 3000 rpm. Before analysis, serum was collected and kept in a deep freezer (-20). At 35 days, the lipid profile, liver and kidney function were assessed using blood serum.

Result:

Effect of whole flaxseed on lipid profile of broilers:

The lipid profile enhanced significantly (P 0.05) in the (FCS) group compared with the (CON). The cholesterol, triglyceride, LDL, vLDL decreased significantly (P 0.05) in the (FCS) compared with the (CON). However, HDL was increased significantly (P 0.05), as shown in Table (**2**).

Table (2): Effect of whole flaxseed-based diet on lipid profile of broilers (Mean±SE)**.**

Parameters(mg/dl)	**Control Group CON**		**Treatment Group (FCS)**	
	Mean ±S. E		**Mean ±S. E**	
Cholesterol	144.6 [a]	23.41	120.6	12.99
Triglyceride	53.22[a]	15.95	37.98	8.78
HDL	79.2	16.6	126.4[a]	24.68
LDL	25.28[a]	5.68	17.78	3.89
vLDL	10.64[a]	2.59	7.59	1.55

Different letters between groups showed a significant difference at (p ≤0.05).

Effect of whole flaxseed on liver and kidney activity of broilers:

The current study showed a decrease significantly in AST, ALT activity, creatinine, and urea concentration, which decreased significantly (P 0.05) in the (FCS) compared with the (CON) as shown in Table (**3**).

Table (3) Effect of whole flaxseed-based diet on liver and kidney function of broilers (Mean$\pm SE$**) :**

Parameters	**Control Group CON**		**Treatment Group (FCS)**	
	Mean ±S. E		**Mean ±S. E**	
AST) U/L)	24.62[a]	0.9	21.8	0.47
ALT) U/L)	145.8[a]	7.39	77.98	9.5
Urea(mg/dl)	9.62[a]	1.95	6.25	0.8
Creatinine(mg/dl)	0.172[a]	0.02	0.128	0,06

Different letters between groups showed a significant difference at (p ≤0.05).

Discussion:

Due to their effects on the expression of genes, omega-3 PUFAs may be responsible for the decrease in triglycerides and cholesterol. They do this by inhibiting various enzymes, which reduces hepatic synthesis and the secretion of triglyceride-rich lipoproteins (Very Low-Density Lipoproteins, or vLDL). When vLDL particles enter the tissue, the enzyme lipoprotein lipase, which hydrolyzes triglycerides from them, is suppressed by omega-3 fatty acids. Additionally, omega-3 enhances the excretion of bile because the chemical composition of chicken bile is characterized by a significant concentration of cholesterol and triglycerides rather than phospholipids as in mammals, which causes the bile to behave as a container for lipid outflow

in chicken. Any action that lowers blood cholesterol, specifically lipids, generally is considered potent if it prevents or promotes its production from the gut [10].

The primary site of cholesterol and phospholipid synthesis in birds is the liver, which also produces fatty acids [11]. Triacylglycerols are packaged into very low-density lipoproteins (vLDL) after lipogenesis, which transports lipids and cholesterol from the site of synthesis (liver) to the site of deposition (adipose tissue) [12]. Typically, serum vLDL is thought to be a good indicator of chicken fatness [13].

Adipose tissue only absorbs 70 to 80 per cent of the vLDL triglycerides produced into the bloodstream; the liver also takes up 10 to 20% of the vLDL [14]. According to research by [15], omega-3 fatty acids may lower serum cholesterol by inhibiting the liver enzyme 5-hydroxy-3-methylglutaryl-coenzyme A reductase (HMG-Co A). According to [16], flaxseed oil may regulate the expression of genes, improving the liver's capacity to synthesize HDL.

The antiradical and antioxidant characteristics of flaxseed, which have an excellent antioxidant impact on preventing lipid peroxidation of the cell membrane, caused flaxseed supplementation to reduce blood AST and ALT activity in bro-chicks [17]. Hypothesized that the flaxseed oil's significant involvement in attenuating liver damage may have contributed to the decrease in ALT and AST activity found in chickens fed the oil. Because of this, adding flaxseed oil to poultry diets did not affect the liver and preserved normal physiological processes. The active component of plant oil extract may increase the inhibition of hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMGCoA) reductase activity [18], which has been demonstrated to be a crucial enzyme in the manufacture of cholesterol [19].

As biochemical markers for liver function, serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were utilized; an increase in this enzyme activity denotes liver injury [20].

According to studies, a rise in kidney efficiency is to blame for the drop in the percentage of urea and creatinine in the serum [21], as the presence of omega-3 in the flax group, known to enhance kidney function by reducing oxidants and reproducing damaged kidney cells, maybe the cause; this in turn, causes an increase in the body's excretion of harmful substances like urea and creatinine. In addition, trustworthy indications of renal function include blood urea nitrogen (BUN), creatinine and uric acid. A high level of creatinine is a sign of kidney disease. Uric acid (UA) is broilers' primary byproduct of N metabolism [22].

By lowering oxidants and regenerating damaged kidney cells, omega-3 fatty acids are essential for restoring kidney function [23], which increases the body's excretion of toxic chemicals like urea and creatinine.

Conclusions:

Reducing oil to feed manufacturing is the best way to minimise feed costs, especially during current challenges. However, minimising oil may reduce the rancidity during feed pellet storage. The use of whole flaxseed led to minimising the addition of oil. On the other hand, using flaxseed reduced cholesterol and triglyceride.

The liver enzyme concentrations AST, ALT, urea, and creatinine decreased in the treatment group (FCS) compared with the control group (CON).

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