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Use of Linseed Oil and Animal Tallow in Nutrition and its Effect on Blood Characteristics and Meat Composition in Broilers

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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 Linseed oil and animal lard and the combination between them on the productive performance and nutritional value of broilers, and (288) chicks of broilers with the age of one day were used in this study type (Ross 308) non-naturalized and the coefficients of the study were as follows The first treatment T1 (control) fed on a standard diet (Free of oil and fat) and the second treatment T2 was fed on a diet containing Linseed 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 Linseed oil by (3) % + animal fat by (3) % , Where the results of the statistical analysis showed a significant increase in the concentration of high-density lipoproteins (HDL-C) and there were no significant differences between the coefficients in the concentration of total protein in blood serum, the concentration of cholesterol and triglycerides, the concentration of low-density lipoproteins (LDL) and the concentration of very low density lipoproteins (VLDL), as well as the absence of significant differences between the coefficients in the percentage of moisture, fat percentage and protein percentage in the breastmeat and thighs.

Keywords: Linseed oil, tallow, Broilers, HDL, LDL

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 to 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 and 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 taken into account that fat absorption increases with the age of birds[4,5]. 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[6]. Since feed costs can account for up to 70% of the total production cost[7]. Adding fat to diets along with

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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[8]. 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 Linseed oil, soybean oil, corn oil, palm oil and sunflower oil[9]. 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 to 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[10]. Commercial broilers are characterized by a short production cycle and high energy requirements, so adding fats to their diet is a must as fats and oils contain the highest level of calories among all nutrients[11]. Currently, the use of various sources of fats and oils such as Linseed oil and animal lard is common in feeding broiler chickens, as animal lard is one of the most important raw materials[12]. 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[13]. 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 Linseed oil, perform better than those that feed on diets without including oil[14]. Linseed oil is one of the richest dietary sources of the essential fatty acid linolenic[15]. The study aimed to include Linseed 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 the effect of adding Linseed oil and animal lard 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 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 number 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 is 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: T1 control diet was free of oil and fat, T2 diet of Linseed oil by (6), T3 diet of tallow by (6), T4 diet of Linseed oil by (3) % + tallow by (3) % as shown in Table (1) and (2), and feed and water were available to birds throughout the study.

Preparation of animal tallow and Linseed oil

The animal tallow used in the experiment is cow tallow, where it is prepared after first cutting it into small pieces and then Thermh so as to easily dissolve it and after the process of therm is placed in a pot and placed on a heat source (electric heater) and for half an hour after which it is left to cool and mix by 6% of the tallow with feed gradually until reaching a weight of 10 kg for the coefficients of adding grease and this process continues whenever birds need feed. As for Linseed oil, it is liquid and was obtained from the local markets and was added 6% to a small amount of feed and then mixed with a larger quantity until it reached a weight of 10 kg for the treatment of adding Linseed oil and this process continued whenever the chicks need feed. As for the treatment of adding animal tallow and Linseed oil, it was done by adding 3% animal tallow with 3% Linseed oil in the same way as before.

Physiological Characteristics

Blood sample collection

The slaughter of birds was carried out at the age of 42 days in the massacre of veterinary medicine / University of Mosul, where blood samples were collected by 36 samples (3 birds / repeater) male and female randomly and placed in tubes free of anticoagulant to isolate blood serum in order to conduct biochemical tests (total protein, glucose concentration, blood cholesterol and triglycerides).

Chemical composition of broiler meat

Chemical estimation of meat was carried out according to[16], where moisture, protein and fat were estimated.

Statistical analysis

CRD (Complete Randomize Design) was used and the data was analyzed 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).

Results and Discussion

Physiological Characteristics

Table (3) shows the effect of adding Linseed oil and animal tallow on the concentration of glucose and total protein in blood serum where the results of the statistical analysis showed a significant decrease for the fourth treatment, which amounted to (194.49) mg / 100 ml compared to the rest of the treatments (228.36, 225.10, 223.84) mg / 100ml, respectively, while the results showed no significant differences between the first, second and third treatments (228.36, 225.10, 223.84) mg / 100 ml, and these results were consistent with some authors [17,18] who showed no significant differences in glucose concentration for the treatment of Linseed oil and animal tallow. With treatment control while these results differed with some studies [19,20]. As for the total protein, the results of the statistical analysis showed that there were no significant differences between the coefficients, which amounted to (36.411, 35.933, 36.300, 35.222 g) / 100 ml for the four treatments respectively, where these results agreed with some investigators [17,21,22], who indicated in their study that there were no significant differences in the total protein concentration of the Linseed oil and animal tallow treatment compared to the control treatment, while these results differed with many reports[23,24,25,26].

Table (4) shows the effect of adding Linseed oil and animal tallow on cholesterol (TC), triglycerides (TG), high-density lipoproteins (HDL), low-density lipoproteins (LDL) and LDL/HDL ratio of broilers In blood serum, where the results of the statistical analysis showed that there were no significant differences between the treatments, which amounted to (107.311, 118.422, 106.322, 113.144) mg / 100 ml for the four treatments respectively, and these results were consistent with several reports[18,21,27,28] who noted no significant differences in the cholesterol concentration of the treatment of Linseed oil and animal tallow compared to the control treatment, while these results were different with some researchers[29,30]. Table (4) also shows the effect of adding Linseed oil and animal tallow on the concentration of triglycerides in blood serum, where the results of the statistical analysis showed that there were no significant differences between the treatments, which amounted to (81.59, 75.53, 49.73, 54.88) mg / 100 ml for the four treatments respectively, and these results were consistent with many works[22,28,31,32] who confirmed that there were no significant differences in the concentration of triglycerides for the treatment of Linseed oil and animal tallow compared to Treatment of control Results differed with [17,29,33]. As for the effect of adding flax oil and animal tallow on the concentration of high-density lipoproteins (HDL-C), low-density lipoproteins (LDL-C) and very low density lipoproteins (VLDL-C), the results of the statistical analysis showed a significant increase in the concentration of high-density lipoproteins (HDL-C) for the second, third and fourth coefficients, which amounted to (63.467, 57.822, 61.756) mg / 100 ml compared to the first treatment, which amounted to (49.378) mg / 100 ml, and these results were consistent with some studies[13,29] who observed a significant increase in the concentration of high-density lipoproteins (HDL-C) for the treatment of animal lard and flax oil compared to the treatment of control while the results were different with some reports[31,33]. The results of the analysis showed that there were no significant differences in the concentration of low-density lipoproteins (LDL-C) between the treatments, which amounted to (42.111, 40.111, 38.889, 40,889) mg / 100 ml for the four treatments respectively, and these results were consistent with many researchers [17,28,31], who found no significant differences in the concentration of low-density lipoproteins (LDL-C) for the treatment of flax oil and animal tallow compared to the control treatment, while the results differed with some studies [29,34]. In addition, there were no significant differences in the concentration of very low density lipoproteins (VLDL-C) between the coefficients (16.267, 15.022, 9.867, 10.867) mg / 100 ml, and these results agreed with Abdulla et al.[31] who noted no significant differences in the concentration of very low density lipoproteins (VLDL-C) for the treatment of flax oil and animal tallow compared to the control treatment while the results differed with Al-Hilali [13].

Chemical composition of broiler meat

Table (5) shows the effect of adding Linseed oil and animal tallow on chemical composition of broiler meat, where the results of the statistical analysis showed that there were no significant differences between the coefficients in the percentage of moisture in the breast, which amounted to (76.450, 75.420, 75.070, 75.970)% and thigh meat, which amounted to (76.060, 76.590, 76.120, 74.450)%, and the results of the analysis showed that there were no significant differences between the transactions in the percentage of fat in the breast, which amounted to (6.5000, 6.9000, 6.8000, 6.7000) % and thigh meat, which amounted to (10.7500, 11.4000, 9.8500, 10.7000)%. In addition to the absence of significant

differences between the coefficients in the percentage of protein in the breast, which amounted to (20.940, 27.130, 22.840, 19.660) % and thigh meat, which amounted to (18.980, 16.290, 18.250, 19.470)%, and these results were consistent with several studies[35,36,37,38] who noted no significant differences in moisture, fat and protein in the chest and thigh muscles, while these results differed with Ozdogan & Akşit [40].

Conclusions

We conclude through the study that the use of flaxseed oil and animal tallow in feeding broilers, the use of a mixture of flax oil and animal tallow lowered blood glucose, while the HDL concentration of the treatments using flax oil and animal tallow has increased, finally, no significant differences were observed in the chemical composition of the broiler meat.

Conflicts of interest

There is no conflict of interest.

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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 Linseed oil and Tallow on Glucose and Total protein

Treatments	Glucose (mg / 100ml)	Total protein (g / 100ml)
T1	228.36±8.37^{A}	36.411±2.73^{A}
T2	225.10±10.34^{A}	35.933±1.15^{A}
T3	223.84±6.01^{A}	36.300±1.58^{A}
T4	194.49±6.75^{B}	35.222±1.06^{A}

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

TABLE 4. Effect of Adding Linseed oil and Tallow on cholesterol (TC), triglycerides (TG), high-density lipoproteins (HDL), low-density lipoproteins (LDL) and LDL/HDL ratio of broilers.

Treatments	Cholesterol (mg/100 ml)	Triglyceride (mg/100 ml)	HDL-C (mg/100 ml)	LDL-C (mg/100 ml)	VLDL-C (mg/100 ml)
T1	107.311±4.74^{A}	81.59±15.94^{A}	49.378±2.95^{B}	42.111±5.33^{A}	16.267±3.10^{A}
T2	118.422±4.99^{A}	75.53±6.78^{A}	63.467±2.43^{A}	40.111±5.11^{A}	15.022±1.36^{A}
T3	106.322±2.85^{A}	49.73±9.19^{A}	57.822±2.57^{A}	38.889±4.45^{A}	9.867±1.84^{A}
T4	113.144±4.31^{A}	54.88±9.62^{A}	61.756±3.13^{A}	40,889±5.21^{A}	10.867±1.92^{A}

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

TABLE 5. Effect of Adding Linseed oil and Tallow on chemical composition of broiler meat

Treatments	Moisture in Breast meat %	Moisture in thigh meat %	fat in Breast meat %	fat in thigh meat %	Protein in Breast meat %	Protein in thigh meat %
T1	76.45±5.773^{A}	6.06±5.326^{A}	6.50±0.582^{A}	10.75±0.984^{A}	20.94±5.993^{A}	18.98±5.662^{A}
T2	5.420±5.692^{A}	6.590±5.783^{A}	6 .90±0.492^{A}	1.400±0.628^{A}	27.13±5.927^{A}	16.29±5.879^{A}
T3	5.070±5.824^{A}	6.120±5.991^{A}	6.80±0.691^{A}	9.850±0.448^{A}	22.84±5.614^{A}	18.25±5.782^{A}
T4	5.97±5.653^{A}	74.45±5.884^{A}	6.70±0.754^{A}	10.70±0.327^{A}	19.66±5.553^{A}	9.470±5.915^{A}

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

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استخدام زيت بذر الكتان والشحم الحيواني في التغذية وتأثيره على خصائص الدم وتركيب اللحوم في فروج اللحم

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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 اظهرت نتائج التحليل الاحصائي ارتفاع معنوي في تركيز البروتينات الدهنية عالية الكثافة (HDL-C) وعدم وجود فروقات معنوية بين المعاملات في تركيز البروتين الكلي في مصل الدم وتركيز الكولسترول والكليسيريدات الثلاثية وتركيز البروتينات الدهنية واطئة الكثافة (LDL) وتركيز البروتينات الدهنية واطئة الكثافة جدا (VLDL) وكذلك عدم وجود فروقات معنوية بين المعاملات في نسبة الرطوبة ونسبة الدهن ونسبة البروتين في لحم الصدر والافخاذ .

الكلمات المفتاحية: زيت بذور الكتان ، الشحوم ، الدجاج اللاحم، البروتينات الدهنية عالية الكثافة، البروتينات الدهنية واطئة الكثافة