Academic International Journal of Veterinary Medicine
ISSN: 2984-7753
Aca. Intl. J. Vet. Med. 2023;1(1) 52-57
Journal homepage: www.aipublishers.org/aijvm

# Effects of Whole Flaxseed on Productive Performance and Immune Response of Broiler Chickens

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(Received 2 January 2023, Accepted 2 February 2023, Published 30 April 2023)

## Abstract
An excellent natural source of -linolenic acid is flaxseed. Feeding broiler birds flaxseed can increase omega-3 (n-3) fatty acids in meat tissues and improve growth performance and immune response. This study investigated the effects of whole flaxseed on productive performance immune response against ND and IBD disease with broiler chickens (meat-producing chickens). A Comprehensive of 200 newly hatched chicks were weighed randomly, split into two Identical treated groups (each with 100 birds), and placed in five replicates (20 birds each). T1 birds were fed an essential diet devoid of additives (as the control group). Nevertheless, T2 (treatment group) birds were fed a flaxseed-corn soybean diet using 75 kg/ton of flaxseed in the starter and grower and 100kg/ton in the finisher diet. A significant finding ($P\leq 0.05$) was noted between treatments in weekly living body weight (BW), weight gain (WG), Feed intake (FI), and Feed conversion ratio (F.C.R.). The highest significant increase (($P\leq0.05$) in productive traits (BW, WG (in the(T2) group that fed flaxseed from one day to 35 days; however, I and FCR decreased significantly (($P\leq0.05$). Antibody titer was increased significantly (($P\leq0.05$) of ND and IBD in the (T2) compared with the (T1). In conclusion, replacing corn with 7.5 whole flaxseed in starter and grower and 10 in finisher broiler chicken diet led to enhanced growth performance and immune response. It was additionally reducing the use of oil and soybeans in the diet.

***Keywords**:* Productive performance, Whole flaxseed, Omega-3, Broilers, Immune response.

## Introduction:
Long-distance travel and late feeding can increase the vulnerability of poultry to diseases, subsequent infections, and death, which can hinder immune system development and the creation of chicken shortfall [1]. Therefore, a key factor affecting the growth and development of broilers at later times is the chick health station. Due to its high oil content (35–45%), which encourages omega-3 polyunsaturated fatty acid (PUFA), primarily ALA (45–52%), flaxseed is recognized as a high-energy feed component for poultry diets [2]. Polyunsaturated fatty acids (PUFA)can be Split into n-3 and n-6 series. PUFA supports growth and regulates immune response in chickens. Fundamentally, while n-6 PUFA negatively impacts immune function, n-3 PUFA has anti-inflammatory, immunoregulatory, and antioxidant capabilities [3,4]. According to [5,6, 7], a healthy metabolism's various inflammatory mediators are mostly to blame for these adverse effects; polyunsaturated fatty acids aid in activating transcription

factors and altering gene expression via regulating signal transmission in immune cells [8]. This study assesses how whole flaxseed affects broiler chickens' immune systems and productivity.

## Material & methods:

### Experiment design:

Two hundred one-day-old, unsexed broiler chicks (Ross-308) obtained from a commercial hatchery divided into two treatment groups, each with 100 birds. Each treated group was split into five replicates with 20 birds in each. T1 (the initial group) fed. Only corn-soybean diet. At the same time, the Second group (T2) was fed a flaxseed-corn-soybean diet using whole flaxseed 75 kg/ton in starter and grower while the finisher was fed 100kg/ton in diet. At 35 days old, each treatment bird's blood samples were collected from the wing vein and placed in a test tube without an anticoagulant. After clotting the lines, they spanned at 3000 RPM for 10 minutes. All serum samples were stored in deep freeze at -20 degrees Celsius until analysis to determine ELISA antibody titer against ND and IBD disease. Table (1) shows the ingredients and nutrients of the experimental diet.

**Table 1. Diet ingredients and nutrient 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, Turkeyimal feed company) ,ADANA, Turkey

Premix 2 contains the following ingredients: vitamin (6,000,000 IU), vitamin D (3,500,000 IU), vitamin E (15,000 mg), riboflavin (3 mg), pantothenic acid (7,000 mg), nicotinic acid (25,000 mg), folic acid (500 mg), and vitamin B12 (15 mg) (Vit-VORM 6/1.5, supplemented by Animedica, Horb, Germany). 4 Trace element content of the premix supplied per kilogram: (Spu"rElevor SGI, supplied by Animedica, Horb, Germany) Mn, 120,000 mg; Zn, 80,000 mg; Fe, 90,000 mg; Cu, 15,000 mg; I, 1,600 MG; Se, 500 mg.

### Statistical analysis:

The normality of the data distribution in the two groups (control group and treatment group) was evaluated using the Shapiro-Wilk test before testing for group differences. The findings are the mean value minus standard error (SE). Levene's test was used to evaluate the homogeneity of variance assumption. An independent sample t-test (control group vs.

treatment group) was used to analyze all the data collected statistically. When a lower probability than 5% was attached to the results, they were deemed statistically significant.

## Result:

### Productive performance:

A significant statistical ($P \leq 0.05$) was observed between treatments in weekly live body weight (BW), weight gain (WG), Feed intake (FI) and Feed conversion ratio (F.C.R.). The highest significant increase ($P \leq 0.05$) in productive traits (BW, WG) in the (T2) group that fed flaxseed from one day to 35 days except week (4) in WG was decreased (($P \leq 0.05$). However, FI and FCR were significantly reduced (($P \leq 0.05$). The result is shown in tables (2,3,4,5).

**Table (2) Effect of whole flaxseed-based diet on broiler chickens' live body weight (gm) and standard error (SE):**

| Parameters | Control Group (T1) | | Treatment Group (T2) | |
|---|---|---|---|---|
| | Mean±S. E | | Mean±S. E | |
| Day 1 | 44.44 | 0.10 | 44.45 | 0.11 |
| Week1 | 180.76 | 10.08 | 196.42[a] | 14.18 |
| Week2 | 411.74 | 15.09 | 449.72[a] | 20.74 |
| Week3 | 922.60 | 28.11 | 1066.74[a] | 29.24 |
| Week4 | 1513.72 | 56.85 | 1623.84[a] | 43.05 |
| Week5 | 2107.10 | 72.09 | 2248.80[a] | 84.12 |

Different letters between groups showed a significant difference at ($p \leq 0.05$).

**Table (3) Effect of broilers eating a diet high in whole flaxseed (grams) (Mean SE)**

| Parameters | Control Group (T1) | | Treatment Group (T2) | |
|---|---|---|---|---|
| | Mean ±S. E | | Mean ±S. E | |
| Week1 | 136.32 | 22.08 | 151.88[a] | 12.22 |
| Week2 | 230.98 | 19.61 | 253.30[a] | 22.85 |
| Week3 | 510.86 | 51.62 | 617.02[a] | 46.55 |
| Week4 | 591.12[a] | 56.84 | 557.1 | 49.68 |
| Week5 | 586.52 | 33.11 | 624.96[a] | 43.28 |
| WGcum | 2013.08 | 66.49 | 2147.58[a] | 47.01 |

Different letters between groups showed a significant difference at ($p \leq 0.05$).

**Table (4) the effect of whole flaxseed-based diet on Feed intake(gm) of broilers (Mean ± SE):**

| Parameters | Control Group (T1) | | Treatment Group (T2) | |
|---|---|---|---|---|
| | Mean ±S. E | | Mean ±S. E | |
| Week1 | 175.29[a] | 25.32 | 169.30 | 20.17 |
| Week2 | 349[a] | 42.29 | 338 | 41.5 |
| Week3 | 801.22[a] | 73.46 | 749.2 | 67.48 |
| Week4 | 897.4[a] | 95.92 | 824.60 | 83.43 |
| Week5 | 1051.97[a] | 94.05 | 990.19 | 96.22 |
| FI cum | 3274.89[a] | 127.05 | 3071.29 | 110.57 |

Different letters between groups showed a significant difference at ($p \leq 0.05$).

**Table (5): Effect of whole flaxseed-based diet on Feed conversion ratio of broilers (Mean ± SE)**

| Parameters | Control Group (T1) | | Treatment Group ( T2) | |
|---|---|---|---|---|
| | Mean ± S. E | | Mean ± S. E | |
| Week1 | 1.28 [a] | 0.2 | 1.10 | 0.01 |
| Week2 | 1.46 [a] | 0.1 | 1.33 | 0.1 |
| Week3 | 1.57[a] | 0.01 | 1.34 | 0.01 |
| Week4 | 1.57[a] | 0.01 | 1.46 | 0.02 |
| Week5 | 1.64a | 0.02 | 1.56 | 0.01 |
| FCR cum | 1.50[a] | 0.01 | 1.39 | 0.01 |

Different letters between groups showed a significant difference at ($p \leq 0.05$).

## Immunological study:

Immune response enhanced by the increase of Antibody titer against ND and IBD vaccines antibody titer increased significantly ($P<0.05$) of ND and IBD in the (T2) compared with the (T1) as shown in table (6).

**Table (6): Effect of whole flaxseed-based diet on Immunological of broilers (Mean ± SE)**

| Parameters | Control Group (T1) | | Treatment Group ( T2) | |
|---|---|---|---|---|
| | Mean ±S. E | | Mean±S.E | |
| ND | 2793.7 | 882.85 | 4648[a] | 1047.7 |
| IBD | 1115 | 49.89 | 2278[a] | 79.72 |

Different letters between groups showed a significant difference at ($p \leq 0.05$)

## Discussion:

The whole flaxseed may help develop intestinal mucosa and the activity of digestive enzymes, which may benefit broiler chicken growth performance [9]. Because it enables better digestion and nutrition absorption, a healthy gut is essential for broiler growth performance. Because flaxseed is high in omega-3 fatty acids, which stimulate the bile, promote the breakdown of lipids in the intestine and enhance the benefits of diet [10], flaxseed has these benefits. By allowing broiler chickens to develop an effective immune system throughout growth by reducing the synthesis of inflammatory eicosanoids, feeding them a diet high in omega-3 fatty acids after hatching may, therefore, be beneficial to them in enhancing bird health and boosting production performance in broiler chickens [11]. According to [12], omega-3 may increase serotonin and dopamine release, two key neurotransmitters affecting mood, reducing stress, and making animals calmer.

According to some studies, broiler chickens' livers may produce more IGF-1 when they consume a diet high in omega-3 fatty acids. IGF-1 and more IGF-1 influence broiler chickens' growth and development, which can result in more weight gain [13].

According to [14], broiler feed containing up to 0–15% flaxseed flour enhanced average body weight while lowering feed intake. Broiler digestion enzyme activity has been shown to increase when flaxseed flour is used as feed; this may improve satiety or the sensation of being full after eating to convert the macronutrients (carbohydrates, proteins, and fats) in meals into smaller molecules that the body can absorb, the body produces digestive enzymes, this could account for the decline in feed consumption and feed conversion ratio.

However, some research indicates that flaxseed contains tannins, which can impart a bitter taste and potentially impact palatability: this could decrease feed intake and feed conversion ratio. According to [15], a low feed conversion ratio figure implies strong feed efficiency, meaning the hens are effectively using the grain they consume for growth and production. Conversely, a high feed conversion ratio figure will result from a high feed intake needs to be followed by significant body weight growth [16].

According to [17], long-chain omega-3 PUFAs have been shown to enhance immune function and lessen inflammation in various animals, including fish, mice, and chicken. Eicosanoids act as a mediator in the cellular regulation of immunological, reproductive, cardiovascular, and secretory processes. Reduced inflammatory and anti-inflammatory effects have been attributed to the influence of omega-3 PUFAs on eicosanoid production. Therefore, controlling the ratio of omega-6 to omega-3 significantly impacts the production of several eicosanoids that are implicated in inflammation and immunological responses. According to [18], EPA prevents the synthesis of eicosanoids produced from AA and serves as a precursor for less inflammatory eicosanoids. Enhancing any of these economic characteristics or the performance and livability of birds may boost industry profits and efficiency.
According to [19], omega-3 is a crucial component of the immune cell structure and the production of eicosanoids. By reducing the release of pro-inflammatory eicosanoids and cytokines, omega-3 PUFAs have anti-inflammatory or less inflammatory characteristics. Therefore, dietary intake of omega-3 PUFAs in the early post-hatch period may influence the growth of a robust immune system in birds by boosting antibody production.
According to [19], the combination of ND, IBD vaccination and immunomodulatory of omega-3 key components of the immune cell structure and eicosanoid synthesis may cause the increase in antibody titer against these vaccines. By reducing the release of pro-inflammatory eicosanoids and cytokines, omega-3 PUFAs have anti-inflammatory or less inflammatory characteristics. As a result, dietary intake of omega-3 PUFAs in the early post-hatch period may influence the growth of a robust immune system in birds by boosting antibody production.
According to [20], the enrichment of cell membrane omega-3 PUFAs is linked to growth rate, erythropoiesis, leucopoiesis, particular immunity, and a reduced inflammatory response.

## Conclusions:

There was an increase in live body weight, weight gain, and decrease in feed intake and feed conversion ratio of chicks fed flaxseed in the treatment from 1rt week until the end of this study. Also, the treatment group(T2) improved to the end of the experiment.
The improvement of immune response showed that IgA titers against Newcastle Disease ND and IBD were improved in the treatment group(T2) compared with the control group(T1).
Reducing adding oil to feed manufacturing is the best way to minimize feed costs, especially during current challenges. However, minimizing oil may lessen the rancidity during feed pellet storage. The use of Whole flaxseed led to underestimating the addition of oil.

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