# EFFECTS OF FEEDING FLAXSEED OIL ON PERFORMANCE AND SOME BLOOD BIOCHEMICAL TRAITS OF BROILER

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## ABSTRACT

This study was designed to evaluate the effect of the flaxseed oil on performance and some blood biochemical traits of broiler. Two equal treated groups (100 birds/treatment) with two replicates (50 birds/ replicate) of total 200 straight run (Ross 308) at age one day old chicks were randomly weighed and divided into two dietary treatments: T1 (as control group) birds fed basal diet without any additives. While, T2 fed diet supplemented daily with 0.6% flaxseed oil to the end of the experiment (42 days). Blood samples were collected and then analyzed. Parameters measured were total protein, cholesterol, serum GOT and GPT concentration. Results showed highly ($p \leq 0.01$) significant differences in the weekly body weight and body weight gain between treatments. Feed conversion ratio recorded better values in (T2) compared with control group (T1). Also, birds fed 0.6% flaxseed oil had significantly ($p \leq 0.05$) lower serum content of GPT and GOT (10.73 ± 0.50 and 98.54 ±3.45) respectively, and cholesterol concentration (176.0 ± 5.19) compared with control group (14.56 ± 0.70, 114.93 ± 2.93 and 217.5 ± 4.83) respectively.

The results showed significantly ($p \leq 0.05$) increased RBC count and PCV of chicks fed 0.6% flaxseed oil. However, there were no significant differences for WBC count and Hb between both treatments. In conclusion, flaxseed oil at a level of 0.6% in broilers diet led to enhance performance, blood biochemical parameters and health status of birds.

**Key words:** broiler, flaxseed, performance**,** blood parameters.

## INTRODUCTION

Flaxseed oil comes from seeds of the flax plant (*Linum usitatissimum, L.*). Flaxseed oil contains both omega-3 and omega-6 fatty acids, which are needed for health. Flaxseed contains high amounts of α-linolenic acid (52% of the total fatty acids), an essential fatty acid, making flaxseed a unique oilseed crop for oil production as well as for incorporation in foods (Chung et al., 2005). Flaxseed is a good source of protein, oil, and α-linolenic acid, so it can be used for enrichments of poultry meat and eggs (Leeson and Summers, 2005). Plant oils



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have different biological activities like antibacterial, antioxidant and antifungal (Steiner, 2009). Supplementation of poultry feed with these oils improves the performance by changing gut microflora, profile of digestive enzymes and stimulation of immune system (Jang et al., 2004; Muzaffar et al., 2016). Improvement in growth performance of broilers may also be due to improvement in gut equilibrium by lowering the fermentation, bacterial colony counts and stimulating the digestive secretions. It has been observed that vegetable oils increase the mucous production in intestine and reduce the bacterial adhesion in broilers (Jamroz et al., 2006; Windisch et al., 2008). Oils are the most important energy source of broiler rations. In order to get the optimum productivity from chickens, the protein and energy levels of ration should be high. By compensation of energy requirements of chickens with oils instead of carbohydrates, a better performance was attained (Tuncer et al., 1987).

The positive effect of replacing n-6 rich soybean oil with n-3 rich linseed oil and rapeseed oil on the nutritional value of chicken meat has been documented (Haug et al., 2007 ; Pappas et al., 2012). Balevi and Coskun, (2000) confirmed to use flaxseed and fish oil in poultry rations would subsequently affect human health in a positive manner by increasing omega-3 fatty acid quantities in animal product.

The aim of our study was to evaluate the effect of flaxseed oil on growth performance, blood characteristics and biochemical traits of broiler chickens.

## MATERIALS AND METHODS

Two hundred day-old straight run broilers chicks (Ross-308) were bought from a commercial hatchery and divided randomly and equally into two treated groups of 100 birds, each treated group was subdivided into 2 replicates of 50 birds per replicate. The first group (T1) was fed daily on diet without flaxseed oil additive as a control group. While Second group (T2) were fed daily on diet with added 0.6% flaxseed oil. Birds were managed according to (Aviagen, 2009) guide for management and nutritional requirements (21.5% protein and 3020 (kcal/kg) energy). Feed and water were provided *ad libitum*. One type of diets was used over the period of experiment (42 days). The chicks were weighted individually on days 7, 14, 21, 28, 35, and 42 for each pen by using digital balance then average body weights and FCR were calculated for each treatment. Feed intake per pen was calculated weekly and used to calculate the Feed conversion ratio. Ten individual blood samples were collected from the wing vein for each replicate for each analysis in a test tube with EDTA. On day 40 of

age. Samples were divided into two parts, the first part was kept in tubes containing anti-coagulant EDTA (ethyl diamine tetra acetic acid) to estimate blood hemoglobin, packed cell volume, RBC and total WBC count. While the other parts of the blood samples were kept in sterilized tubes free from the anticoagulant substance (gel tube), then serum isolated by centrifuge (3000 rpm) for 10 minutes then stored in a deep freeze (-20 ºC) until the analysis were performed (Al-Daraji, 2008).

Sera were obtained to estimate the total serum protein, cholesterol, triacylglycerol, high density lipoprotein (HDL) and the liver enzymes glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) concentration by using of diagnostic kits and spectrophotometer. The results were statistically analyzed to find the Least Significant Differences (LSD) between groups, using one way Analysis of Variance (Snedecor and Cochran, 1973).

**Table 1: compositions of experimental diets (NRC, 1994)**

| Ingredient | % diet |
|---|---|
| Yellow corn | 33 |
| Soybean meal (48% protein) | 30 |
| Wheat | 30 |
| Animal protein | 5 |
| flaxseed oil | 0.6 |
| Premix | 0.5 |
| DL-Methionine | 0.1 |
| Lysin | 0.1 |
| Dicalcium phosphate | 0.7 |
| Total | 100 |
| Calculated chemical analysis | |
| Metabolize energy (kcal/kg) | 3020 |
| Crude protein (%) | 21.5 |

## RESULTS AND DISCUSSION

Feeding of 0.6% flaxseed oil increased ($p \leq 0.05$) growth rate of birds (Table 2). Similar results was found by Sahib et al., (2012). Mean live body weight of T2 (0.6% flaxseed oil) was significantly increased ($P<0.05$) as compare with T1 (control group).This significant increase through the whole experimental period may be due to the presence of essential fatty acids in flaxseed oil. Because flaxseed is rich with omega-3 which activate the bile and lead to increase digestion of fats in the intestine lead to greater benefit from the diet ( Al-Zuhairy and Alasadi, 2013). Several workers have also reported such improvement in body weight (Tucker, 2002; Abdel-Azeem, 2006; Al Daraji et al., 2011).

**Table 2. Effect of flaxseed oil on weekly body weight (gm) of broiler (mean ± SE)**

| Time | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| 7 days | 118.7 ±1.25 B | 126.2± 0.87 A |
| 14 days | 313.8 ± 4.12 | 325.5 ± 5.85 |
| 21 days | 649.73 ±12.24 B | 685.25±11.56 A |
| 28days | 990.13±19.78 B | 1089.88± 33.13 A |
| 35 days | 1653.5±31.88 | 1652.38±23.27 |
| 42 days | 2129.0 ± 25.01B | 2407.14 ± 32.24A |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$).

Results refereed to significant ($P \leq 0.05$) differences between treated groups 0.6% flaxseed oil and the control in the weekly body weight gain throughout the sixth week that recorded (649.3 ± 8.70 and 530.01 ± 10.20 g/week) respectively (Table 3). Similar Results were found by Al-Rubaee, (2011) and Beheshti et al., (2017) they confirmed that increase in body weight gain may be attributed to improve in intestinal absorption of polyunsaturated fatty acids (PUFA) eventually, increase apparent metabolic energy value.

**Table 3. Effect of flaxseed oil on weekly weight gain (gm) of broiler (mean ± SE)**

| Time | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| 7 days | 71.10 ±0.73 B | 78.18± 1.29 A |
| 14 days | 198.6 ± 4.03 | 204.75 ± 4.76 |
| 21 days | 317.75 ±5.72 | 297.80±13.91 |
| 28days | 370.5±5.31 B | 426.0± 11.08 A |
| 35 days | 607.88±12.05 | 625.5±15.68 |
| 42 days | 530.01 ± 10.20 B | 649.3 ± 8.70 A |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$)

The results showed significantly ($p \leq 0.05$) increase in feed consumption during the period (1- 4wks) between the treated group 0.6% flaxseed oil and control group which may be attributed to palatability improvement of the diet mixed with flaxseeds which have omega-3 fatty acids. While a significant ($P \leq 0.05$) increase was noticed in feed consumption in the last week for the birds of control group as compared with 0.6% flaxseed oil group (Table 4). Similar Results were found by Najib and Al-Yousef, (2011).

**Table 4. Effect of flaxseed oil on weekly feed intake (gm) of broiler (mean ± SE)**

| Time | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| 7 days | 104.98±1.36 B | 115.93 ±2.69 A |
| 14 days | 270.93 ±8.99 B | 292.25 ± 4.41 A |
| 21 days | 469.0 ±18.83 B | 613.1±5.98 A |
| 28days | 728.0 ±12.92 B | 828.1± 20.24 A |
| 35 days | 881.0± 38.88 | 844.25 ±19.67 |
| 42 days | 1132.63±16.20 A | 1062.13 ±19.25 B |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$)

The result revealed no Significant ($P \leq 0.05$) differences were observed in feed conversion ratio during the first and the second week. While significant ($P \leq 0.05$) differences were observed (Table, 5) between treated and control group in the last three weeks of the experiment they recorded (1.76 ± 0.03**,** 1.46 ±0.01**,** 1.74± 0.02**)** respectively.

**Table 5. Effect of flaxseed oil on weekly feed conversion ratio of broiler (mean ± SE)**

| Time | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| 7 days | 1.52±0.04 | 1.47 ±0.04 |
| 14 days | 1.49 ±0.03 | 1.55±0.03 |
| 21 days | 1.48± 0.06 B | 1.74± 0.02 A |
| 28days | 1.93 ±0.03 A | 1.76 ±0.03 B |
| 35 days | 1.68 ±0.06 A | 1.46 ±0.01 B |
| 42 days | 1.86 ±0.02 A | 1.74± 0.02 B |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$)

These results were supported with the findings of Roy *et al*. (2008) who indicated that an improvement in feed conversion ratio and they referred to the dietary fat spare protein and amino acid from energy yielding processes and direct them towards the growth of the animals.

The results of this study showed significantly ($P \leq 0.05$) increase of RBC counts and PCV between added 0.6% flaxseeds oil and control group. While no significant differences in WBC count and hemoglobin percentage were observed between treated and control (Table 6). The improvement in red blood cells count occur in flaxseed oil groups may be due to high growth speed and an increase in body weight gain. All these make the bird suffered from metabolic stress represented by deficiency of oxygen in the blood "hypoxemia" and this led to

enhance bone marrow to increase producing red blood cells to face high metabolic requirements of oxygen (Price et al., 1998).

**Table 6. Effect of flaxseed oil on blood parameters of broiler (mean ± SE)**

| Items | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| RBC × ($10^6$/$mm^3$) | 4.16 ± 0.84 B | 4.27 ± 0.71 A |
| WBC× ($10^3$/$mm^3$) | 4.18 ± 1.32 | 4.43 ±1.05 |
| PCV % | 26.20 ±0.41 B | 28.2 ±0.38 A |
| HB ( g/100ml) | 7.33 ±0.28 | 8.09 ± 0.28 |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$)

Chicks fed flaxseed oil showed significantly ($P \leq 0.05$) lower cholesterol concentration in blood serum. This reduction may be due to inhibits lipid metabolism by interfering with micelles solubilization of cholesterol in digestive tract which in turns decreased cholesterol absorption and increased the excretion of fecal bile acid cholesterol (Yang and Koo, 2000) While no significant differences in triglyceride, HDL and total protein between treated and control groups were observed (Table 7).

**Table 7. Effect of flaxseed oil on blood serum constituents of broiler (mean ± SE)**

| Items | Treatments | |
|---|---|---|
| | T1<br>Control | T2<br>0.6% flaxseeds |
| Total protein | 3.2 ± 0.16 | 2.93 ± 0.10 |
| cholesterol | 217.5 ± 4.83 A | 176.0 ± 5.19 B |
| triglyceride (mg/dL) | 107.3 ± 9.81 | 98.11± 7.2 |
| HDL | 49.23± 5.1 | 63.2±4.5 |
| GPT | 14.56 ± 0.70 A | 10.73 ± 0.50 B |
| GOT | 114.93 ± 2.93 A | 98.54 ±3.45 B |

Means in the same row with different superscripts are significantly different ($p \leq 0.05$)

The effect of adding flaxseed oil on GPT and GOT were showed significantly ($p \leq 0.05$) decrease in T2 compared with control group Therefore, the use of flaxseed oil in poultry diets was not harmful to the liver and maintained the normal physiological function. The active ingredient of plant oil extract may enhance inhibition the activity of hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMGCoA) reductase (Crowell, 1999) who has shown that this enzyme is considered a key enzyme in cholesterol synthesis. Our results are in agreement with (Abbas, 2010).

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## تأثير إضافة زيت الكتان في الأداء الانتاجي وبعض الصفات الكيموحيوية للدم في فروج اللحم

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**المستخلص**

صُممت هذه الدراسة لتقييم تأثير زيت بذور الكتان في الأداء الانتاجي وبعض الصفات الكيموحيوية للدم. تم وزن مجموعتين متساويتين (100 طائر/ معاملة) وبمكررين (50 طائرًا/ مكرر) من إجمالي 200 صنف (Ross 308) بعمر يوم واحد بشكل عشوائي وقسمت المعاملات الغذائية إلى نوعين: T1 (مجموعة سيطرة) تغذت الطيور على عليقة اعتيادية من دون أي إضافات، وT2 عليقة اعتيادية يوميا مع اضافة 0.6 % من زيت بذور الكتان إلى نهاية التجربة (42 يوما). جمعت عينات الدم وتم تحليلها. المؤشرات التي تم قياسها كانت البروتين الكلي والكوليسترول وتركيز GOT وGPT في مصل الدم. أظهرت النتائج وجود فروق عالية المعنوية بين المعاملات ($p \leq 0.01$) في الوزن الإسبوعي للجسم والزيادة الوزنية. سجلت كفاءة التحويل الغذائي قيمًا أفضل في المعاملة (T2) مقارنة بمجموعة السيطرة (T1). انخفض محتوى المصل من GPT و GOT بشكل معنوي ($P \leq 0.05$) في الطيور التي غذيت 0.6 % زيت بذور الكتان (0.50 ± 10.73) و(98.54 ± 3.45) على التوالي، وتركيز الكوليسترول (176.0 ± 5.19) مقارنة مع مجموعة السيطرة (14.56 ± 0.70، 114.93 ± 2.93 و 217.5 ± 4.83) على التوالي.

أظهرت النتائج زيادة معنوية ($p \leq 0.05$) في عدد كريات الدم الحمرا و PCV للافراخ التي غذيت بزيت بذور الكتان بنسبة 0.6%، ولم تكن هناك فروق معنوية لعدد كريات الدم البيض والهيموغلوبين بين المعاملتين. يمكن الاستنتاج أن زيت بذور الكتان عند مستوى 0.6 % في غذاء فروج اللحم أدى إلى تحسين الأداء الانتاجي، ومؤشرات الدم الكيموحيوية والوضع الصحي للطيور.

**الكلمات المفتاحية:** فروج اللحم، زيت الكتان، الأداء الانتاجي، مؤشرات الدم.