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Original Research Article

The Effect of Adding Various Sources of Vegetable Oils on the Chemical and Sensory Characteristics of the Ross 308 Meat Broilers

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Abstract: The field experiment was conducted in the poultry field of domestic birds affiliated with the Department of Animal Production/College of Agriculture/University of Tikrit for the period from 11/28/2022 to 1/5/2023 with the aim of identifying the effect of the use of five different types of vegetable oils on the chemical properties of meat and the sensory evaluation of the rogue meat Ross 308 ، In the experiment, 150 unnaturalized traps of the Ross strain (308) were used at one day's age and at a weight rate of (39.12) g. The chicks were distributed to five transactions by six duplicates per transaction and the chicks were distributed by 5 chicks for each repeater and used in the first transaction sunflower oil, the second treatment flax oil, the third Olive oil ،The fourth treatment is cannula oil and the fifth treatment is corn oil. Feed was provided in the form of shovel, lighting and water (according to the Ross 308 Education Manual). Thigh meat samples were taken and tests were performed. The results were as follows: Significantly ($P < 0.05$) the second, third and fourth treatments were superior to the second and fifth treatments in the concentration of cholesterol, malonaldehyde and peroxide value. As for the percentages of fatty acids in the thigh, we note that the second and third treatments were superior to the first and fifth treatments, and there was no significant difference between the experimental treatments in the two consumption characteristics. Feed and feed conversion factor.

Keywords: Oil, olive oil, chicken meat, flax oil, p.v, TBA.

INTRODUCTION

Nowadays, disorders of fat metabolism are a serious health problem in the world population, mainly causing obesity, insulin resistance, infections, coronary artery sclerosis and type 2 diabetes (Cao, 2014; Elbaz *et al*., 2023). The main risk factors for these types of diseases are high body weight, alcohol and tobacco consumption. lower body activity, lower fruit and vegetable intake, higher saturated fats, lower essential fatty acids, higher n-6/n-3 ratio (Yin *et al*., 2017; Sierżant *et al*., 2023). Many international organizations recommend daily consumption of omega essential fatty acids. 3 and Omega 6, as well as a close ratio between them to stimulate brain development, reduce cancer incidence and metabolism (British Nutrition Foundation, 1992; World Health Organization, 1995). Poultry diets have been modified to contain essential fatty acids found in meat and eggs in order to increase these fatty acids and reduce harmful fats (cholesterol and triglycerides), which increases the quality of the final product (Simopoulos, 2002; Aguilar *et al*., 2011). Thus, the addition of essential fatty acids such as A-linolenic and linoleic in poultry diets, reduces low-density lipoprotein (VLDL), low-density lipoprotein (LDL), triglycerides (TAG) and cholesterol, and reduces atherosclerosis in birds (Ayerza & Coates, 2000). Oil seeds such as linseed, sunflower oil, flaxseed oil, olive oil, canola oil and corn oil are the main sources of these fatty acids of vegetable origin, and they have been added effectively to treat the deficiency of fatty acids in poultry as well as to increase growth and improve the immune status of animals (Aguilar *et al*., 2011; Banaszkiewicz, 2013; Chen *et al*., 2014; Apperson & Cherian, 2017). The addition of these oilseeds can replace the traditional as a source of energy and protein in poultry diets (Woyengo *et al*., 2017; El-Bahr *et al*., 2021).

Therefore, the study aimed to use different sources of vegetable oils (sunflower, canola, olive, corn and flax) and their effect on the chemical properties and quality of ROSS 308 broiler meat.

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MATERIALS AND METHODS

The experiment was conducted in the poultry field of the Department of Animal Production, College of Agriculture / University of Tikrit for the period from 11/28/2022 to 1/5/2023 in order to identify the effect of using five different types of vegetable oils on the chemical composition of the thigh in broiler chickens.

Sunflower oil, corn oil, olive oil, flaxseed oil and canola oil were used in this study.

1. Bird Management:

In the experiment, 150 unsexed chicks of the Ross strain (308) were used, one day old, with an average weight of (39.12) g. The chicks were prepared from Al-Moatasem hatchery - Samarra. Chicks were distributed randomly into (30) cages (repeated) with (5) birds per cage. The dimensions of the cage were 0.75×0.75m. As I was raised in special cages, the experimental treatments were distributed among the replicates randomly, with six replicates for each treatment. The hall was prepared and equipped with all the breeding requirements, including feeders and manholes, and the appropriate temperature was provided, as mentioned in the Ross 308 guide for the year 2007.

2. Nutritional Transactions and Relationships:

The chicks were fed free feed (Ad libitum) on a starting diet from the age of (1-10) days. From the age of (11-24) days, she was fed on a growth diet. From the age of (25-35) days, she was fed a final diet, as shown in Table No. (1) and according to the Ross 308 guide for the year 2019. These diets were prepared in the feed laboratory of the College of Agriculture / Tikrit University. Sunflower oil was used in the first treatment, flax oil in the second treatment, olive oil in the third treatment, canola oil in the fourth treatment, and corn oil in the fifth treatment. It was used at a rate of 2% in the starter ration, 2.75% in the growth ration, and 3.8% in the final ration.

Table 1: Percentages of feed materials included in the composition of the experimental rations, along with the chemical composition

Feed Ingredients (%)	**Experimental diets**		
	10-1**days**	**11-24 days**	**25-35 days**
Yellow Corn(%)	56.45	60.12	62.93
Soybean meal(48%)	37.4	33.65	30.01
Premix*	2.5	2.5	2.5
Oil(%)	2	2.75	3.8
Dicalcium phosphate(%)	0.40	0.20	0.00
Caco3(%)	0.7	0.6	0.6
Lysine(%)-L	0.3	0.10	0.09
Methionine(%) DL-	0.25	0.08	0.07
Total	**%100**	**%100**	**%100**
****Nutrient composition**			
ME/(MJ/kg)	3002	3101	3201
Crude protein(%)	23.00	21.51	20.00
Crude fibre(%)	2.33	2.3	2.61
Lysine(%)	1.44	1.15	1.06
Methionine(%)	0.73	0.47	0.52
Methionine+Cystine(%)	1.08	0.87	0.918
Calcium(%)	0.97	0.88	0.83
Phosphorus(%)	0.48	0.45	0.402

*Primus used the product from the Dutch company WAFI, which contains 10% crude protein, 5% crude fat, 20.4% calcium, 10.85% available phosphorus, lysine 1.6%, methionine 6%, methionine + cysteine 6.05%, represented energy 766.1 kilocalories / kg, crude fiber 3.20%.

** According to the chemical composition of the materials included in the composition of the diet according to NRC (1994).

3. Analysis of the Types of Fatty Acids

3.1. Analysis by GC (Gas Chromatography)

The analysis was carried out in the Environment and Water Laboratory / Ministry of Science and Technology with 3 samples per treatment using a GC device from Shimadzu company, model (Japanese-made A-17), equipped with an ionic flame detector (FID), an Auto Sampler injector (Agilent tech.) Model7683b, and a highly polar capillary column of the type DB 23 (60m×0.25mm×0.25µm thickness). The volume of the syringe was 1 microliter, and high-purity nitrogen gas was used as a phase separation at a flow rate of 1.5 ml/min. The temperature of the injector and detector was set at 250°C. The column oven temperature was programmed to start at 50°C for two minutes, then increased to 180°C at a rate of 10°C/min. This temperature was for 30 minutes, then it was raised to 230°C at a rate of 10°C/ for 10 minutes.

Form Preparation:

The solution for injection is prepared according to the type of forms:

1- The oil is converted into a methyl ester, according to the following method:

A- The solvent is prepared with a weight of (11.33) KOH, then we add methanol to it to dissolve it, then it is placed in a 100 ml volumetric vial and supplemented with ethanol to the mark.

B- Weigh 0.1 gm of the oil in a small glass vial, then add 0.1 ml of the solvent to it, add 1 ml of heptane, shake well and leave it to settle, as two layers separate, the oil and the solvent, and the upper layer (the solvent) is withdrawn.

2- The type of detector used in the device is determined according to the type of injected sample. The FID detector is used to diagnose only organic compounds with high sensitivity, and the TCD detector is a detector that diagnoses organic and inorganic compounds or substances that turn into steam only.

3.2. Estimation of Cholesterol Concentration in Thigh Meat

The test was conducted in the laboratories of the Ministry of Science and Technology / Department of Environment and Water to estimate the amount of cholesterol using the gas chromatography technique (GC-2010 Japan), where a separation column (30m×0.25mm) ZB-1 was used and the flame ionized detector (FID) was used according to the method of Madzlan (2008). Take 5 gm of the sample and add 50 ml of hexane and 3 ml of sodium hydroxide at a concentration of (1N) and shake well for 30 seconds and place in an ultrasonic cracker for 5 minutes. Then it was transferred to a centrifuge at 4000 revolutions / min. For 10 minutes, the organic layer was taken, filtered, and injected into the gas chromatography (GC) according to the analysis conditions. The temperature of the injection area and the detector were respectively (280 and 310) °C, while the temperature of the separation column starts from (90-200) m° with a gradual rise of 10 m°/min. Inert nitrogen gas was used as a carrier medium at a rate of 100 kPa/sec.

3.3. Measurement of Thiobarbituric Acid (TBA) Concentration

The concentration of malondialdehyde (MDA), which is one of the indicators of fat oxidation, was measured in samples of frozen chicken meat by estimating the concentration of thiobarbutyric acid (TBA) according to what was stated by Witte *et al*., Cold, which consists of 20% of (TCA) Trichloroacetic acid, dissolved in phosphoric acid of concentration (2M), and put the samples in the homogenizing device for a period of 2 minutes, then transfer them and put them in a Volumetric Flask with a volume of 50 milliliters, and complete it with distilled water to the mark. The mixture of meat and solution is shaken well and then Then 25 ml of it is taken and placed in the centrifuge at a speed of 3000 revolutions / min for half an hour, then the mixture is filtered using filter papers No. 1. After that, 5 milliliters of the transformer after filtration are transferred to test tubes and 5 milliliters of thiobarbutyric acid is added to it with a concentration of (0.005M) dissolved in distilled water. The standard reading solution is prepared by mixing 5 milliliters of distilled water and 5 milliliters of thiobarbutyric acid solution. The test tube is well and the sample is heated using a water path for half an hour (Tarladgis *et al*., 1964). The absorbance of samples of the resulting color is measured at a wavelength of 530 nanometers using a spectrophotometer, and the number of milligrams of malondaldehyde per kg of meat is calculated by the following equation:

The thiobarbituric value (mg MDA kg^{-1} meat) = sample absorbance × reading constant.

Reading constant = 5.2.

3.4. Measuring the value of peroxide Value (P.V)

The peroxide value was estimated according to the method of Pearson and Dustson (1985) by taking a 5 gm fat sample of the fat extracted from the transaction forms using the Soxhlet extractor and adding 30 ml of a mixture consisting of three parts of icy acetic acid + two molecules of chloroform with the addition of 0.5 ml of saturated Potassiumiodide solution, 30 ml distilled water and 1 ml Starch index at a concentration of 1% N. Then the mixture was wiped with a 0.01 titer sodium thiosulfate solution until the blue color disappeared, and the estimate was made according to the following equation:

Peroxide number (mequivalent) = (number of milliliters of sodium thiosulfate x 0.1 x 1000) / sample weight (g)

3.5. Sensory Evaluation

The sensory evaluation procedure was based on the method mentioned by Cross (1978), where the meat samples (thigh) were cooked in an electric oven at a temperature of 165 C until the internal temperature of the meat reached 70 C, then the cooked meat samples were presented to conduct the sensory evaluation of the characteristics of flavour, tenderness, juiciness and acceptability The year, with the availability of drinking water during the evaluation, using eight arbitrators, according to the sensory evaluation scores consisting of 5 degrees, and according to the sensory evaluation form, Table (2).

Thigh meat sensory evaluation score form

Resident's name.....

Evaluation date.....

Treatments	Juicy	tenderness	flavor	general acceptance
T1				
T2				
T3				
T4				
T5				

Degrees of sensory evaluation of thigh meat

Degrees	Juicy	Tenderness	Flavor	General Acceptance
1	Solid	dry	Unacceptable Quite	Unacceptable
2-3	little freshness	Low juice	acceptable	Quite acceptable
4	Mushy	juice	acceptable	Acceptable
5	Too mushy	So juicy	Very acceptable	Very acceptable

4. Statistical Analysis

The data were analyzed using a complete random design (CRD) to study the effect of coefficients on the studied traits. Significant differences between the averages were compared using Duncan's multinomial test (Duncan, 1955) at the level of 5%. The statistical program SAS (2001) was used in the statistical analysis according to the following mathematical model.

$Yij = \mu + Ti + eij$

Where:

Yij=Value of observation j of transaction i

μ = the overall average of the studied trait

Ti = effect of treatment i

eij = the random error that is assumed to be normally and independently distributed with a mean value of zero and a variance of σ2

RESULT

1. Concentration of Cholesterol, Malondialdehyde, and Peroxide Value in Meat:

Table (2) shows the effect of using sunflower oil, flax, olive oil, canola and corn in broiler diets on the concentration of cholesterol, malondialdehyde and peroxide value in the meat stored for a period of 60 days. And T3 and T4 in which flaxseed, olive and canola oils were used, respectively, in comparison with the treatments in which sunflower and corn oils (T1 and T5) were used. From the same table, we notice a significant decrease ($p<0.05$) for treatments T2, T3, and T4 in malondaldehyde concentration compared to treatments T1 and T5, which had no significant difference between them. As for the value of peroxide in the thigh meat, we note from Table (2) as well that there is a significant decrease ($p<0.05$) for the treatments T2, T3 and T4 in which flax, olive and canola oils were used, respectively, compared with the treatments in which sunflower and corn oils were used. (T1 and T5) Also, treatments T2 and T3, in which flax and olive oil were used, were significantly decreased in comparison with T4, in which canola oil was used in their diets, in the peroxide value of thigh meat.

Table 2: The effect of using different sources of oils on the concentration of cholesterol, malondaldehyde and peroxide value of thigh meat stored for 60 days of Ross308 broilers (means ± standard error)

Traits / Treatment**	peroxide value milliequivalents/kg meat	Cholesterol mg / 100 grams of meat	Malondialdehyde mg / kg meat
T1	4.370±0.30a	0.079±0.032a	0.0790±0.011a
T2	2.220±0.19c	0.052±0.011c	0.0435±0.021c
T3	2.376±0.44c	0.051±0.120c	0.0452±0.015c
T4	3.321±0.38b	0.068±0.023b	0.0632±0.016b
T5	4.411±0.38a	0.073±0.012ab	0.0789±0.024a
significant level	*	*	*

*Different letters within the same column indicate that there are significant differences between the treatments at the probability level ($p<0.05$).

** T1 = control treatment, sunflower oil was used. T2 = using flaxseed oil instead of sunflower oil. T3 = Use olive oil instead of sunflower oil. T4 = using canola oil instead of sunflower oil. T5 = using corn oil instead of sunflower oil. *et al*., 2023).

2. Fatty acids in the thigh meat.

The results in Table (3) showed a significant increase ($p<0.05$) in the percentage of oleic fatty acid in meat for treatments T2 and T3 (olive and flax oil, respectively) compared to treatments T1 and T5 (sunflower and corn oil, respectively). There was no significant difference between them and T4 (canola oil), and the significant superiority continued ($p<0.05$) for the

two treatments T2 and T3 in the percentage of oleic fatty acid compared to the rest of the experimental treatments. Also, T4 was significantly superior compared to T1 and T5. From the same table, we note the continued superiority of the T2 treatments. T3 and T4 were significantly ($p<0.05$) in the percentage of alpha-linolenic fatty acid compared with T1 and T5, as well as significantly superior to T2 over T4.

Table 3: Effect of using different sources of oils on the concentration and types of fatty acids of thigh meat stored for 60 days of Ross308 broilers (means ± standard error)

Traits	Fatty acids%				
	Oleic	**Linoleic**	**Linolenic**	**EPA**	**DHA**
Oil Type	C18:1n-9	C18:2n-6	C18:3n-3	C20:5n-3	C22:6n-3
T1	6.21±0.06c	8.43±0.06c	2.31±0.03c	4.97±0.09b	3.26±0.04b
T2	6.78±0.08a	8.97±0.04a	2.87±0.09a	5.76±0.06a	3.82±0.03a
T3	6.81±0.03a	9.01±0.03a	2.76±0.04ab	5.69±0.04a	3.91±0.03a
T4	6.41±0.05ab	8.89±0.08b	2.69±0.08b	5.34±0.07ab	3.64±0.05ab
T5	6.22±0.07c	8.39±0.09c	2.38±0.06c	5.01±0.02b	3.30±0.08b
significant level	*	*	*	*	*

*Different letters within the same column indicate that there are significant differences between the treatments at the probability level ($p<0.05$).

** T1 = control treatment, sunflower oil was used. T2 = using flaxseed oil instead of sunflower oil. T3 = Use olive oil instead of sunflower oil. T4 = using canola oil instead of sunflower oil. T5 = using corn oil instead of sunflower oil. EPA: eicosapentaenoic acid. DHA: docosahexaenoic acid.

As for the EPA fatty acid, we note from Table (3) that there is a significant ($p<0.05$) superiority of the two treatments T2 and T3 over T1 and T5, and there was no significant difference between them and T4. From the same table, we note the continued superiority of T2 and T3 significantly in the percentage of DHA fatty acid Compared to T1 and T5.

3. Sensory evaluation of thigh meat.

Table (4) indicates that there were no significant differences between the experimental treatments in the characteristics of the sensory evaluation of the thigh meat (tenderness, flavour, juiciness and general acceptance), perhaps due to the fact that all types of vegetable oils used were fresh and newly made.

Table 4: The effect of using different sources of oils on the sensory evaluation of thigh meat of Ross308 broilers (means ± standard error)

Treatments	Juicy	tenderness	flavor	general acceptance
T1	3.88±0.30	3.75±0.53	3.63±0.26	4.50±0.19
T2	4.00±0.19	4.13±0.30	3.88±0.44	4.13±0.48
T3	3.88±0.44	4.00±0.27	3.88±0.30	4.25±0.37
T4	4.00±0.38	4.38±0.18	4.63±0.18	4.50±0.19
T5	4.38±0.38	4.38±0.38	4.38±0.38	4.63±0.18
significant level	N.S	N.S	N.S	N.S

*Different letters within the same column indicate that there are significant differences between the treatments at the probability level ($p<0.05$).

** T1 = control treatment, sunflower oil was used. T2 = using flaxseed oil instead of sunflower oil. T3 = Use olive oil instead of sunflower oil. T4 = using canola oil instead of sunflower oil. T5 = using corn oil instead of sunflower oil.

DISCUSSION

The reason for the decrease in the concentration of cholesterol in the thigh meat may be due to the treatments using olive oil and flax because they contain a high concentration of avalinolenic acid and oleic acid, which work to increase the gene expression of liver cells in activating fat metabolism and using fats to produce energy and reduce their deposition in the tissues of the body, which leads to a decrease in concentration Cholesterol in meat (Alagawany *et al*., 2019). And that the reason for the low concentration of malondialdehyde and the value of peroxide in the treatments themselves may be due to the fact that they contain carotenoid dyes, which interact with the terminal ionic oxygen groups by giving the ionic ends an electron and transferring it from the carotenoid dyes to the free radicals, which makes the free radicals inactivated, which in turn leads to a decrease in malondaldehyde and peroxide value in meat (Perez-Galvez *et al*., 2020; Hashem The reason for the decrease in the concentration of cholesterol in the thigh meat may be due to the treatments using olive oil and flax because they contain a high concentration of avalinolenic acid and oleic acid, which work to increase the gene expression of liver cells in activating fat metabolism and using fats to produce energy and reduce their deposition in the tissues of the body, which leads to a decrease in concentration Cholesterol in meat (Alagawany *et al*., 2019). And that the reason for the low concentration of malondialdehyde and the value of peroxide in the treatments themselves may be due to the fact that they

contain carotenoid dyes, which interact with the terminal ionic oxygen groups by giving the ionic ends an electron and transferring it from the carotenoid dyes to the free radicals, which makes the free radicals inactivated, which in turn leads to a decrease in malondaldehyde and peroxide value in meat (Perez-Galvez *et al*., 2020; Hashem).

The composition of fatty acids in meat is greatly affected by the change in the sequence and types of fatty acids in the diet (Qasim, 2015). Oils containing associated fatty acids that are used in diets can change the sequence of fatty acid chains in meat, as well as the type and level of unsaturated fatty acids in meat, Unsaturated fatty acids affect the chemical and qualitative characteristics of the meat, and this characteristic is necessary for the meat because it controls the nutritional value of the meat as it works to raise the nutritional value and make the food organically functional (Qasim *et al*., 2017; Corrales *et al*., 2023), and the reason may be attributed to the qualitative improvement in the fatty acids of the meat Broilers use olive oil and flax, which are rich in umeric acids 3 and 9, which improve the nutritional value and quality of the meat through precipitation in the meat, which in turn increases the nutritional value of the meat (Flores *et al*., 2019; Vasilopoulou *et al*., 2023).

CONCLUSION

We conclude that there is a significant decrease in cholesterol and malondaldehyde in the meat of the treatments in which flax, olive and canola oils were used compared to sunflower and corn oils. Also, there was a significant increase in non-comedogenic fatty acids in the meat of the treatments in which flax and olive oils were used compared to the other treatments. Thus, flax oils can be used. Olives are used in poultry feed to obtain good quality meat .

Conflict of Interest: The authors declare no conflicts of interest associated with this manuscript.

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