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Effect of Adding Flaxseed Oil and Tallow and Their Combination on The Productive Performance of Broilers

Hasan N. Alhayaly[1], Ali M. Saadi[1,2]* and D.Th.Younis[3]

[1] *Department of Animal Production, Technical Agricultural College, Northern Technical University.*

[2] *Mosul Medical Technical Institute, Northern Technical University.*

[3] *Department of Animal Production, College of Agriculture & Forestry, University of Mosul.*

THIS study was conducted in the field of domestic birds of the Department of Animal Production at the College of Agriculture and Forestry / University of Mosul, and the field study period was from 7/2/2023 to 20/3/2023 (42 days) for the purpose of studying the effect of adding flaxseed oil and animal tallow and the combination between them on the productive performance and nutritional value of broilers. In this study, 288 non-naturalized broilers chicks (type Ross 308) at the age of one day were used in this study. The coefficients of the study were as follows: the first treatment (T1, control) fed on a standard diet (Free of oil and fat), the second treatment (T2) was fed on a diet containing flaxseed oil by 6 %, the third treatment (T3) was fed on a diet containing animal fat by 6 %, and the fourth treatment (T4) was fed on a diet containing flaxseed oil by 3 % with animal fat by 3 %. The results showed a significant increase in vivo weight and weight gain in addition to the relative weight of the thighs, the percentage of visceral fat and the concentration of high-density lipoproteins (HDL-C). besides that, the results also showed a significant decrease in percentage of net and relative weight of the chest, back and wings in addition to glucose concentration. However, there were no significant differences between the coefficients in total feed consumption, nutritional conversion factor, relative weight of neck, heart, liver, gizzard and Fabricia gland.

Keywords: Flaxseed oil, Tallow, Broilers.

Introduction

Chicken is usually the least expensive meat in most countries and therefore it is the first or second for per capita consumption and this competitive situation has occurred due to continuous improvements in production efficiency, which often require the acceptance of new ideas and innovations by poultry producers and agribusiness, where meat is one of the main products that humans depend on in their nutrition and are an essential source of proteins of high nutritional value, which is the basic material for human growth and body building. and its various tissues[1].Among the sources of meat, chicken meat has a high protein content in addition to the low fat and cholesterol content compared with red meat and is considered beneficial to human health[2]. In addition, fats and fatty acids in muscles and adipose tissue are among the main factors that affect the quality of meat, especially the nutritional value in addition to palatability [3]. The continuous genetic improvement of the genetic lines of broilers leads to continuous changes in their nutritional requirements, which requires improvements in the formulation and manufacture of feeds in order to provide these requirements as the addition of fat sources increases food energy levels and thus nutrition efficiency, however, it must be

*Corresponding author: Ali M. Saadi, E-mail: ali.mohammed@ntu.edu.iq. Tel.: 009647719623303
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taken into account that fat absorption increases with the age of birds[4]. Where the stages of feeding are important to improve the use of feed, as these divisions depend on the physiological and metabolic processes of the animal in order to provide the bird with the necessary amount of nutrients at a certain age and avoid waste or overfeeding [5]. Since feed costs can account for up to 70% of the total production cost[6]. Adding fat to diets along with energy saving improves the absorption of soluble vitamins and increases palatability, in addition to increasing the efficiency of energy consumed, moreover, it reduces the rate of digestion passage in the digestive system, allowing better absorption of all nutrients in the diet[7]. Where the cost and demand for increased energy in feed meals to meet the requirements of fast-growing birds has become the subject of attention of nutritionists, as dietary fats are one of the preferred ways to achieve this purpose, as various sources of fat have been introduced in poultry nutrition, including animal fats such as cow fat, lard, poultry fat, vegetable oils such as flax oil, soybean oil, corn oil, palm oil and sunflower oil[8]. In addition to the high energy density that is almost twice the same amount of carbohydrates and proteins, fats and edible oils are relatively inexpensive compared with corn, so the use of dietary fats provides a reasonable alternative to increase the energy density in the diets of modern high-performance broilers at relatively low costs [9]. Commercial broilers are characterized by a short production cycle and high energy requirements, so the need to add fats to their diet is a must as fats and oils contain the highest level of calories among all nutrients[10]. Currently, the use of various sources of fats and oils such as flaxseed oil and animal lard is common in feeding broiler chickens, as animal lard is one of the most important raw materials[11]. Fats and oils not only help to improve the quality of feed, but they also reduce the amount of dust produced by dry feed materials and thus increase digestibility and physiological terms fats are important in the formation of the cell membrane[12]. Vegetable oils are often used as a high-energy food in the nutrition of broilers, as it is noted that broilers that are fed on diets containing vegetable oils, including flax oil, perform better than those that feed on diets without including oil[13]. Flaxseed oil is one of the richest dietary sources of the essential fatty acid linolenic[14]. The study aimed to include flaxseed oil and animal lard in broiler nutrition and their effect on productive qualities.

Material and Methods

This study was conducted in the field of domestic birds of the Department of Animal Production at the College of Agriculture and Forestry / University of Mosul for a period of 42 days from 7/2/2023 to 20/3/2023 and the aim was to study the effect of adding flaxseed oil and animal tallow and the combination between them on the productive performance and nutritional value of broilers. In this study, 288 chicks of broilers aged one day, type (Ross 308) were used, where the experiment was carried out in a hall that divided into an equal floor measuring 2.5×2 m distributed over both sides of the hall, which contains windows on both sides and the floor of the hall of cement, distributed mattress (sawdust) inside the cages, which was 12 cages, in addition to the operation of a club (lighting) for each cage capacity of 100 watts to ensure that the chicks get a homogeneous lighting throughout the duration of the experiment. This hall has been equipped with electric heaters distributed on each cage to maintain the temperature of the hall. The chicks were distributed from the first week to four transactions and by three repeaters for each transaction, as each transaction is 72 chicks, and each repeater had 24 chicks, and the feeds used were in two stages: the starting diet for the period (1-21) days, and the end diet for the period (22-42) days and the relationship was formed according to the recommendations approved by the National Research Council (NRC, 1994) The experiment coefficients are: control diet (T1) was free of oil and fat, diet of flaxseed oil by 6% (T2), diet of tallow by 6% (T3), and diet of flaxseed oil by 3 % with tallow by 3 % (T4) as shown in Table (1) and (2), and feed and water were available to birds throughout the duration of the study.

The data on the productive characteristics of the week, represented by the average body weight (g), weekly weight gain (g), the amount of feed consumed (g / bird) and the food conversion factor (g feed / g weight gain) were recorded, and the speed of passage of food in the gut was estimated at the end of the period, where 12 birds were selected (bird / repeated) and were starved for 4 hours and provided with feed added to it with a red food dye obtained from the local markets and then waited until the colour came out with waste then calculated the speed of passage of food, which is the period from eating the coloured food until the colour comes out with the waste.

Statistical analysis

Complete Randomize Design (CRD) was used, and the data was analysed using SAS software and to determine the significance of the differences between the coefficients, the Dunkin' multi-range test was used at a significant level (0.05). This is according to the following mathematical model:

YIj=u+Ti+eij

Whereas:

Yij = Views Value

u = overall average views

Ti = Transaction Effect

eij = Experimental error effect

Results and Discussion

Table (3) shows the effect of adding flaxseed oil and animal tallow on live body weight, weight gain, feed consumed, nutritional conversion factor and net percentage. As for living body weight, the results of the statistical analysis showed a significant superiority of the third and fourth treatments compared with the first treatment, which did not differ significantly from the second treatment. This increase in body weight may be due to the presence of essential fatty acids in flax oil, especially the Linolenic Acid, which In turn, bile activates and leads to increased digestion of fat in the intestine, which leads to increased utilization of the diet [13]. These results are consistent with some authors [14,15] they observed a significant increase in living body weight when feeding broilers different percentages of flax oil. As for the increase in live body weight for animal tallow treatment, it may be due to the fact that animal tallow reduced the speed of food passing through the digestive system, allowing nutrients to be absorbed and used better [16]. These results agreed with many authors[17,18,19] who found that there is a significant increase in the weight of the living body when adding different percentages of animal fat in the diets of broilers either the results of weight gain showed the results of a significant superiority of the third and fourth treatments on the first treatment, which did not differ significantly from the second treatment and the reason for the superiority of the third and fourth treatment is that the addition of oils and fats (flaxseed oil and animal fat) led to improved palatability and increased the ratio digestive feed materials included in the diet and this is the reason for weight gain and this applies to what he reached[20,21] where they found that adding oils to broiler diets led to a significant increase in weights. These results were consistent with many researchers [15,22,23] who found a significant increase in weight gain when feeding broilers on different proportions of flaxseed oil and animal tallow, while the results of the consumed feed showed that there were no significant differences between the treatments and to explain this, it can be said that all the diets are close in their content of energy represented and therefore the feed consumption of these treatments and the extent of utilization of it will be almost the same. These results were consistent with some investigators [24,25] who found that there were no significant differences in feed consumption between the treatments when using different oil sources, including flaxseed oil and animal tallow, in broiler feed. As for the food conversion factor, the results showed that there are no significant differences between the coefficients, and therefore the reason for this may be due to the results of the statistical analysis of feed consumption. Table (3), which showed that there were no significant differences in the food conversion factor and these results were consistent with some literature [24,26] who indicated that there were no significant differences in the food conversion factor between the coefficients when feeding broilers on different proportions of flaxseed oil and animal tallow. While the results of the net ratio showed a significant decrease in the second, third and fourth transactions compared with the first treatment, these results were consistent with some investigators [27,28] , which showed a significant decrease in the net ratio of flaxseed oil treatment compared with the control treatment.

Table (4) shows the effect of adding flaxseed oil and animal tallow on the relative weight of carcass segments, which include the main segments (chest, thighs) and secondary segments (back, wings, neck), where the results of the statistical analysis showed a significant decrease in the relative weight of the chest for the second and fourth treatments compared with the first treatment, while there were no significant differences between the first and third treatments, and these were consistent with some reports[27,29]who found a significant decrease in the relative weight of the chest for the treatment of flax oil. Compared with the control treatment As for the results of the relative weight of the thighs, the results showed that there were no significant differences in the relative weight of the thighs between the third treatment compared with the first treatment, as well as no significant differences between the second and fourth

treatments, and these results were consistent with [24,30] who found that there were no significant differences in the relative weight of the thighs for the treatment of animal fat with the control treatment. On the rest of the coefficients while there are no significant differences between the first, third, and fourth coefficients and these results were consistent with Huo et al.[31] who did not find significant differences in the relative weight of the back of the treatment of flaxseed oil and the treatment of animal tallow compared with the treatment of control As for the relative weight of the wings, the results showed a significant superiority of the second treatment compared with the rest of the coefficients As for the relative weight of the neck, the results showed that there were no significant differences between The coefficients and these results agreed with Baighi & Nobakht [32] who showed that there were no significant differences in the relative weight of the neck between the coefficients.

Table (5) shows the effect of adding flaxseed oil and animal tallow on the ratios of eaten viscera weights, which include the relative weight of the heart, liver and gizzard, in addition to the percentage of belly fat, Fabrichia gland and the speed of passage of food in the gut, where the results of the statistical analysis showed that there are no significant differences in the relative weight of the heart, liver and gizzard, and these results agreed with some studies [24,33] where they did not notice significant differences in the relative weight of the heart, liver and gizzard for oil treatment Linen and the treatment of animal fat compared with the treatment of control, while the results of the statistical analysis showed a significant superiority in the relative weight of visceral fat for the third and fourth treatments compared with the first treatment, and these results were consistent with some authors [24,32] who indicated a significant superiority in the relative weight of visceral fat for the treatment of flaxseed oil and animal fat compared with the control treatment, while the results showed no significant differences in the relative weight of the Fabresia gland and these results agreed with [25,29,34] who indicated that there were no significant differences in the relative weight of the Fabrecia gland for the treatment of flaxseed oil and animal tallow compared with the control treatment The results of the statistical analysis showed that the third and fourth treatment doubled the speed of passage of food in the gut compared with the second and first treatment and these results agreed with some investigators[35,36] and perhaps because fat digestion is the most Difficulty compared with other nutrients [37].

TABLE 1. Shows the components of the starter's diet used in the experiment

Feed feedstock	Initiator Diet%			
	Diet control (T1)	Flaxseed oil diet (T2)	tallow diet (T3)	Oil and tallow diet (T4)
Yellow corn	61.5	5	25	15
Wheatgrass	0.5	55.5	32.5	44
Soybean meal 44%	34.5	30	33	31.5
Tallow (Bovine)	0	0	6	3
Flaxseed oil	0	6	0	3
Premix*	2.5	2.5	2.5	2.5
Salt	0.25	0.25	0.25	0.25
Limestone	0.75	0.75	0.75	0.75
Total	%100	%100	%100	%100
Chemical Analysis %				
Crude Protein%	22	22	22	22
Energy represented (kcal/kg)	2945	2977	2979	2978
Ether Extract%	2.673	7.535	7.882	7.708
Crude Fiber %	3.903	3.652	3.759	3.705
Lysine %	1.365	1.318	1.362	1.340
Methionine %	0.586	0.548	0.564	0.556

*Premix: Contains 30.01% crude protein, 2% crude fat, 0.79% crude fiber, 42.95% crude ash. 5.30 Sodium (Na), 6.20% Chloride (CL), 8.19% Lysine, 9.52% Methionine, 0.12% Tryptophan, 2.11% Valine, 0.65% Argenian, 3.05% Threonine, 400.000 IU/kg Vitamin A, 100.000 IU/kg Vitamin D3, 60.000 IU/kg 25-Hydroxyvitamin D3, 3.000 mg/kg Vitamin E, 120 mg/kg Vitamin B1, 320 mg/kg Vitamin B2, 240 mg/kg B6, 1.800 mg/kg Iron (Fe), 2.400 mg/kg Manganese (Mn), 2.800 mg/kg Zinc(Zn).

TABLE 2. Shows the components of the finite diet used in the experiment

Feed feedstock	Initiator Diet%			
	Diet control	Flaxseed oil diet	Tallow diet	Oil and tallow diet
Yellow corn	67.5	15	35.5	25.5
Wheatgrass	0.5	51	26.5	38
Soybean meal 44%	28.5	24.5	28.5	27
Tallow (Bovine)	0	0	6	3
Flaxseed oil	0	6	0	3
Premix*	2.5	2.5	2.5	2.5
Salt	0.25	0.25	0.25	0.25
Limestone	0.75	0.75	0.75	0.75
Total	%100	%100	%100	%100
Chemical Analysis %				
Crude Protein%	20	20	20	20
Energy represented (kcal/kg)	3017	3072	3071	3070
Ether Extract%	2.853	9.378	8.131	9.712
Crude Fiber %	3.597	3.362	3.517	3.464
Lysine %	1.204	1.163	1.231	1.209
Methionine %	0.559	0.524	0.545	0.537

*Premix: Contains 30.01% crude protein, 2% crude fat, 0.79% crude fiber, 42.95% crude ash. 5.30 Sodium (Na), 6.20% Chloride (CL), 8.19% Lysine, 9.52% Methionine, 0.12% Tryptophan, 2.11% Valine, 0.65% Argenian, 3.05% Threonine, 400.000 IU/kg Vitamin A, 100.000 IU/kg Vitamin D3, 60.000 IU/kg 25-Hydroxyvitamin D3, 3.000 mg/kg Vitamin E, 120 mg/kg Vitamin B1, 320 mg/kg Vitamin B2, 240 mg/kg B6, 1.800 mg/kg Iron (Fe), 2.400 mg/kg Manganese (Mn), 2.800 mg/kg Zinc(Zn).

TABLE 3. Effect of Adding Flaxseed oil and Tallow on Live Body weight (g), Weight Gain (g), Feed Consumption (g/bird), Feed Conversion Ratio (gmFeed\gm gain) and Net Percentage %

Treatments	Body weight (gm)	Weight Gain (gm)	Feed Consumption (gm \ bird)	Feed Conversion Ratio (gmFeed\gm gain)	Net Percentage %
T1	2827.92±55.68^{B}	2787.52±55.02^{B}	4336.2±101.02	1.5559±0.019	82.9487±0.4807^{A}
T2	2936.80±30.02^{AB}	2894.0±30.11^{AB}	4393.6±81.75	1.5179±0.012	79.0035±0.5918^{B}
T3	3023.98±58.56^{A}	2981.78±58.40^{A}	4553.5±109.63	1.5269±0.008	78.6926±0.7049^{B}
T4	3091.92±73.81^{A}	3048.2573.68±^{A}	4648.4±140.10	1.5246±0.015	76.9484±0.2133^{C}

* The different letters within the column indicate the existence of significant differences (P≤0,05).

TABLE 4. Effect of Adding Flaxseed oil and Tallow on the Ratio of Breast, Thighs, Back, Wings and Neck

Treatments	Breast %	Thigh %	Back ٪	Wings%	Neck%
T1	42.176±0.570^{A}	24.1213±0.543^{B}	15.6076±0.468^{B}	10.1046±0.066^{D}	7.9908±0.314
T2	36.143±0.837^{B}	26.6155±0.597^{A}	17.5968±0.420^{A}	11.3096±0.294^{A}	8.3347±0.209
T3	40.548±0.887^{A}	24.7951±0.591^{A}	15.8388±0.416^{B}	10.5248±0.278^{C}	8.2930±0.375
T4	37.269±0.734^{B}	26.6219±0.492^{A}	16.3795±0.298^{B}	11.1800±0.244^{B}	8.5492±0.352

* The different letters within the column indicate the existence of significant differences (P≤0.05).

TABLE 5. Effect of Adding Flaxseed oil and Tallow on Percentage of Entrails Eaten, Belly Fat, Fabrecia Gland, and Food Passage Speed (min)

Treatments	Heart %	Liver %	Gizzard%	Belly fat %	Fabrecia Gland %	Food passage speed (min)
T1	0.61847±0.054	2.4614±0.095	2.0009±0.125	0.6766±0.1083^{B}	0.24366±0.0375	210±5.773^{D}
T2	0.70346±0.053	2.6563±0.162	2.3217±0.182	1.0159±0.1007^{AB}	0.36743±0.0597	284±5.862^{C}
T3	0.73016±0.04	2.4478±0.125	1.8991±0.149	1.0884±0.1117^{A}	0.24229±0.0263	430±7.256^{A}
T4	0.66136±0.050	2.4459±0.044	2.1648±0.051	1.1553±0.1607^{A}	0.35578±0.0568	375±5.971^{B}

* The different letters within the column indicate the existence of significant differences (P≤0,05).

Conclusions

We conclude through the study that the use of flaxseed oil and animal tallow in feeding broilers led to an increase in body weight and Weight Gain, and the net percentage, as well as led to an increase in the weight of the breast, thigh, and wings, as well as increased the percentage of belly fat and the food passage speed, while there were no significant differences in the weights of the internal organs of broilers.

Conflicts of interest

There is no conflict of interest.

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تأثير إضافة زيت الكتان والشحم الحيواني والتوليفة بينهما على الأداء الإنتاجي لفروج اللحم

حسن نزار الحيالي[1] ، علي محمد سعدي[2,1] و دريد ذنون يونس[3]
[1] قسم إنتاج الحيوانات - كلية الزراعة التقنية - الجامعة التقنية الشمالية - العراق.
[2] المعهد التقني الطبي - الموصل - الجامعة التقنية الشمالية - العراق.
[3] قسم إنتاج الحيوانات - كلية الزراعة والغابات - جامعة الموصل - العراق.

أجريت هذه الدراسة في حقل الطيور الداجنة التابع لقسم الإنتاج الحيواني في كلية الزراعة والغابات / جامعة الموصل وكانت فترة الدراسة الحقلية من 2023/2/7 ولغاية 2023/3/20 (42 يوما) وذلك لغرض دراسة تأثير إضافة زيت الكتان والشحم الحيواني والتوليفة بينهما على الأداء الإنتاجي والقيمة الغذائية لفروج اللحم واستخدم في هذه الدراسة (288) فرخاً من أفراخ فروج اللحم بعمر يوم واحد نوع (Ross 308) غير مجنسة وكانت معاملات الدراسة كالتالي المعاملة الأولى (T1) (السيطرة) غذيت على عليقة قياسية (خالية من الزيت والشحم) والمعاملة الثانية (T2) غذيت على عليقة تحتوي على زيت الكتان بنسبة 6 % والمعاملة الثالثة (T3) غذيت على عليقة تحتوي على الشحم الحيواني بنسبة 6 % والمعاملة الرابعة (T4) غذيت على عليقة تحتوي على زيت الكتان بنسبة 3 % + الشحم الحيواني بنسبة 3 % حيث أظهرت نتائج التحليل الاحصائي ارتفاع معنوي في وزن الجسم الحي والزيادة الوزنية بالإضافة الى الوزن النسبي للأفخاذ ونسبة دهن الاحشاء وتركيز البروتينات الدهنية عالية الكثافة (HDL-C) وحصول انخفاض معنوي في نسبة التصافي والوزن النسبي للصدر والظهر والاجنحة بالإضافة الى تركيز الكلوكوز وعدم وجود فروقات معنوية بين المعاملات في استهلاك العلف الكلي ومعامل التحويل الغذائي والوزن النسبي للرقبة والقلب والكبد والقانصة وغدة فابريشيا.

الكلمات المفتاحية: زيت بذور الكتان ، الشحوم ، الدجاج اللاحم.