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PREPARATION OF COMPOUND FILMS FROM PROTEIN HYDROLYSATES OF BUFFALO SKIN AND PLANT EXTRACTS AND STUDY ITS PROPERTIES AND THEIR USE IN COAT MEAT CHICKEN

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Abstract

This study included preparation of a protein hydrolysate from buffalo skin in an acidic way, and a study the chemical content of the skin and an acidic protein hydrolysate moisture 67.24%, 9.81%, protein 29.52%, 83.85%, fat 1.86%, 2.82%, and ash 0.85%, 3.12% For both the skin and the acidic protein hydrolysate, respectively. Protein hydrolysate a rate of 4% and 40% of glycerol used in the preparation of a simple films and its detention and mechanical properties were studied. Then, the compound films with extracts of ginger, thyme and cloves were prepared at a concentration of 0.3%. The results showed that their values decrease in permeability, solubility, tensile strength and elongation in compound films with simple films. Simple and compound films prepared were used in coated chicken breast slices and refrigerated at (5 ± 1)C for 10 days during which some specific characteristics of the coated slices were studied and compared with uncoated slats.

***Keywords* :** Plant extracts; buffalo skin; protein hydrolysates.

Introduction

Protein hydrolysates are peptide chains of various lengths and various amino acids resulting from hydrolysis of proteins by acids, bases and enzymes. Protein hydrolysate products have been used in many fields, especially nutrition, as well as some of the decomposition products have vital efficacy as antimicrobial and antioxidant (Harris *et al*., 2009 and Zhao *et al*., 2011). Degradation of proteins by acids or enzymes results in a number of products that end with amino acids, starting with the production of protein and then di peptide and ending with free amino acids (Manninem, 2009 and Herpandi *et al*., 2011), films are defined as the thin layers surrounding the food and can Consuming it with the food material, it works to extend the storage period of the food product by improving the detention properties of water and oxygen vapor or the transfer of the hydrolysis substance, increasing thermodynamic and reducing enzymatic reactions and pregnancy and microbial count (Falguera *et al*., 2011). The films were classified as oily films, as these films were characterized by their good detention properties of water vapor as a result of their anti-hydrophobic nature and their crystalline structure that acts as a barrier to moisture as well as they gain the appearance and luster of the product, but fish and fragility are accustomed to it, so some other materials must be added to improve its mechanical properties, especially proteins or derivatives. Cellulose (Cutter and Sumner, 2002) and glucose films, as Taylor (2005) indicated that glucose films have characteristics that make them suitable for preserving frozen foods that include meat, poultry, fish, and seafood. protein films, edible protein films have received great attention in recent years due to their nutritional and health benefits, abundance and renewable nature, as they can be used to package small portions of food or as carriers of antioxidants and as well as the possibility of using them in the packaging of multi-layered foodstuffs, as these are films are in direct contact with the foodstuff, followed by the other inedible layers. Many protein substances were used in preparing the edible films that were used in the packaging of food products, especially meat. Collagen is a fibrous protein with great interest in the production of edible films, as it possesses distinct properties that made it the most successful in preparing edible films, including biocompatibility with the biological material, non-toxic, and possessing appropriate physical and chemical properties as well as the ability to extract and purify it in large quantities (Wittaya, 2012), As Quiros–Sauceda *et al*. (2014) mentioned, the bioactive compounds are added to the films either on the surface layer of the films or the addition of the active substance in the bottom layer of the films or it may be in contact with the food material and the addition may be through two layers or through multiple layers of the films as the layers containing the bioactive compounds are not in contact with the material Food. The aim of this Study was prepared protein hydrolysate from buffalo skin and use it in preparing compound films by adding plant extracts, and study their reservation and mechanical properties, and test the efficiency of these films to maintain the qualitative characteristics of chicken breast slices.

Materials and Methods

Raw Materials

The buffalo skin was obtained from the massacre of Maysan Governorate, it was cleaned, washed and cut into small pieces ranging from 2-3 cm and kept freezing until use.

Plants used in the Study

Samples of plants were purchased from the local markets in Basra and included thyme, ginger, and cloves. It was ground with softly by electric grinder and sieved well, then placed in polyethylene bags and kept in the refrigerator (5 ± 1) c until use (Table 1).

Part used	Scientific name	Plant
Rayesomate	*Zingiber officinale*	Ginger
Seeds	*Thyme vulgaris*	Thyme
Fruits	*Eugenia caryophyllata*	Clove

Chicken Breast Meat : The meat was cut into strips with a thickness of 2 cm and a length of 4 cm. It was wrapped with prepared films and stored in refrigeration for 10 days, during which it studied some of its quality characteristics. which included peroxide number, thiobarbituric acid, and of free fatty acids, the percentage of lost moisture and the percentage of fat after frying and the cooking yield .

Chemical content

The chemical content of buffalo skin and the hydrolysate prepared in an acidic method was studied which included moisture, fat and ash according to the AOAC (1995). Protein according to the Egan *et al.* (1988).

Preparation of Protein Hydrolysate

Acidic hydrolysate was prepared by using citric acid according to the method of Niu *et al.* (2013) and Ktari *et al.* (2014).

Detention and mechanical characteristics

Measurement of Films thickness:

The thickness of the prepared films was measured in different proportions of the protein hydrolysate and plasticizer using a manual measuring tool with a sensitivity of closer to 0.01 mm. The measurements were taken by testing five random locations for each films from the circumference to the films center and then calculating the five films average readings (Bourtoom, 2008).

Estimation permeability of films of water vapor

The films permeability of water vapor (WVP) was estimated according to the method Oh (2012).

Tensile strength and elongation till the cutting edge

Tensile strength and Elongation percentage were measured According to the method described by Kaya and Kaya (2000) and Tanaka *et al.* (2001).

Estimation of the solubility of films in water

The solubility of films in water was estimated according to the method used by Zahedi *el al.* (2011).

Light transmittance

The light transmittance was estimated by dissolving the films in 0.5 M of acetic acid at a concentration of 2 mg / ml. Absorbance was measured by the ultraviolet device of the Polymer Research Center - University of Basra at a wavelength of 200-500 nm at a scan rate of 210 nm, according to the method described by Yan *et al.* (2008).

Peroxide Number Value (P.V.)

Peroxide number was estimated before and during storage periods according to Egan *et al.* (1988).

Thiobarbituric acid

Method mentioned in Pearsson (1970) was used in estimation of thiobarbituric acid .

Free fatty acids

Acid value was calculated from which the percentage of free fatty acids was calculated according to the method mentioned in Al-Ta'i and Al-Mousawi (1992).

Lost moisture ratio

Al-Rmedh (2014) method was followed to estimate the percentage of moisture in chicken meat parts and fish fillets after frying.

Estimating of Fat Percentage

The percentage of fat in chicken pieces and pieces of wrapped and uncoated fish after frying was estimated according to the method.

Percentage of cooking yield

The yield was calculated by weighing the wrapped and uncoated chicken and fish pieces after frying, and the yield was determined according to the Mukprasirt *et al.* (2000) method.

Results and Discussion

Chemical content of buffalo skin and acidic protein hydrolysate

The results in Table (1) show the chemical content of buffalo skin and acid decomposing that included moisture, protein, fat and ash, as they reached 67.24%, 29.52%, 1.86%, and 0.85%, respectively. These results converged with what Mulyani *et al.* (2017) found. When they studied the chemical content of buffalo skin, as the moisture content was 68.62%, protein content was 30.22%, and ash content was 0.72%, based on the wet weight. As for the chemical content of the acid protease decomposition, it amounted to 9.81%, 83.85%, 2.82% and 3.12% for moisture, protein, fat and ash, respectively.

Table 1 : Chemical content of buffalo skin and acid decomposing

Chemical content%				
Ash	**Fat**	**Protein**	**Moisture**	
0.85	1.86	29.52	67.24	Buffalo skin
3.12	2.82	83.85	9.81	Hydrolysis acid

The thickness of films

Table (2) indicates the thickness of the films prepared from protein hydrolysate by 4% and plasticized by 40% with the addition of plant extracts. It was noted that the thickness of the compound films increased to 0.25, 0.21 and 0.26 mm for the compound films prepared by adding ginger, thyme and clove extracts, respectively, compared which simple films (0.037), and the reason for this may be attributed to the concentration of the added extract, as the increase in concentration and solid materials leads to an increase in the thickness of the films (Dashipour *et al.*, 2014).

Table 2 : Thickness of compound films with added plant extracts

Thickness of compound films	Glycerol %	Hydrolysate %	Films type
0.25	40	4	Compound with ginger
0.21	40	4	Compound with thyme
0.26	40	4	Compound with clove
0.037	40	4	Simple film

Detention Properties of Films

Solubility of films

The results in Figure 1, showed that the solubility of the compound films decreased compared to the simple films (38.14%), as the ratio of the melting of the compound films by adding ginger extract decreased to 30.72%, the prepared films by adding clove extract to 27.6%, and the films prepared by adding thyme extract, solubility reached 29.2% , The reason for the decrease in the solubility of the films may be attributed to the increase in the density of the hydrolysis in the films, and consequently the movement of the molecules, leading to a decrease in the solubility of the films.

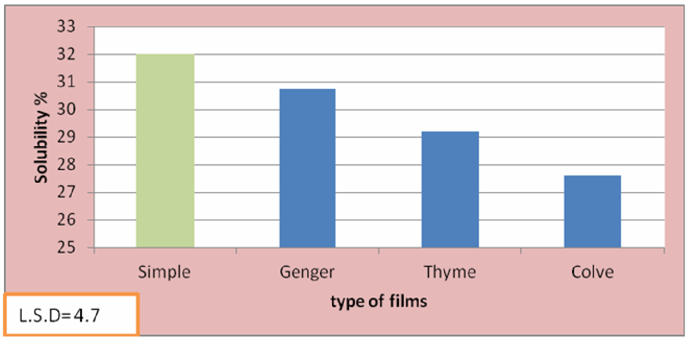

Fig. 1 : Solubility of simple and compound films with added plant extracts

Films Permeability of Water Vapor

Figure (2) showed a decrease in the permeability values of the compound films of water vapor, as it reached 8.15%, 7.2% and 5.4% g. Mm/m^2. Hour. KPa for films with extracts of ginger, thyme and clove, respectively, compared to the simple films (9.15) and The results of the statistical analysis showed the presence of significant differences for the permeability of the compound films for which plant extracts were added at the probability level P <0.05). The reason for the decrease may be attributed to the interaction between the extract and films components, which led to an increase in the hydrophobic nature of the films, thus decreasing the hydroxyl (OH) groups that interact with water molecules and thereby reducing the susceptibility of water-soluble films (Shojaee-Aliabadi *et al*., 2013).

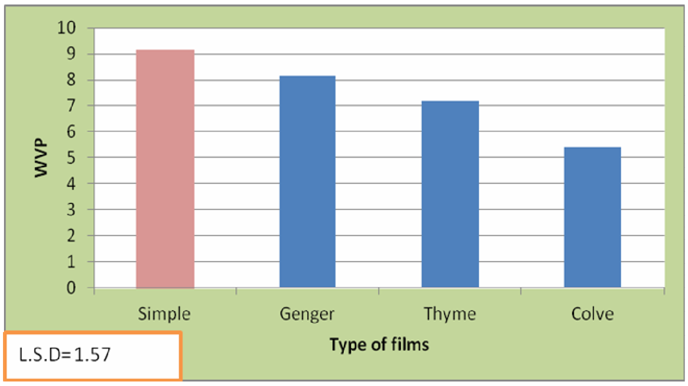

Fig. 2 : Permeability values 0f simple and compound films with added plant extracts

Mechanical Properties

Tensile strength

Figure 3 showed the tensile strength of compound films compared to simple ones (28.8) MPa. The highest tensile strength value when adding an extract of ginger was 26.8 MPa and the lowest tensile value was at the extract of thyme and cloves, reaching 26.1 MPa and 26.5 MPa, respectively. The tension when adding the cholesterol to the prepared gelatin films decreases due to the decrease in the hydrogen bonds and the transverse bonds between the gelatin molecules, as the interaction of the beta-gelatin peptides occurs and the OH group in the glycerol that leads to a weak network structure of the gelatin films.

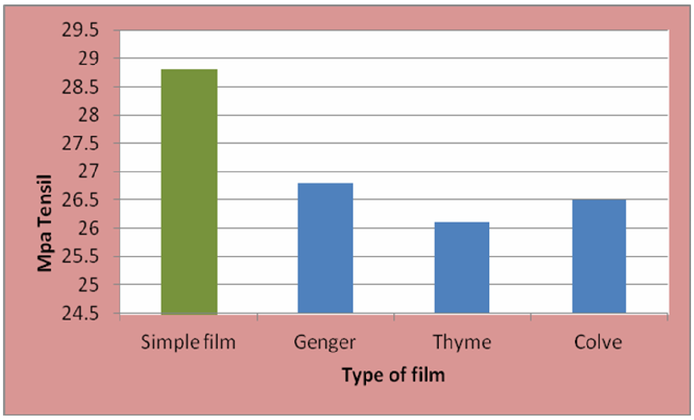

Fig. 3 : Tensile strength of simple and compound films to which plant extracts added

Elongation percentage

Figure 4 showed slight decrease in the elongation rates with simple films (18.1%), as it decreased in the compound films with the ginger extract reached 17.88%, then the thyme and clove films were 18% and 17.9%, respectively. The reason for this is due to the presence of the extract in the compound films, as it works to reduce the elasticity and consistency of the films, as well as its penetration of the polymer, causing the breakdown of hydrogen bonds between the polymer chains, which leads to increased molecular freedom of movement for these chains, especially as they suffer from a lack of synthetic cohesion (Dashipour *et al.,* 2014).

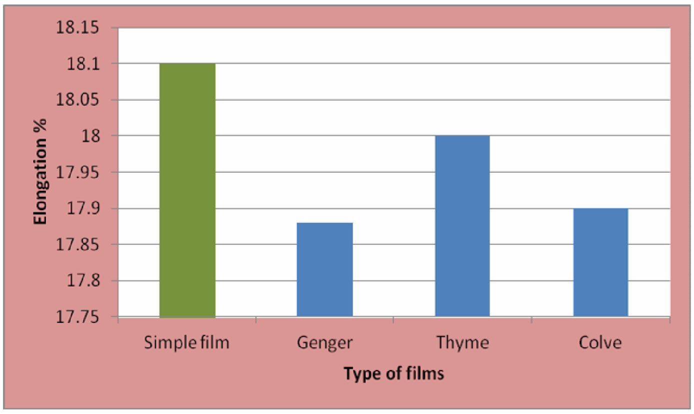

Fig. 4 : Percentage of elongation of simple and compound films with plant extracts

The Permeability of Compound Films for Light

Figure (5) showed the light transmittance of the compound films to which the extracts of ginger, thyme and cloves are added, as it was observed that the greatest absorption region appeared within the wavelength range of 390 nanometers and thus began to decrease at the higher wavelengths as the absorbance decreased with increasing wavelength. Limpan *et al.* (2010) indicated Protein films with a high content of cyclic amino acids are characterized by their ability to penetrate the visible spectrum, as the results showed that there is very little light absorption in the visible spectrum region at wavelengths between 400-600 nm for all films as the films block permeability As light by food and thus preventing fat oxidation by blocking it to ultraviolet radiation, which is the main cause of oxidation of fats, which may lead to color changes or formation of off flavors as well loss in nutritional value (Orliac *et al*., 2003 and Limpan, 2009).

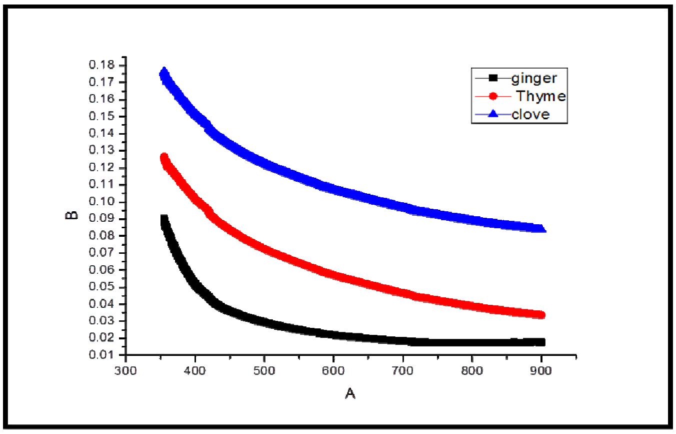

Fig. 5 : A profile of the permeability of the compound films for light

Quality Properties

Peroxide Value (P V)

The results in Figure (6) indicate the values of peroxide for uncoated and coated pieces of chicken breast with simple and compound protein films and stored in refrigeration for 10 days. It is noted from the results that peroxide values decrease in models coated with simple films and compound films compared to the control treatment, and the of statistical analysis results showed peroxide values decreased significantly (P <0.05) in chicken breast pieces coated with compound films compared to coated with simple films and control. The lowest values were for the coated films sample prepared and ginger. Coated films with thyme extract have extracts and then coated films with added films with clove extract. This may be due to the presence of effective compounds in these extracts, the variation of their types, their concentrations and their anti-oxidant effectiveness. The results of the statistical analysis that the duration of cryopreservation significantly affected (P <0.05) on the peroxide values in all coated and uncoated samples, the peroxide values increased with the advance of the storage period, in the control treatment the peroxide values increased from 0.35 to 2.92 after 10 days of the storage.

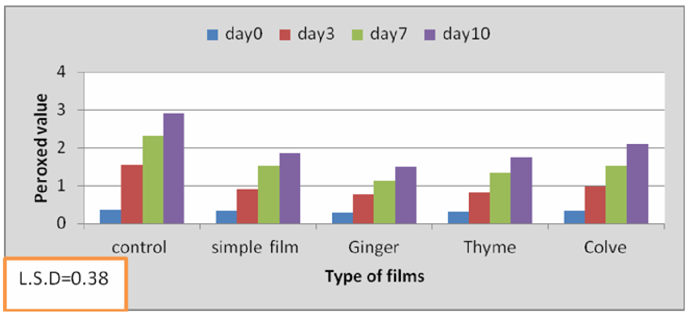

Fig. 6 : Peroxide values for chicken breast pieces uncoated and coated with simple, compound films.

The reason of this may be due to the chicken meat content of the fat and the type of fatty acids in it. As for the reason for the rise in the peroxide values due to the advance of the storage period in all coated and uncoated samples, it is due to the oxidation of fats and thus peroxide is formed that increases during the storage period but the covers with which the extracts were added have lower values in Peroxide, as it contains compounds that have inhibitory activity to form peroxides, and results also agreed with Al-Ghazzi (2019) who observed high peroxide values in meat during the storage period.

Thiobarbituric Acid (TBA)

The results in Figure (7) showed the values of TBA for chicken breast uncoated and coated with simple protein films and compound films stored in refrigeration for 10 days, as the results of the statistical analysis showed a significant decrease of P <0.05) in the TBA values for samples coated with simple films and compound films compared to the control treatment TBA values decreased in simple films and compound films for which plant extracts were added, and this decrease was in all coated sample compared to the control, but this decrease varies according to the type of added extract, as the lowest TBA values were in samples covered with added films. It has ginger extract, thyme, and finally clove. The reason for this difference in acid values when adding plant extracts to films is the difference in their content of phenolic compounds with antioxidant effectiveness. The results of the statistical analysis also showed a significant effect during the storage period at the level (P <0.05) on the peroxide values and for all samples in chicken pieces coated with simple and compound films also increased and for all extracts.

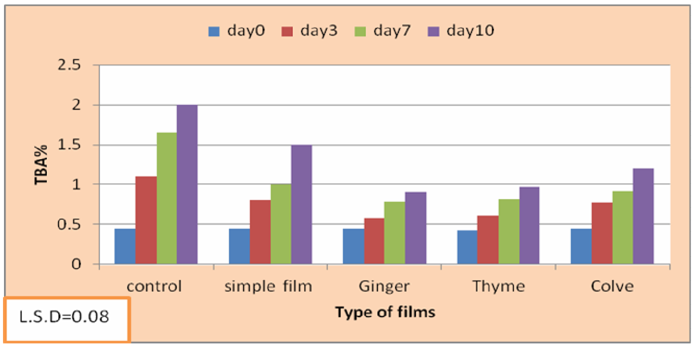

Fig. 7 : TBA values for chicken meat coated with simple, compound films and uncoated

The results of the statistical analysis also showed that the values of TBA increased significantly (P <0.05) during the storage period. The increase was more evident in the control treatment, as it increased from 0.45 mg MAL/ kg to 2.0 MAL/kg in the end of the 10 days in refrigeration storage period, where samples coated with simple and compound films, the values in them increased, but the rise was lower compared to the control treatment, as the lowest values were in chicken pieces coated with films with added ginger extract, as after 10 days passed it reached 0.91 which is much less than the control treatment, followed by thyme extract 0.97 then the clove extract 1.2 mg Hand / kg respectively, and is due to rise in the values increase for TBA storage to fat oxidation during storage, resulting in peroxides and aldehydes and ketones.

Free Fatty Acids (FFA)

The results in Figure (8) indicate the ratio of free fatty acids of uncoated, coated pieces of chicken breast with simple and compound protein films stored in refrigeration for a period of 10 days. The lowest values of fatty acids were for samples coated with films with added ginger extract, as the decrease was clear in the ratio of free fatty acids followed by thyme and then cloves. The reason of the difference in free fatty acids was attributed free of pieces coated with films is the result of different additive extracts and their active compounds such as phenolic compounds and flavonoids and ascorbic acid and their effect as inhibitors for the work of fat-analyzing bacteria. The ratio of compounds was high in the extract of ginger and thyme, which has a clear impact on reducing the FFA ratio through its effect on limiting the growth of bacteria that secrete lipase enzyme that works to cause analytic rancidity.

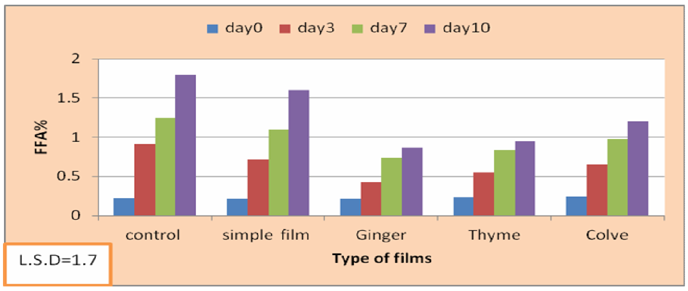

Fig. 8 : FFA ratio of uncoated, and coated chicken breast pieces with simple,and compound films

The results of the statistical analysis also showed that the storage period had a significant effect (P <0.05) on the value of free fatty acids, as it increased with the progress of the refrigerating storage period, so the ratio of free fatty acids increased by the advance of the storage period for all uncoated and coated chicken parts with simple and compound films as they increased in non-coated samples 0.22% before storage to 0.91%, 1.25% and 1.8% after the passage of 3, 7 and 10 days, respectively, and the increase in the ratio of free fatty acids in all samples stored in refrigeration may be due to the increase in the storage period due to the activity of the lipase enzyme, which works to analyze Or tear down the triglycerides as fatty acids Free products are considered to processes hydrolysis of fats by enzyme reaction and Allaypez bacteria analyst fat I agreed with what they found Baker *et al.*, (2013) when adding ginger and rosemary extract to the meat, as they noticed that the ratio of free fatty acids increased gradually throughout the storage period for all the samples to which the extracts were added, but the height was less compared to the control treatment.

The percentage of moisture lost

Figure (9) shows the percentage of moisture lost for the uncoated chicken breasts and samples coated with simple and compound protein films and stored in refrigeration for 10 days, as significant differences (P <0.05) were observed in the chicken breast pieces coated with compound films compared to the simple films and control coefficient, as The percentage of moisture lost in chicken breast coated with simple and compound films decreased compared to the uncoated pieces.

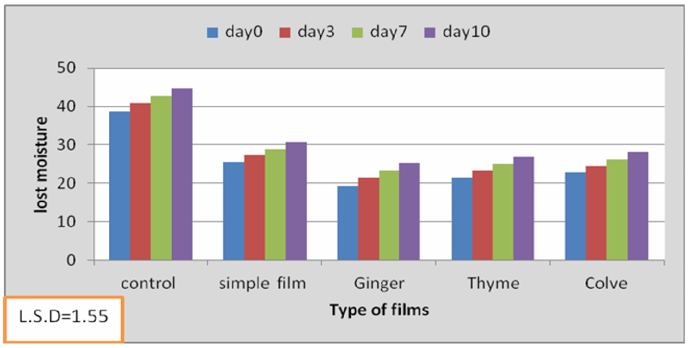

Fig. 9 : The percentage of lost moisture of chicken breast pieces coated with simple and compound films.

It also increased with the advance of the period of storing fish amounted to non-coated samples, from 38.78% before storage to 44.7% at the end of the storage period. As for the samples coated with simple films, it continued to rise sample 25.6% to 27.2% after 3 days and reached 28.8% and 30.7% after the passage of 7. And 10 days in a row and in samples coated with films added to them ginger increased from 19.2% to 25.21% after the passing of 10 days. As for the increase in samples coated with films added with clove extract, it increased from 22.8 before storage to 28.1% at the end of the storage period.

The percentage of fat after frying

The results in Figure (10) indicate the percentage of fat after frying in pieces of coated and uncoated fried chicken breast with simple and compound protein films and stored in refrigeration for 10 days, as the results of the statistical analysis showed that the percentage of fat after frying decreased significantly (P <0.05) in pieces chicken breast coated with compound films compared to simple films and control treatment. The lowest fat percentage for chicken parts coated with compound films which added to ginger extract, as it reached 3.51%, followed by samples coated with thyme extract as it reached 3.55% and then clove extract reached 3.62% either in together A control ratio of fat after frying high was reached 7.1%. The reason for this may be due to the presence of the films, which reduces the absorption of fat in fried food and the formation of a solid shell that imposes a loss of nutrients. The results of the statistical analysis showed that the storage period had a significant effect (P <0.05) on the percentage of fat after frying in all coated and uncoated samples. High percentage of fat percentage after frying with the advance of the Storage period.

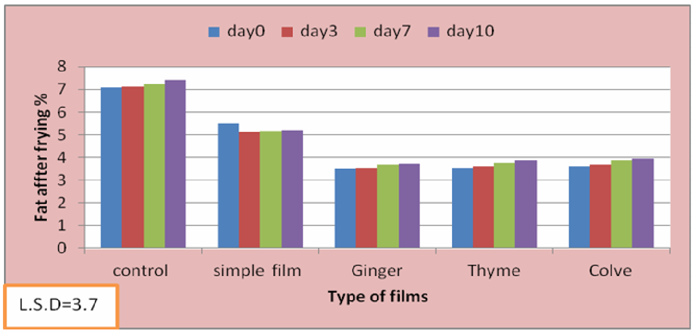

Fig. 10 : The percentage of fat after frying of chicken breast pieces coated with simple and compound films.

Cooking Yield

The results in Figure (11) indicate the percentage of the cooking yield for the uncoated chicken breast pieces coated with simple protein films and compound films stored in refrigeration for 10 days, as the results of the statistical analysis showed a significant increase (P <0.05) for the percentage of the cooking yield for the chicken breast cut with compound films compared to simple films and control treatment, the percentage of cooking yield in chicken pieces decreased significantly (P <0.05) during storage period. In the control treatment, it decreased from 59.6% before storage and continued to decrease, reaching 51.8% after 10 days, as it decreased in models The envelope with simple films, from 66.2% to 64.1%, then to 61.5%, and finally, it reached 58.3% after the passage of 3, 7 and 10 days after storage, while for coated films, the decrease was less than 78.6% before storage to 69.1% after 10 days in The films added to it with ginger extract. As for thyme extract, the decrease was from 77.2%

to 67.7%. In the clove extract, it decreased from 75.8% before storage and continued to 64.3% at the end of the storage period. The decrease in the percentage of the cooking quotient with the advance of the storage period may be attributed to the increase in the loss of moisture and fat during cooking that causes only weight, which is reflected in the percentage of the cooking yield.

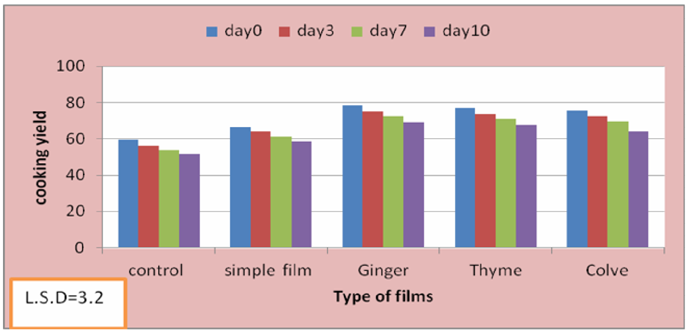

Fig. 11 : The percentage of cooking yield of chicken breast pieces coated with simple and compound films.

These results were in agreement with Al-Athari (2017), as they observed that the percentage of cooking yield decreased significantly in meat patties treated with extracts compared to the control treatment. These results were also consistent with what Ibrahim *et al.* (2018) found when studying the addition of lemon and orange peel extracts to meat pies, as they observed a gradual decrease in the cooking quotient with the advance of the storage period and the control treatment was more lower compared to the samples treated with the extracts.

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