Effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet in oxidation indicators for the meat of broilers chickens

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ABSTRACT

The experiment was designed to determine the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet in oxidation indicators for the meat of broilers chickens raised for 35 days age, where 240 unsexed broilers chickens (Ross 308) with one day age were used, the chicks were distributed on four treatments with rate of 60 chicks/treatment. the chicks of each treatment were divided into three replicates (20 chick/replicate). The chicks were fed on the initiator and final diets with the level of crude protein (21.76 and 8818%), the metabolic energy was (3000.13 and 3120.98 kcal/kg), respectively, added to it the following nutritional flavorings : First treatment (T1): Control treatment without any addition, second treatment (T2): A diet added to it (5 $g.kg^{-1}$ feed) of cardamom powder, Third treatment (T3): A diet added to it (5 $g.kg^{-1}$ feed) of cinnamon powder, Fourth treatment (T4): A diet added to it (2.5 $g.kg^{-1}$ feed) of cardamom powder + 2.5 $g.kg^{-1}$ feed of cinnamon powder. The results showed a significant decrease ($P < 0.05$) in the values of Thiobarbituric acid (TBA), free fatty acids (FFA) and the number of peroxides (PV) for all additive treatments (T2, T3, T4) compared to the control treatment at the period of 0 and 30 days of storage. The current study concludes that the addition of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet of broilers chickens contributed to the reduction of meat oxidation indicators and to the periods before and after 30 days of storage.

Keywords: cardamom and cinnamon, oxidation indicators, the meet of broilers chickens.

*Research paper from MSc thesis for the first author.

تأثير أضافة نوعين من المنكهات الغذائية (الهيل والقرفة) وخليطهما الى العليقة في مؤشرات الاكسدة للحم فروج اللحم

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الخلاصة

استهدفت التجربة معرفة تأثير أستخدام نوعين من المنكهات الغذائية(الهيل والقرفة) وخليطهما الى العليقة في مؤشرات الاكسدة للحم فروج اللحم والمربى لعمر35 يوم ، حيث تم استخدام 240 فرخ من فروج اللحم سلالة Ross 308غير مجنسة بعمر يوم واحد وزعت الافراخ على أربعة معاملات بواقع 60 فرخ/معاملة وقسمت افراخ كل معاملة الى ثلاثة مكررات (20فرخ/مكرر) ،غذيت الافراخ على عليقتي البادئ والنهائي بمستوى بروتين خام21.76 و 18.88% ، وطاقة ممثلة 3000.13 و3120.98كيلو سعرة / كغم علف على التوالي مضافاً اليها المنكهات الغذائيه كالأتي :الأولى(T1) معاملة سيطرة بدون أية أضافه،الثانية (T2) أضافة 5غم مسحوق الهيل /كغم علف، الثالثه(T3)أضافة 5غم مسحوق القرفة/كغم علف،الرابعة (T4) أضافة 2.5غم هيل+2.5 غم قرفة/كغم علف.وقد اظهرت النتائج :- حصول أنخفاض معنوي ($P<0.05$) في قيم حامض الثايوباربيوترك(TBA)والأحماض الدهنيه الحره (FFA) ورقم البيروكسيد(PV) لجميع معاملات الأضافه (T2،T3،T4) مقارنة مع معاملة السيطره عند مدة 0 و30 يوم من الخزن . يستنتج من الدراسة الحالية أن أضافة المنكهات الغذائيه (الهيل والقرفه) وخليطهما لعليقة فروج اللحم أسهمت بخفض مؤشرات أكسده اللحم وللمدد قبل وبعد 30 يوم من الخزن .

كلمات مفتاحية : الهيل والقرفة ، مؤشرات الاكسدة ، لحم فروج اللحم.
البحث مستل من رسالة ماجستير للباحث الاول.

1. INTRODUCTION

The process of Fat oxidation is considered the main reason for the corruption of meats and its products. The reacting the products of the oxidation process with the meat components is reflected negatively on the sensory traits from the flavor, odor and nutritional value caused its rejection by the consumer (Gray et al., 16). The oxidative damage for the poultry meat has occurred because it contains many unsaturated fatty acids found in the cellular membranes for the meat, where the presence of double bonds in these acids contributes to the oxidation process, which results in the formation of secondary products and compounds involved in the production of unwanted flavors and odors especially in cooked and frozen meat, The use of industrial antioxidants has become the subject of suspicion for many researchers, causing cancer of the body that may kill the body (Reische et al., 27) and for the purpose of producing high-quality meat free of any reason refuses to increase the trend towards the use of nutritional flavorings as natural antioxidants, where work to maintain flavor and color and taste and prevent it (10), such as garden sage, cinnamon, rosemary, and grape seeds, because they contain effective natural compounds and they have a role to prevent the occurrence of oxidation and the fact that they are nutritional sources that are safe to use (Ahn et al, 4). Cardamom (Elettaria Cardamomum) is considered one of the most important flavorings and it is described as the dry fruit of an aromatic herbaceous annual plant belonging to the Zingiberaceae family. It contains phenol compounds found in the botanical kingdom rather than flavonoids such as Linalool, Terpinen acetate, α-terpineol, α-terpined, Limonen, Cineol with anti-oxidant effect (Nair et al., 21), It makes it a one of the natural nutritional flavoring used to prevent and inhibit oxidation (Kalembe and Kunicka, 19). Cinnamon (Cinnamomum Cassia) is considered a medicinal herb that has received great interest as a nutritional additive for poultry diets because it contains many active compounds (Cinnamaldehyde, Eugenol, Methoeugenol Methoeugenol, Cinnamylacetate), which play a large role in their antioxidant activity (13, 20), where it plays a direct role in lipid metabolism and prevention of high cholesterol and low free fatty acids due to the presence of polyphenol, It is the compound of the antioxidant base (Jalaluddin et al., 18). Botsoglou et al., (8) confirmed that when added it to diets of broiler chicken or used in the preparation of their meat, these flavors would act as natural antioxidants by reducing TBA and PV values, Abd El-Qader, (3) indicated that the cardamom powder or the extracted oil from it used in the preparation of chicken burger and storage in freezing led to a decrease in the values of TBA, PV and FFA compared to the control treatment, Ooi et al., (23) stated that cinnamon powder added to the birds' poultry diets will contribute to reducing the TBA and PV values for its role in maintaining the activity of antioxidant enzyme rather than the presence of cinnamaldehyde, the active substance in which vitamin E acts as an antioxidant, Stefan et al., (30) observed a significant decrease in TBA and PV values when adding different levels of cinnamon powder (0, 0.1, 0.05, 0.025%) to the diet of broiler chicken with 35 day age, which contributed to a significant decrease in the TBA and PV values of the meat produced for all additive treatments compared to the control treatment, In addition, the percentage of the addition of 0.1% of the powder has achieved the least significant decrease in the TBA and PV values compared to other additive treatments coincided with the trends towards the use of flavored medicinal plants and herbs. This study was conducted to investigate the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet in oxidation indicators for the meat of broilers chickens. The essential oils of the cardamom contribute to increasing the levels of the body's Glutathione, it is the natural source of oxidation (Hossaina et al., 17), where they act to remove and eliminate toxins by stimulating cell activity, working on different molecular and cellular levels, interacting with carcinogens, increasing the

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level of the antioxidant enzyme, and enhancing its ability to remove toxins and reduce lipid peroxidation (Smaranika et al., 29).

2. MATERIALS AND METHODS

This experiment was conducted in the poultry field belonging to the Department of Animal Production at the College of Agriculture, University of Baghdad (old location for the Faculty of Agriculture), Abu Ghraib for the period from 6/10 to 10/11/2017 to find out the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet in oxidation indicators for the meat of broilers chickens for the age of 35 days for the duration of 0 and 30 days of storage. where 240 unsexed broilers chickens (Ross 308) with one day age were used, with an initial weight of (38.6 g/chick). The chicks were distributed on four treatments with a rate of 60 chicks/treatment. the chicks of each treatment were divided into three replicates (20 chick/replicate). The treatments were as follows: First treatment (T1): Control treatment without any addition, second treatment (T2): A diet added to it (5 $g.kg^{-1}$ feed) of cardamom powder, Third treatment (T3): A diet added to it (5 $g.kg^{-1}$ feed) of cinnamon powder, Fourth treatment (T4): A diet added to it (2.5 $g.kg^{-1}$ feed) of cardamom powder + 2.5 $g.kg^{-1}$ feed of cinnamon powder. The birds raised a ground floor in hens with an area of (1.8 x 3 m/hen) each containing 20 chickens. The temperature was set automatically using gas incubators and airbags. The temperature was then kept gradually until it reached 20-22 m until the marketing age. Feeders were fed freely ad libitum and crushed during the duration of the experiment, Initiator diet was used for a period of 1-21 days from the age of chicks, which contained 21.76% crude protein and 3000.13 kcal/kg of metabolic energy, according to the nutrition index for the Ross 308 chick. Thus, the percentage of energy to protein (C / P) was 137.87, followed by the final diet which contained 18.88% crude protein and 3120.98 kcal/kg metabolic energy, Thus, the percentage of energy to protein was 165.30, which continued up to 35 days. Table (1) shows the percentages of feed materials included in the composition of the diets with the calculated chemical composition. The birds were starved for 4 hours prior to the slaughter. six birds then took from each treatment randomly. The birds were slaughtered and submerged in the water at 54 °C for two minutes and the feathers were removed. The removal of the internal intestines was conducted in a precise anatomical manner from the beginning of the esophagus to the end of the Rectum according to the method (Fletcher, 15).

The carcasses were then cut into the main pieces (chest and thigh) according to mentioned by (Al-Fayadh et al., 5). After that, the physical separation, the removing of meat, skin, and bone were conducted for the main pieces only, which included both the chest and the thigh, each separately. The meat then was taken only and cut into small cubes for each treatment and save it in polyethylene sac at temperature -18 °C for 0 and 30 days. The amount of peroxide value (POV) and the percentage of free fatty acid (FFA) based on the method of (Egan et al., 12) and Thiobarbituric acid (TBA) according to (Balentine et al., 7). The data were analyzed using a factorial experiment, the completely randomized design (C.R.D) was applied, Duncan's New Multiple tests was conducted to compare the differences between the averages of the studied traits. The statistical program (SAS, 28) was used to analyze the data.

Table 1: Percentage of feed materials included in the composition of the diets with the calculated chemical composition.

Ingredients of the diet (%)	The initiator diet (%)	Growth diet (%)
Yellow corn	56.5	64

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Soybean Meal (1) (48%)	34	26
Concentrated Proteins (2)	5	5
Sunflower oil	2.5	3
Limestone	1	1
Calcium Diaphosphate (3)	0.5	0.5
Salt	0.3	0.3
Mixes of vitamins and minerals (4)	0.2	0.2
Total	100	100
The calculated chemical composition*		
Crude protein	21.76	18.88
metabolic Energy (kcal / kg feed)	3000.13	3120.98
C / P ration	137.87	165.30
Lysine (%)	1.24	1.04
Methionine (%)	0.49	0.45
Cysteine (%)	0.34	0.3
Methionine + Cysteine	0.83	0.75
Calcium (%)	0.77	0.75
Phosphorus (%)	0.48	0.43

1) soybeans meal contain 44% protein

2) The concentrated protein (Brocon-5 Special) produced from Al Wafi company contains 40% Crude protein, 5% crude oil, 2.26% raw fiber, 2183.70 kcal, methionine 3.70%, Lysine 3.85%, Calcium 3.53%, phosphormethane 2.65%, methionine + Cysteine 4.12%, vitamins (Vit A 200.000 IU, Vit D3 60.000 IU, Vit E 600.00 mg, VitB1 60.00mg, VitB2 140.00mg, VitB6 80.00mg, VitB12 700.00mg, VitH 2.00mg, Niacin 800.00mg, VitBc (Folic acid) 20.00mg, Vit K3 50.00mg.

(3) phosphorus 18%, Calcium 24%

(4) Premix contains vitamin and elements (VitA 1.250.000IU/kg, Vit D3 310.000IU/kg, Vit E acetate 5.000mg/kg, Vit K3 200mg/kg, VitB1 250 mg/kg, VitB2 500mg/kg, D.Pantothenic Acid 200mg/kg, VitB6 500mg/kg, VitB12 2mg/kg, Vit PP 3.500mg/kg, Folic Acid 150mg/kg, Vit H(Biotin) 2.5mg/k, Choline Chloride 40.000mg/kg.

* The calculated Chemical composition for the ingredients of the diet according to NRC (22)

3. RESULTS AND DISCUSSION

Table (1) shows that the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet of the broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens before storage and after 30 days of storage in freezing at temperature of -18 °C for the values of thiobarbituric acid test, It was observed a significant decrease ($P < 0.05$) in the values of thiobarbutyric acid (TBA) for the two periods and for all treatments (T2, T3, T4) compared to the control treatment (T1), where the values before storage amounted to (0.14, 0.16, 0.14) compared to (0.27 mg Malondialdehyde/kg Fat) and the values after 30 days of storage amounted to (1.13, 1.18, 1.14) compared to (1.86 mg Malondialdehyde/kg fat).

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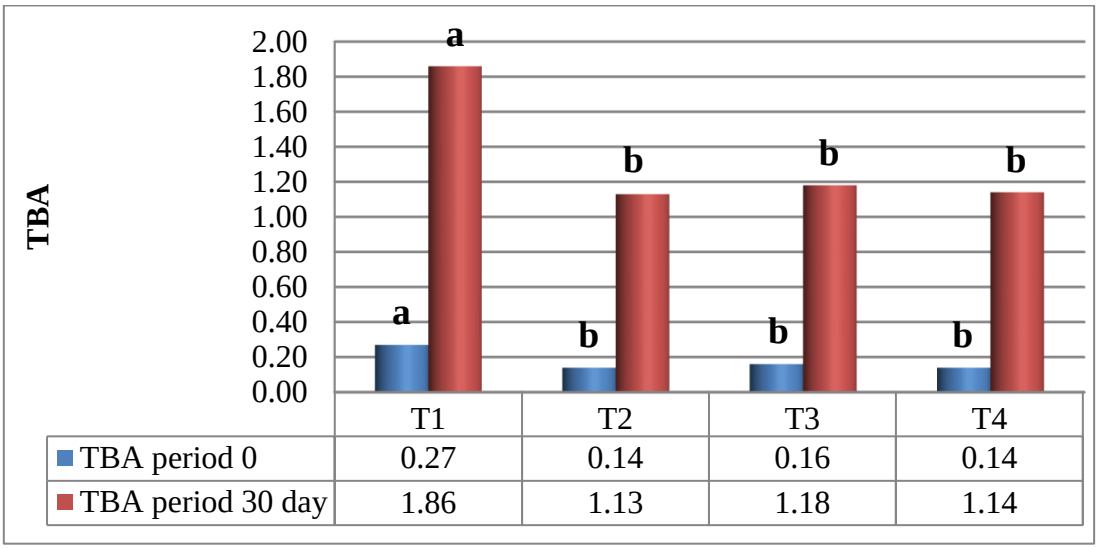


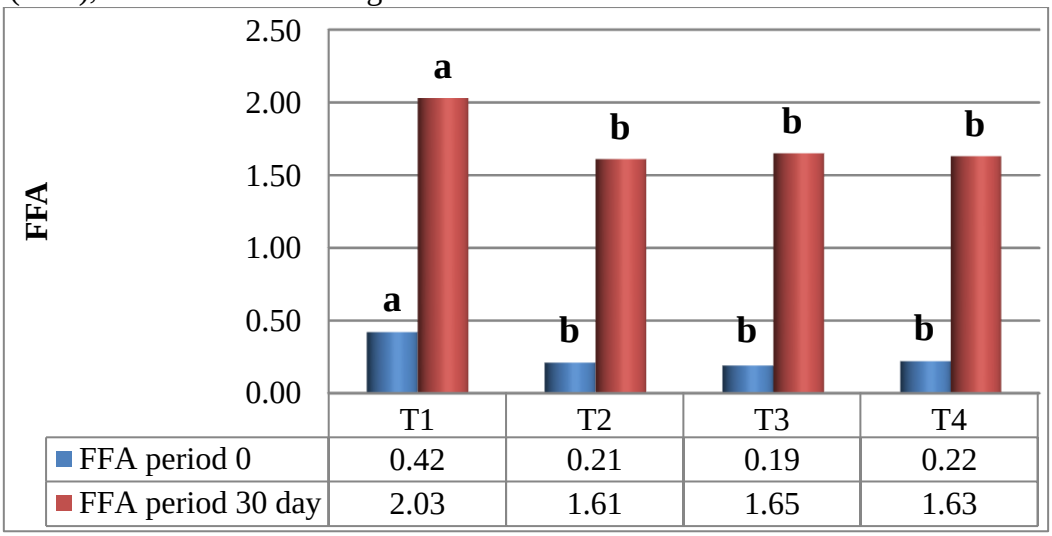
	T1	T2	T3	T4
TBA period 0	0.27	0.14	0.16	0.14
TBA period 30 day	1.86	1.13	1.18	1.14

Figure 1: Effect of adding two types of nutritional flavorings and their mixture to the diet of broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens for the values of thiobarbutyric acid at period 0 to 30 days from the storage.

The different letters within the same color mean that there are significant differences between the averages of the treatments.

First treatment (T1): Control treatment without any addition, second treatment (T2): A diet added to it (5 g.kg^{-1} feed) of cardamom powder, Third treatment (T3): A diet added to it (5 g.kg^{-1} feed) of cinnamon powder, Fourth treatment (T4): A diet added to it (2.5 g.kg^{-1} feed) of cardamom powder + 2.5 g.kg^{-1} feed of cinnamon powder.

Table (2) shows that the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet of the broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens before storage and after 30 days of storage in freezing at temperature of -18 °C for the values of free fatty acid (FFA), It was observed a significant decrease ($P < 0.05$) in the values of free fatty acid (FFA) for the two periods and for all treatments (T2, T3, T4) compared to the control treatment (T1), where the values before storage amounted to (0.21, 0.19, 0.22 %) compared to (0.42%) and the values of FFA after 30 days of storage amounted to (1.61, 1.65, 1.63 %) compared to (2.03%).



	T1	T2	T3	T4
FFA period 0	0.42	0.21	0.19	0.22
FFA period 30 day	2.03	1.61	1.65	1.63

Figure 2: Effect of adding two types of nutritional flavorings and their mixture to the diet of broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens for the values of free fatty acid (FFA) at period 0 to 30 days from the storage.

The different letters within the same color mean that there are significant differences between the averages of the treatments.

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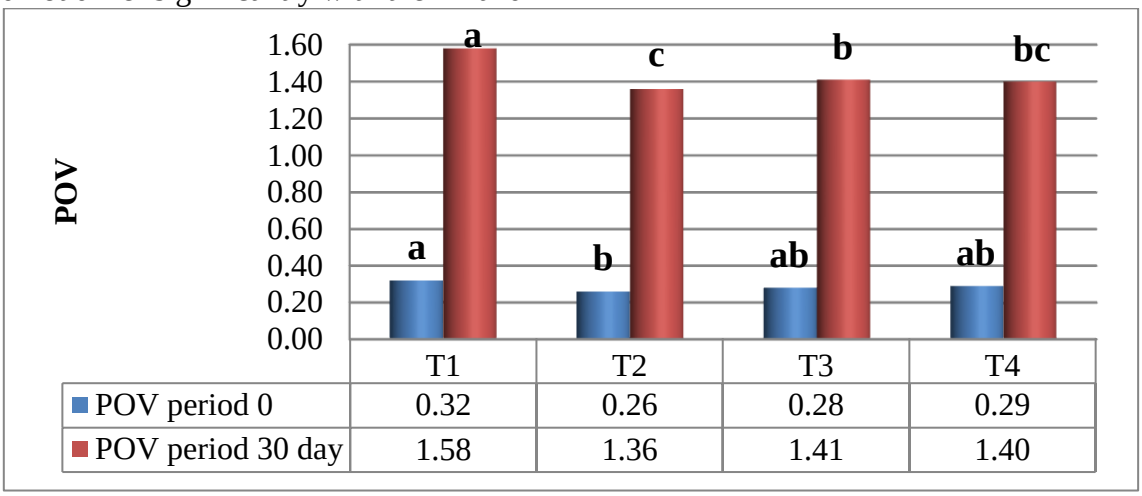
First treatment (T1): Control treatment without any addition, second treatment (T2): A diet added to it (5 g.kg^{-1} feed) of cardamom powder, Third treatment (T3): A diet added to it (5 g.kg^{-1} feed) of cinnamon powder, Fourth treatment (T4): A diet added to it (2.5 g.kg^{-1} feed) of cardamom powder + 2.5 g.kg^{-1} feed of cinnamon powder.

Table (3) shows that the effect of adding two types of nutritional flavorings (cardamom and cinnamon) and their mixture to the diet of the broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens before storage and after 30 days of storage in freezing at temperature of -18 °C for the values of peroxide (PV), It was observed a significant decrease (P <0.05) in the values of peroxide (PV) for the adding treatment (T2) compared to the control treatment (T1), where the values were (0.26 Meq/kg fat) compared to (0.32 Meq/kg fat). The two adding treatments (T3, T4) did not differ significantly with the T2 and T1 treatment, although they did not rise to the significant level compared to the control treatment T1, which gave the value for each of them (0.21, 0.29 Meq/kg fat), respectively. The value of peroxide after storage was significantly lower (P <0.05) for the adding treatment of T2 compared to the control treatment (T1) which amounted to (1.36 Meq/kg fat) compared to (1.58 Meq/kg fat) respectively, the treatment T4 did not differ from the treatment T3, where the treatments (T3, T4) have significantly excelled on the control treatment (T1) which amounted to (1.41, 1.40 Meq/kg fat) respectively.



	T1	T2	T3	T4
POV period 0	0.32	0.26	0.28	0.29
POV period 30 day	1.58	1.36	1.41	1.40

Figure 3: Effect of adding two types of nutritional flavorings and their mixture to the diet of broilers chickens in the estimation of the oxidation indicators for the fat in the carcasses of the meat of broilers chickens for the values of peroxide (PV) at period 0 to 30 days from the storage.

The different letters within the same color mean that there are significant differences between the averages of the treatments.

First treatment (T1): Control treatment without any addition, second treatment (T2): A diet added to it (5 g.kg^{-1} feed) of cardamom powder, Third treatment (T3): A diet added to it (5 g.kg^{-1} feed) of cinnamon powder, Fourth treatment (T4): A diet added to it (2.5 g.kg^{-1} feed) of cardamom powder + 2.5 g.kg^{-1} feed of cinnamon powder.

The reason for the decrease in the values of oxidation indicators in the treatments added to their diets, both cardamom and cinnamon is the presence of active compounds Thymol, Terpinen, terpinen-Y and phenolic compounds that act as antioxidants that contribute to the inhibition of fat oxidation Pino et al. (25), where they have large force in breaking and destroying the chain resulting from the reactions of oxidation because of its high ability to give the hydrogen atom for the free radicals or the fatty acid, Chrpova et al., (9) showed that the plants which have active compounds Thymol, Terpinen and Y-Terpinen have a high capacity to prevent fat oxidation compared to Sweet basil and rosemary. Velasco and Williams (31) showed that the most common phenolic compounds in cloves are Eugenol and Acetyl eugenol, which act as antioxidants, Prostos et al., (26) indicated that the most phenolic acids found in some plant extracts are Coumaric acid or Cinnamic acid, which gives the anti-oxidant effect for these extracts, where its form 54.54% of the total

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and effective compounds in the cinnamon extract (Al-Atari, 2), compared to the presence of Ascorbic acid with percentage of 3.73%. The increase in the percentage of free fatty acids in 30 days of storage is due to the presence of lipolytic enzymes, such as Phospholipase and Lipase, which works to release free fatty acids that cause the unacceptable smell for meat, which may be rejected by the consumer when increasing the storage period (1, 6). We can deduce from the results of this study that the continuation of the addition of materials such as cardamom and cinnamon to the diet of the breeder chicken contributed to reducing the development of fat rancidification deposited in the carcass and this may indicate the low deposition of unsaturated fatty acids, namely Linolenic acid and Linoleic acid, which is characterized by more rapid response to rancidification compared to saturated fatty acids, this result agrees with (Pacheco-Aguilar et al., 24) who showed that the occurring of a significant decrease in the indicators of oxidation is the reason for the decrease in the percentage of unsaturated fatty acids at the expense of saturated fatty acids .

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