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EFFECT OF DIFFERENT CONCENTRATION OF POMEGRANATE PEEL AND SEED EXTRACT ON SOME CHEMICAL, PHYSICAL TRAITS AND SENSORY EVALUATION OF KARADY SHEEP MEAT DURING DIFFERENT FROZEN STORAGE

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Received: 18 December 2019; **Accepted:** 9 January 2020

ABSTRACT

The experiment carried out to examine the effect of pomegranate peel extract (PPE) and pomegranate seed extract (PSE) on some proximate chemical composition (Moisture, Protein, Fat, and Ash), chemical traits (pH value, Thiobarbioteric acid and Free Fate acids), Physical traits (Water holding capacity and pH) and sensory evaluation of karady meat during frozen storage period (0, 30, 60 and 90) days at -18°C. Meat pieces (Freshly Longissimus dorsi (LD) muscle) were divided into nine treatments: T1consider as control (not immersed with PSE or PPE), T2 (immersed with 0.3% PSE), T3 (0.6% PSE), T4 (0.9% PSE), T5 (1.2%PSE), T6 (0.3% PPE), T7 (0.6% PPE), T8 (0.9% PPE) and T9 (1.2%PPE). Meat samples were dipped with PSE and PPE for 24 hours, then stored under frozen condition (-18°C) for (0, 30, 60 and 90) days. Results indicated that PSE lead to a significant increase of Protein, Fat, Ash, pH, and over all acceptability also PSE lead to a significant decrease of (Moisture, and TBA). On the other hand, PPE lead to Significant increase of (Fat, Ash, TBA, FFA, WHC, and over all acceptability). PPE lead to a significant decrease of (Moisture, Protein, pH and Juiciness). The karadi sheep meat exhibited higher ($P < 0.05$) Flavor and aroma, Tenderness and Juiciness in meat of T4 (PSE 0.9%) compared with T1. and recorded higher Color and over all acceptability at T3 (PSE 0.6%) compared withT1. different freezing storage (0, 30, 60 and 90) days showed higher percentage of (Protein, Fat, Ash, FFA and pH).

Keywords: Pomegranate Seed, Pomegranate peel, Chemical composition, chemical traits, Physical traits and sensory evaluation.

INTRODUCTION

Meat and meat products provide the majority of the nutrients required for human health. Meat is recognized as a significant source of high biological value protein and micronutrients (including for example vitamins B6, B12, E and iron) and certain minerals which are essential for growth and health of human (Williamson *et al.,* 2005). Sheep meat proves to be an excellent source of high biological value protein, vitamins B-complex, minerals such as iron, copper, zinc and phosphorus, also a source of a long chane omega-3 polyunsaturated fatty acids, which are needed for good health throughout life (Lawire, 2002).

Numerous food products require protection against microbial spoilage during their shelf life. The growing demand of consumers for safe and natural products has resulted in thorough investigations from food authorities and researchers to assess the feasibility of mild preservation techniques and to improve the microbial quality and safety of products, with maintaining their good nutritional and organoleptic properties (Burt, 2004). The use of synthetic antioxidants in food has been decreased due to their suspected action as promoters of carcinogenesis, as well for the general consumer rejection of synthetic food additives (Namiki, 1990). In the recent years, there has been a huge demand for natural antioxidants mainly because of adverse toxicological reports on many synthetic compounds. These natural antioxidants have been extracted from different plant parts like Leaves, roots, stems, fruits, seeds and bark. The application of plant extracts as antioxidants have been studied extensively in different types of meat and meat products. These studies show promising results regarding the use of plant extracts as antioxidants in meat (Shah *et al.,* 2014). The pomegranate is one of the important dietary sources of antioxidant phenolics (Ozgen *et al.,* 2008). Pomegranate peel is recognized for antimicrobial activity (Braga *et al.,* 2005), anticancer property (Jeune *et al.,* 2005.), antiatherosclerotic and antioxidative capacities (Tzulker *et al.,* 2007). Pomegranate (Punica granatum L.) is better known in some countries as the fruit of Eden (Al-Quran) for its pleasant taste and excellent health benefiting

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properties. Therefore, in the view of the above considerations, the present study designed to investigate the effect of different concentrations of pomegranates peels and seeds extract and different freezing storage periods on some physiochemical and sensory properties changes on Longissimus dorsi muscle (LD) in karadi sheep during frozen storage at -18°C for (0, 30, 60, 90) days.

MATERIALS AND METHODS

1- Preparation of samples

Longissimus dorsi muscle (LD) w separated from male karadi sheep carcasses which slaughtered at about 12-14 months age, and storage at 4°C for 24 hour. Shelf connective tissues and external fat removed from LD, then the (LD) muscle were slit into approximately 3×3cm slices.

2- Expermintal treatments:

Freshly harvested, ripened and mature pomegranate fruits local species (Sallaxhani) were purchased from Sazan village near Hallabja, Iraq (Season October 2018). The pomegranate transported to higher education laboratory, department of Animal science, college of Agriculture engineering science- University of Sulaimania. Were the present experiment was carried out.

3- Preparation of pomegranate Peel powder:

Pomegranate fruits were washed by distilled water then cut manually to separate the arils and peel and their edible portions were carefully separated, the pomegranate peel was cut to small pieces about 2× 2cm by using a sharp Knife and washed by distilled water then dried in air, after 24h the peels dried in a ventilated oven at 40°C for 48h. Dried pieces were powdered in heavy duty kitchen grinder and ground to a fine powder and passed through a 24 mesh sieve and stored in refrigerator at 4°C.

4- Preparation of pomegranate seed powder:

Pomegranate seed were washed by distilled water then the pomegranate arils shall be pressed manually to extract pomegranate juice. The seed crust was removed by hand carefully so as not cause harm or broken the pomegranate seeds, then the seeds was washed by distilled water and dried in air after 24h the seeds dried in a ventilated oven at 40°C for 48h. Dried seeds were powdered in heavy duty kitchen grinder and grounded to a fine powder and passed through a 24 mesh sieve and stored in refrigerator at 4°C.

5- Preparation of Pomegranate peels and seed extraction:

150g powdered sample of Pomegranate peel and seed were extracted with 3liter of distilled Water the mixture was keep it on magnetic stirrer at room temperature for 48h, and then filtered through cheese cloth to removal of peel particles. The combined filtrate was concentrated in a ventilated oven at 40°C for 48h. The extract was dried and stored in refrigerator at 4°C until use meat pieces (Freshly Longissimus dorsi (LD) muscle) were divided to nine treatments: T1consedred as control (not immersed with PSE or PPE), T2 (immersed with 0.3% PSE), T3(immersed with 0.6% PSE), T4 (immersed with 0.9% PSE), T5 (immersed with 1.2%PSE), T6 (immersed with 0.3% PPE), T7 (immersed with 0.6% PPE), T8 (immersed with 0.9% PPE) and T9 (immersed with 1.2%PPE). All treated sample was stored in freezing storage at -18 cº for (0, 30, 60 and 90) day.

6- Analyses and measurement

6-1- Proximate chemical composition

6-1-1- Moisture percentage

Moisture content was determined according to AOAC (2000) by drying 5gm of meat in oven at 105°C until constant weight obtained, then the weight differences was calculated and moisture percent was determined.

6-1-2- Protein percentage

Total Nitrogen is measured according to the standard AOAC (2000) procedures by using (micro- kjeldahl) procedure and conversion factor of 6.25 to extract protein percent in meat sample used.

6-1-3-Fat Percentage

The percentage of fat in muscle (LD) is measured by using Soxhlet extraction units where hexane is used as a solvent according to a AOAC (2000) procedures.

6-1-4- Ash percentage

Procedures of AOAC (2000) were used for Ash determination. 5gm of meat was put in silica dish then transferred to a muffle furnace maintained at 525°C for 16-18hr till grey ash was obtained then left to be cooled, then it weighed and Ash percent was calculated according to:

$$\text{Ash\%}=\frac{\text{Ashweight}}{\text{Sampleweightbeforeashing}}\times 100$$

6-2- Chemical traits

6-2-1-Thiobarbuteric acid

Determine of TBA was measured according to the method described by Witte *et al.* (1970). 20g of minced meat were blended with 50 ml of cold solution containing 20% (Trichloroacetic acids (TCA) in 2ml Phosphoric acid) the resulting slurry was then transferred in to a 100 ml with distilled water, the homogenized by Shaking and filtered through Whatman no. 1 filter paper. (5ml) of filtrate solution was pipette into test tube and added 5ml of fresh chilled Thiobarbituric acid (0.005M in distilled water). The test tube was shaken well and placed in the dark room at temperature (25℃) for 15-17hr for change the color of solution and developing the

reaction color. Spectrophotometer (Shimdzu, Japan) was used and the absorbance was read at 530nm to calculate the TBA value. The TBA value was expressed as mg MDA/ Kg meat, which it was calculated by multiplying the absorbance by 5.2 factors as following:
TBA (mg MDA/ Kg meat) = A× 5.2

6-2-2- Free fatty acid:
Free fatty acids (FFA) were determined according to the method described by Egan *et al.* (1981). Ten gram of meat was dissolved in the neutral solvent chloroform and filtered through whatman No.1 filter paper. The filtered was titrated with 0.1N of sodium hydroxide (NaoH), with shaking constantly until a pink color appeared. The FFA was calculated as follows:

$$\text{FFA\%} = \frac{0.282\ x ml NAOH\ (0.1N)}{Weight of Sample\ (g)} \text{ x } 100.$$

6-3- Physical test
6-3-1- Water holding capacity:
According to Wardlaw *et al.* (1973) procedure water holding capacity was determined for meat sample. Twenty gram of minced meat was mixed with 30ml of Nacl (0.6M) in centrifuge tube and mixed for 1min. the sample was placed into refrigerator at 5°c for 15 min. then centrifuged at (4°C) for 5000rpm for 25min. the supernatant was decanted and measured. WHC was reported as ml of 0.6M Nacl per 100g of muscle as following:

$$\text{WHC\%} = \frac{\text{Initial Solutionwieght} - \text{final Solutionweight}}{\text{sampleweight (g)}} \times 100.$$

6-3-2- pH Value Determination
pH value of meat was determinate according to the determination method described by Ibrahim *et al.* (2011). 10g of meat sample was homogenized in 100ml of distilled water for 1 min in a blender and the pH was measured using a digital pH- meter (WTW. Multi 350i, India).

6-4- Sensory Evaluation
Sensory evaluation of samples was carried out by nine member panels from Animal sciences dept of agriculture engineering sciences / University of Sulaimani. And all were experienced in sensory evaluation of meat and meat production. Panelist members were using quantitative descriptive analysis methods for different attributes color, flavor and aroma, tenderness, juiciness and over all acceptability with five point scales ranging between 1 and 5. The description of sensory properties and how to rate a sample for the particular sensory property were on the evaluation form. The sample were dry cooked in an oven at 165°C for 10min until reaching the internal temperature of 70°C then cooled to 60°c prior to test. (Murphy and Zerby, 2004). Approximately a (20gm) of meat sample were served on plates to panelists and a glass of water at room temperature was provided to each assessor between samples. The panel scores were as (Table 1).

Statistical analysis
Statistical Package for the Social Science (SPSS, 2018) was used for all data in this experiment were analyzed to Evaluate the effect of two different factor (Treatment and period) by factorial analysis in a Completely Randomized Design (CRD). Duncan (1955) multiple range tests were used to detect a significant difference among means for each factors without interaction between the factors. Assuming the following statistical model:

1- Effect of treatment in study parameters:
$yij = \mu + Ti + eij$

2- Effect of period in study parameters:
$yij = \mu + pi + eij$

Where:
$yij =$ Observational value of sample
μ = Overall mean
$Ti =$ Effect of i_{th} treatment (pomegranate Peels: 0.3, 0.6, 0.9, and 1.2%. or Pomegranate Seed: 0.3, 0.6, 0.9, and 1.2%).
$pi =$ The Effect of Period (0, 30, 60 and 90 days).
$eij =$ Random error associated with each observation assumed to be NID with Zero mean and σ^2e variance.

RESULTS

1- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Moisture during different freezing storage (0, 30, 60, and 90) days:
Result presented in table (2) that there were a significant ($P < 0.05$) decrease moisture content recorded for all treatments except T3 (80.58%) which treated by 0.6 PSE (pomegranate Seed extraction) at (0) day storage period compared with T1 (80.04%). moisture percentage was significantly decreased as a result of the different PSE and PPE treat after 30 day frozen storage. In table (2), there is no significant difference ($P > 0.05$) between the means of Moisture during (60) day freezing storage. PSE showed decrease of moisture percentage as compared with control T1 (75.59%). Also decreases of moisture percentage were observed for all treatment except T1 at (30) days frozen (81.74%) which record highest moisture percentage as compared with control and other treatments (table 2). PPE at T7 recorded lower Moisture content as compared with other treatments during (90) days frozen.

2- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Protein during different frozen storage (0, 30, 60, and 90) days:

Rise of protein percentage observed significantly (P< 0.05) for all means at (0) day storage period (Table 3). The protein content in control was (14.80%) at (0) day. highest increase was recorded by T5 (16.33%), and T6 (16.95%) recorded higher protein percentage for PPE. During 30 day of frozen storage significantly differences (P < 0.05) observed in Protein percentage after treating different PSE and PPE while compared with T1 (14.64). Result in Table (3) showed significant effect (P< 0.05) of the PSE and PPE on the protein value, When we compare the effect of the treatments with control we found that all protein means increased significantly except T2 (14.18) showed decrease of protein value during (30) days frozen storage. Significant differences (P <0.05) between the means of protein content during 60 days frozen storage (Table 3) were recorded. Protein value increased significantly in all treatments as compared with T1 (15.26).

3- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Fat during different freezing storage (0, 30, 60, and 90) days:

Significant differences (P < 0.05) observed among the means of Fat (table 4) at (0) day storage period and fat content gradually increased. The highest content of fat recorded in T1 (3.02%) control during (90) days frozen storage and T9 (3.01%) as compared with the lower fat content was T1 control (1.2%). The fat content was increased significantly during (30) day frozen storage. Table (4) results clarified that there is a significant differences among the means of fat content during (60) days frozen storage, Gradually Fat content increased in all treatments as compared with T1 (1.83%). Whereas, the highest fat content were recorded in T9 (3.00%) during (60) days frozen.

4- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Ash during different freezing storage (0, 30, 60, and 90) days:

Result in table (5) showed that there is no significant difference (P > 0.05) among means of Ash at (0) day frozen storage, the highest Ash percentage was found at T5 PSE (1.92%) and T6 PPE (1.92%). Significant differences (P < 0.05) between the means of Ash after treated by PSE and PPE different concentration during (30) day frozen storage (table 4). The highest Ash content was at T2 (2.36%) during (90) days frozen and the lower ash content was T1 (0.94%) at (0) day frozen. It was noticed in table (5) results that no significant differences (P > 0.05) were observed between the means of Ash during (60) days frozen storage and Lower Ash content recorded by T7 (2.12%) and higher Ash content was recorded in T5 (2.28%) as compared with control.

5- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat TBA during different freezing storage (0, 30, 60, and 90) days:

Significant differences (P< 0.05) was found between the means of TBA at (0) day storage, result showed that T3 (0.58mg/ MDA/ kg) differ significantly among T1 and T2, T4 and T5 of PSE. On the other hand (Table 6) showed that during (0) day frozen the highest value recorded in T9 (0.63mg/ MDA/ Kg) among all treatments except T1 (0.68mg/ MDA/ Kg) control while the lowest value recorded in T4 (0.46) malonaldehyde/ kg. In present study table (6) showed significant differences (P < 0.05) between treatment during (30) days frozen storage. the initial TBA value of the control T1 was (0.35)mg/MDA/kg after (30) days frozen storage, TBA value of control was higher significantly than all treatments except T9 which record highest TBA value (0.36 mg) and T3 was lower TBA value (0.13mg). The result in table (6) show that there is a significant differences (P < 0.05) among the means of TBA value in karady sheep meat treated by different concentration of PSE and PPE during (60) days frozen storage. All treatments showed decrease in TBA value as compared with control T1 (0.53mg MDA/Kg) during (60) days frozen. As a result the lower TBA value was recorded by T7 (0.08mg/MDA/Kg) during (90) days frozen and the higher TBA value was recorded by T1 (0.68mg/ MDA/ Kg) during (0) day frozen.

6- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat FFA value during different freezing storage (0, 30, 60, and 90) days:

Table (7) results showed significant effect (P<0.05) of FFA during (0) day storage, when making compartment among treatments at the same periods we found that FFA percentage rise gradually compared to control T1 (0.21%) and the highest value recorded in T5 (0.30%) for PSE. And for PPE the highest record was T9 (0.36%) which it was a highest records for all treatments during (0) day frozen. There was a significant difference (P < 0.05) among means of treatments. The table (7) showed the effect of PSE and PPE on FFA. Rise of FFA content observed as compared with control in present study during (30) days frozen storage, T8 recorded the highest value of FFA content (0.35%) and T1 control was the lower FFA content (0.27%).Results in table (7) showed significant differences (P <0.05) among the treatments, differ in FFA content were observed in meat during 60 days frozen storage, both PSE and PPE recorded gradually increase in FFA content. The higher FFA content was T8 (0.44%) at (90) days frozen and lower FFA content was T1 control (0.26%).

7- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat pH during different freezing storage (0, 30, 60, and 90) days:

Significant differences showed between the means of pH value of meat treated by PSE and PPE at (0) day storage. Generally decrease of pH value was observed in all treatment after treated by different percentage of PSE and PPE at some storage day. T8 and T9 recorded significantly lower pH (4.97) compared with all treatment except T1. On the other hand, highest pH value was observed in T2 (5.21) compared with all treatments at (0) day frozen. Table (8) results indicated that no significant differences observed in pH value during 30 day frozen storage. PPE led to decrease of pH value, T5 (5.08) recorded lower pH value compared with T1 (5.29) control and T2 (5.38) recorded highest pH value compared with control. Results in table (8) significant differences ($P < 0.05$) was observed between the means of pH value in meat which treated with different concentration of PSE and PPE. pH value of T1 control was (5.30) after 60 days frozen storage, all meat sample were treated by PSE recorded decrease in pH value and T4 (5.17) was lowest pH value as compared with all other sample. Nevertheless, differences found in pH value in meat sample treated by PPE and the higher pH value was T8 (5.40) during 60 days storage Table (8). Higher pH value were recorded by T3 (5.70) at 90 frozen days.

8- Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Water holding capacity during different freezing storage (0, 30, 60, and 90) days:

The results of water holding capacity (WHC) showed in Table (9). There were a significant differences ($P < 0.05$) between the means of Water holding capacity at (0) day. WHC decreased in all treatment when compared with T1 (43.93%), T2 (40.09%) recorded lower WHC value. There were significant differences ($P < 0.05$) among treatments in water holding capacity during 30 days frozen storage, T3 (52.60%) was higher WHC and T5 (38.44%) was lower WHC value when compared with Control T1 (40.57%). On the other hand, study resulted significant differences ($P < 0.05$) among means of WHC during 60 days frozen storage, table (9) results of PSE reported rise of WHC percentage as compared with control T1 (37.02%). Higher WHC percentage was recorded by T4 (38.96%). On the other hand lower WHC percentage was recorded by T7 (35.97%). Lower WHC value was recorded by T3 (21.20%) at (90) days frozen (Table 9).

9- The Effect of different frozen storage (0, 30, 60 and 90) days on karadi meat composition treated by different concentration of pomegranate peel and Pomegranate seed extract:

The result in table (10) indicated that there was significant difference ($P < 0.05$) among the means of moisture Protein, Fat and Ash value during (0, 30, 60 and 90) frozen storage days. The result in table (10) showed that lower moisture content was recorded by T4 (71.38%) during 90 days frozen, T8 (72.70%) during 90 days frozen for PSE and T9 (70.00%) during 90 days frozen in sample treated with PPE. On the other hands higher moisture content was observed in T2 (80.74%) at 30 days frozen, T6 (80.43%) for PSE during 30 days frozen and for PPE the higher moisture percentage was (78.73%) during (0) day frozen. Nevertheless, the higher moisture for all treatments during (0, 30, 60 and 90) days frozen was T2 (80.74%) at 30 day frozen and lower moisture content for all treatment was (70.00%) for PPE during (90) days frozen.

Different protein value were indicated during different frozen storage period higher protein content was recorded by T8 (17.85%) for PSE during 90 days frozen and lower protein content was recorded by T2 (14.74%) during 30 days frozen, generally protein content Increased with increase of frozen period. In spite of that, and as a result of frozen storage same increase of fat content observed with the meat samples which treated by PSE, for instance, at (0) day storage Fat content was (1.7%) then increased to (1.9%) at 30 days frozen storage and at 60 days storage frozen the fat content was (2.31%). Similar increase were noticed in meat samples which treated by PPE during frozen storage period, at (0) day fat content was (1.99%) after (30) days frozen storage fat content increase to (2.44%) and at (60) days frozen storage the fat content was (2.7%). The lower Fat content recorded by control at (0) time of frozen (1.2%) and higher Fat content was recorded in meat sample which treated by PPE at 90 days frozen storage (3.15%). Fat Rise of Ash content observed for all treatments with gradually increase of frozen period. In present study the lower Ash content was (1.82%) which recorded by sample treated by PSE at 0 days frozen storage and higher Ash content was (2.25%) recorded by meat sample treated with PSE at 90 days frozen storage.

10- Effect of different frozen storage day on TBA and FFA on karadi meat treated by different concentration of pomegranate peel and Pomegranate seed extract:

10-1-TBA:

Result showed (Table 11) significant differences ($P < 0.05$) among means. TBA value of control at (0) day frozen was (0.68mg MDA/ Kg meat) then at 30 days frozen storage the TBA value decreased to (0.36mg MDA/Kg meat) and at the 60 days frozen storage the TBA value was decreased to (0.42 mg MDA/ Kg meat). In meat sample which treated by PSE the value of TBA was decreased with increase of frozen storage time. At (0) day storage TBA value was (0.51mg MDA/ Kg meat) then decreased to (0.20mg MDA/ Kg meat) after 30 days frozen and at 60 days frozen the TBA value was (0.42mg MDA/ Kg meat). Similar

decrease of result of TBA value was observed with the meat sample that treated with PPE, At (0) day storage the TBA value was (0.53mg MDA/ Kg meat) then decreased to (0.21mg MDA/ Kg meat) at 30 days frozen and at 60 days frozen the TBA value was (0.43mg MDA/ Kg meat) (Table 11).

10-2- FFA

Table (11) results showed significant differences (P < 0.05) among means of FFA content. FFA content for control at (0) time was (0.21%) then after 30 days of frozen the FFA content increased to (0.30%) with increase of frozen time to 60 days the FFA of control was increased to (0.35%) and at 90 days frozen the FFA was 0.39% for control. Gradually increase of FFA content were found in meat that treated with PSE during (0, 30, 60 and 90) days. At (0) day of storage the FFA content was (0.27%) then increased to (0.29%) after 30 days frozen storage and at 60 days frozen storage rise of FFA content continue to be (0.30%) then at (90) days FFA recorded (0.32%). Similar result were observed in meat sample that treated with PPE during (0, 30, 60 and 90) days storage frozen. At (0) day storage the FFA content was (0.31%) then at 30 days frozen the FFA content increased to (0.32%) while at the 60 days storage frozen the FFA content increased to (0.38%) and during (90) frozen FFA recorded (0.41%).

11-The Effect of different refrigerator storage days (0, 30, 60 and 90) on pH and Water holding capacity on karadi meat treated by different concentration of PPE and PSE:

11-1-pH:

Table (12) showed significant differences (P<0.05) between the means of pH during different frozen storage (0, 30, 60 and 90) days. The pH value affected by different frozen storage days, gradually increase of pH value recorded with increase of frozen storage days. pH value of meat sample at (0) storage days for control was (5.06) after (30) days frozen storage the pH value increased to (5.20), during (60) days frozen storage days pH value was (5.27) and at (90) days frozen the pH value was (5.58). Similar increase were recorded for meat samples treated by PSE, during (0) day frozen the pH value was (5.17) then at (30) days frozen pH value was increased to (5.28) and after (60) days frozen storage pH value was (5.22) and at (90) days was (5.60). Obviously increase of pH value was recorded in meat samples which treated by PSE, at (0) day storage pH was (5.01) after (30) days frozen the pH value increased to (5.14), with increase of storage days to (60) days the pH value increased to (5.31) and during (90) days pH was (5, 54) for PSE. The lower pH value was (5.01) recorded at (0) days frozen for meat sample which treated by PPE on the other hand the higher pH value was (5.60) recorded at (90) days frozen in sample which treated by PSE.

11-2- Water Holding Capacity:

Significant differences (p <0.05) between the means of WHC were indicated during (0, 30, 60 and 90) days frozen storage. Reduction of WHC percentage was obtained in the present study as a result of different storage period Table (12). The WHC percentage in meat sample not treated (control) during (0) day was (43.93%) after (30) days frozen WHC decreased to (40.70%) and at (60) days frozen storage WHC value decreased to (37.23%) but during (90) days frozen the WHC percentage was (42.89%). meat samples which treated by PSE showed difference value of WHC as a result of different frozen storage period for instance, at (0)days storage WHC value was (41.87%) but at 30 days frozen the WHC percentage increased to (46.66%) and at 60 days frozen the WHC percentage decreased to (37.90%) then at (90) days frozen WHC percentage was (27.73%). on the other hands, gradually decrease of WHC value were observed in meat sample which treated by PPE as a result of difference frozen storage period, at (0) days storage the WHC percentage was (42.06%) then frozen storage increased to 30 days and WHC value was decreased to (39.09%) decrease of WHC continue to record (37.32%) at 60 days frozen storage and during (90) days frozen storage WHC percentage was (38.52%). Table (12) showed that lower WHC percentage was (27.73%) recorded by meat sample treated PSE at 90 days frozen, on the other hands the higher WHC was (46.66%) recorded by meat sample treated by PSE at (30) days frozen.

12- Effect of different concentration of pomegranate peel and Pomegranate seed extract on Color, Flavor and Aroma, Tenderness, Juiciness and overall acceptability in LD Muscle of Karadi meat during 90 day frozen storage:

Table (13) showed significant differences (P < 0.05) among means treatments of Flavor and Aroma, tenderness, juiciness and over all acceptances. Also table (13) showed that there is no significant differences among the means of color at (60) day storage. PSE T3 (0.6) recorded the highest score (3.80) for color, (4.00) and (3.80) for overall acceptance. On the other hands, T4 recorded higher Flavor and Aroma (4.00) and higher score for Tenderness (4.00).

In spite of that results in table (13) indicated that T4 was more acceptable in Flavor and Aroma which had significantly (P< 0.05) higher score (4.00) as compared with T1 (2.60). Also the table showed that pomegranate seed extraction led to significant (P < 0.05) decrease in T4 (3.40) as compared with T1.

Table 1: panel scores Table was as following:

Treatment	Color	Flavor and aroma	Tenderness	Juiciness	Overall Acceptance

Table 1: Sensory evaluation form (Murphy and Zerby, 2004).

Score	1	2	3	4	5
Color	Very dark	Dark brown	Acceptable brown	Light reddish brown	Reddish Brown
Flavor and aroma	Very pronounced rancid	Pronounced rancid	Moderate rancid	Slight rancid	No detectable Rancid
Tenderness	Tough	Low tender	Moderate tender	Tender	Very tender
Juiciness	Dry	Slightly juicy	Moderate juicy	Juicy	Very juicy
Overall acceptance	Refused	Slightly acceptable	Moderate acceptable	Acceptable	Very Acceptable

Table 2: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Moisture percentage during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen period / Tre.		0 Day	30 Day	60 Day	90 Day
Control	T1	80.04 ± 0.35^{bc}	81.74 ± 0.57^{c}	75.59 ± 0.26^{a}	75.08 ± 0.05^{c}
PSE	T2	78.94 ± 0.38^{b}	80.68 ± 0.52^{bc}	74.88 ± 0.60^{a}	73.21 ± 0.48^{bc}
	T3	80.58 ± 0.56^{c}	80.03 ± 0.56^{abc}	73.28 ± 0.07^{a}	71.87 ± 0.40^{ab}
	T4	79.62 ± 0.79^{bc}	79.28 ± 0.60^{abc}	72.40 ± 0.25^{a}	70.67 ± 0.67^{ab}
	T5	78.73 ± 0.60^{b}	77.45 ± 0.57^{ab}	75.35 ± 2.52^{a}	70.26 ± 0.59^{ab}
PPE	T6	80.01 ± 0.20^{bc}	78.06 ± 0.66^{ab}	75.78 ± 0.49^{a}	70.15 ± 0.82^{ab}
	T7	79.23 ± 0.21^{bc}	77.18 ± 0.17^{a}	75.57 ± 0.48^{a}	69.52 ± 1.01^{a}
	T8	78.60 ± 0.43^{b}	79.67 ± 0.76^{abc}	75.16 ± 0.34^{a}	70.09 ± 1.05^{ab}
	T9	77.07 ± 0.15^{a}	80.74 ± 1.32^{bc}	74.57 ± 0.29^{a}	71.38 ± 0.65^{ab}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different ($P < 0.05$).

Table 3: Effect of PPE and PSE on Karadi sheep meat Protein percentage during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Period / Tre.		0 Day	30 Day	60 Day	90 Day
Control	T1	14.80 ± 0.26^{a}	14.64 ± 0.30^{ab}	15.26 ± 0.27^{a}	15.91 ± 0.58^{a}
PSE	T2	14.80 ± 0.11^{a}	14.18 ± 0.35^{a}	15.60 ± 0.14^{ab}	19.00 ± 1.34^{a}
	T3	15.32 ± 0.32^{a}	15.99 ± 0.10^{bc}	16.14 ± 0.54^{ab}	18.18 ± 0.37^{a}
	T4	15.40 ± 0.09^{ab}	16.07 ± 0.35^{bc}	15.79 ± 0.23^{ab}	18.30 ± 0.40^{a}
	T5	16.33 ± 0.47^{bc}	16.61 ± 0.09^{c}	17.14 ± 0.08^{bc}	18.16 ± 0.49^{a}
PPE	T6	16.95 ± 0.39^{c}	16.05 ± 0.27^{bc}	16.59 ± 0.42^{abc}	17.33 ± 0.81^{a}
	T7	16.59 ± 0.19^{bc}	16.32 ± 0.40^{bc}	17.98 ± 0.17^{c}	16.08 ± 0.36^{a}
	T8	16.06 ± 0.11^{abc}	14.66 ± 0.62^{ab}	16.15 ± 0.39^{ab}	17.26 ± 0.48^{a}
	T9	15.69 ± 0.48^{abc}	14.74 ± 0.34^{ab}	17.15 ± 0.47^{bc}	15.94 ± 0.52^{a}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different ($P < 0.05$).

Table 4: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Fat percentage during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Period / Tre.		0 Day	30 Day	60 Day	90 Day
Control	T1	1.20 ± 0.05 ^{a}	1.43 ± 0.08 ^{a}	1.83 ± 0.06 ^{c}	3.02 ± 0.06 ^{b}
PSE	T2	2.33± 0.03 ^{e}	2.43 ± 0.12^{cd}	2.35 ± 0.17^{ab}	2.90 ± 0.008^{ab}
	T3	1.50 ± 0.15 ^{b}	1.80 ± 0.05^{ab}	2.11 ± 0.003 ^{a}	2.26 ±0.003 ^{a}
	T4	1.56 ± 0.03 ^{b}	1.63 ± 0.08 ^{a}	2.26 ± 0.29^{ab}	2.93 ±0.29 ^{b}
	T5	1.50 ± 0.05 ^{b}	1.76 ± 0.08^{ab}	2.53 ± 0.31 ^{a}	2.96 ±0.31 ^{b}
PPE	T6	1.90± 0.05^{cd}	2.16 ± 0.06^{bc}	2.84 ± 0.06^{bc}	3.01 ±0.06 ^{b}
	T7	2.26 ± 0.03 ^{e}	2.46 ± 0.06^{cd}	2.70± 0.12 ^{a}	2.99 ±0.32 ^{b}
	T8	2.13 ± 0.03 ^{de}	2.36 ± 0.14^{cd}	2.16 ± 0.06^{ab}	2.97±0.02 ^{b}
	T9	1.66 ± 0.03^{bc}	2.76 ± 0.08 ^{d}	3.00 ± 0.10^{bc}	3.01 ± 0.08 ^{b}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 5: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Ash percentage during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Days / Tre.		0	30	60	90
Control	T1	0.94 ±0.005 ^{a}	1.96±0.005 ^{a}	2.17 ±0.06 ^{a}	2.24 ±0.08 ^{a}
PSE	T2	1.6±0.15 ^{a}	2.25 ±0.12 ^{b}	2.24 ±0.13 ^{a}	2.36 ±0.12 ^{a}
	T3	1.87± 0.04 ^{b}	2.10± 0.02^{ab}	2.18 ± 0.01 ^{a}	2.22± 0.09 ^{a}
	T4	1.90 ±0.06 ^{b}	2.10 ±0.01^{ab}	2.21 ±0.14 ^{a}	2.25 ±0.07 ^{a}
	T5	1.92 ±0.01 ^{b}	2.10 ±0.01^{ab}	2.28 ±0.16 ^{a}	2.19 ±0.05 ^{a}
PPE	T6	1.92 ±0.01 ^{b}	2.09 ±0.02^{ab}	2.24 ±0.12 ^{a}	2.19 ±0.02 ^{a}
	T7	1.91 ±0.005 ^{b}	2.11 ±0.02^{ab}	2.12 ±0.04 ^{a}	2.15 ±0.05 ^{a}
	T8	1.90± 0.08 ^{b}	2.06 ± 0.03^{a}	2.15± 0.02 ^{a}	2.20 ± 0.04 ^{a}
	T9	1.90± 0.05 ^{b}	2.00± 0.05^{a}	2.19 ± 0.03 ^{a}	2.21 ± 0.04 ^{a}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 6: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat TBA (mg malonaldehyde/kg Muscle) during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Period / Tre.		0 Day	30 Day	60 Day	90 Day
Control	T1	0.68 ± 0.002 ^{f}	0.35 ± 0.006^{d}	0.53 ± 0.007 ^{c}	0.14 ± 0.002^{bc}
PSE	T2	0.51± 0.002^{bc}	0.18 ± 0.006^{b}	0.37 ± 0.006 ^{a}	0.12 ± 0.006 ^{b}
	T3	0.58± 0.006 ^{d}	0.13 ± 0.004 ^{a}	0.35 ± 0.01 ^{a}	0.13 ± 0.006^{bc}
	T4	0.46 ± 0.01 ^{a}	0.15 ± 0.006^{ab}	0.42 ± 0.002 ^{b}	0.14 ± 0.004^{bc}
	T5	0.48 ± 0.006^{ab}	0.24 ± 0.006 ^{c}	0.48± 0.006 ^{c}	0.14 ± 0.002^{bc}
PPE	T6	0.48 ± 0.002^{ab}	0.28 ± 0.006 ^{d}	0.44 ± 0.01^{bc}	0.15 ± 0.005 ^{c}
	T7	0.49 ± 0.004^{ab}	0.15 ± 0.01^{ab}	0.43 ± 0.007 ^{b}	0.08 ± 0.002 ^{a}
	T8	0.54± 0.01 ^{c}	0.18 ± 0.003^{b}	0.37 ± 0.01 ^{a}	0.09 ± 0.02 ^{a}
	T9	0.63± 0.02 ^{e}	0.36 ± 0.01 ^{d}	0.42 ± 0.003 ^{b}	0.44 ± 0.01^{d}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 7: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat FFA value during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Period / Tre.		0 Day	30 Day	60 Day	90 Day
Control	T1	0.21± 0.008 ^{a}	0.27± 0.01^{a}	0.26 ± 0.01 ^{a}	0.28 ± 0.01 ^{a}
PSE	T2	0.24± 0.01^{ab}	0.29 ± 0.005^{abc}	0.30 ± 0.01 ^{b}	0.33 ± 0.01 ^{b}
	T3	0.27± 0.003^{bc}	0.31± 0.02^{abcd}	0.32 ± 0.01^{bc}	0.34 ± 0.005^{bc}
	T4	0.27± 0.008 ^{c}	0.32 ± 0.008^{bcd}	0.33 ± 0.01^{bc}	0.36 ± 0.01 ^{c}
	T5	0.30 ± 0.008^{cd}	0.28 ± 0.01^{ab}	0.35 ± 0.01^{cd}	0.40 ± 0.005 ^{d}
PPE	T6	0.27± 0.01^{bc}	0.33± 0.003^{bcd}	0.38 ± 0.02 ^{de}	0.39 ± 0.005 ^{d}
	T7	0.30 ± 0.008^{cd}	0.33 ± 0.01^{cd}	0.39 ± 0.01 ^{de}	0.41± 0.01 ^{d}
	T8	0.32 ± 0.011^{d}	0.35 ± 0.01 ^{d}	0.40 ± 0.05 ^{e}	0.44 ± 0.01 ^{d}
	T9	0.36± 0.017 ^{e}	0.30 ± 0.01^{abc}	0.35 ± 0.05^{cd}	0.39 ± 0.03 ^{d}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 8: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat pH value during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Days / Tre.		0	30	60	90
Control	T1	4.93± 0.01^{a}	5.29 ± 0.02^{ab}	5.30 ± 0.05^{abc}	5.37 ± 0.05 ^{a}
PSE	T2	5.21± 0.04 ^{f}	5.38 ± 0.02 ^{b}	5.21 ± 0.01^{ab}	5.69 ± 0.01 ^{c}
	T3	5.16 ± 0.01^{def}	5.09 ± 0.02 ^{a}	5.19 ± 0.05^{ab}	5.70 ± 0.06 ^{c}
	T4	5.13 ±0.004 ^{de}	5.35 ±0.05^{ab}	5.17 ±0.04 ^{a}	5.62 ±0.02^{bc}
	T5	5.19±0.015^{ef}	5.08 ±0.04 ^{a}	5.20 ±0.006^{ab}	5.59 ±0.02^{bc}
PPE	T6	5.11±0.013^{cd}	5.15 ±0.02^{ab}	5.34 ±0.007^{bc}	5.58 ±0.01^{bc}
	T7	5.04 ± 0.013 ^{b}	5.11 ± 0.13^{ab}	5.31 ± 0.01^{abc}	5.50 ± 0.01^{ab}
	T8	4.97 ± 0.024 ^{a}	5.21 ± 0.05^{ab}	5.40 ± 0.03 ^{c}	5.48 ± 0.02^{ab}
	T9	4.97 ± 0.019 ^{a}	5.20 ± 0.03^{ab}	5.27± 0.03^{abc}	5.58 ± 0.06^{bc}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 9: Effect of Pomegranate Peel and Seed extract on Karadi sheep meat Water holding capacity percentage during different freezing storage (0, 30, 60, and 90) days (Mean ± SE):

Frozen Days / Tre.		0	30	60	90
Control	T1	43.93± 0.44 ^{d}	40.57 ± 0.49 ^{a}	37.02 ± 0.50^{ab}	31.52 ± 0.52 ^{c}
PSE	T2	40.09 ± 0.28 ^{a}	41.80 ± 1.02^{a}	37.69 ± 0.61^{ab}	30.35 ± 0.58^{bc}
	T3	42.19 ± 0.66^{bc}	52.60 ± 0.75^{b}	37.94 ± 0.97^{ab}	21.20 ± 0.18 ^{a}
	T4	42.43 ± 0.28^{cd}	51.68 ± 1.57^{b}	38.96 ± 0.28 ^{b}	27.85 ± 0.74 ^{b}
	T5	42.79 ± 0.14^{cd}	38.44 ± 0.66^{a}	38.86 ± 0.50 ^{b}	31.12 ± 0.41^{c}
PPE	T6	40.81 ± 0.41^{ab}	38.49 ± 1.00 ^{a}	38.06 ± 0.50^{ab}	37.48 ± 0.79 ^{d}
	T7	41.73 ± 0.47^{bc}	39.68 ± 0.54^{a}	35.97 ± 0.56 ^{a}	43.12 ± 1.09 ^{e}
	T8	42.73± 0.82^{cd}	39.77 ± 0.47^{a}	36.39 ± 0.55^{ab}	42.34 ± 0.87 ^{e}
	T9	42.98 ± 0.30^{cd}	40.70 ± 0.68^{a}	37.23 ± 0.48^{ab}	42.89 ± 0.44 ^{e}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 10: The Effect of different refrigerator storage (0, 30, 60 and 90) days on karadi meat Proximate chemical composition treated by different concentration of pomegranate peel and Pomegranate seed extract (Mean ± SE):

Treat	Frozen storage day	Moisture	Protein	Fat	Ash
C	0	78.94 ± 0.38^{bc}	15.69±0.26^{abc}	1.2±0.51^{a}	1.9±0.005^{ab}
	30	80.74 ± 1.32^{d}	14.74±0.34^{a}	1.4± 0.88^{ab}	1.96±0.005^{ab}
	60	74.57 ± 0.29^{a}	17.15±0.47^{d}	1.8±0.06^{c}	2.17±0.06^{c}
	90	71.38±0.65^{ab}	15.94±0.52 ^{a}	2.03±0.08 ^{a}	2.24±0.08 ^{a}
PSE	0	79.73± 0.32^{bcd}	15.08±0.15^{ab}	1.7±0.11^{bc}	1.82±0.05^{a}
	30	80.43 ±0.36^{cd}	15.22±0.27^{ab}	1.9±0.10^{c}	2.14±0.03^{c}
	60	74.04 ± 0.40^{a}	15.70±0.17^{abc}	2.31±0.10^{de}	2.23±0.05^{c}
	90	72.70 ±0.53 ^{c}	17.85±0.48 ^{c}	2.96±0.01 ^{b}	2.25±0.04 ^{a}
PPE	0	78.73 ± 0.35^{bc}	16.48±0.16^{cd}	1.99±0.07^{cd}	1.91±0.01^{ab}
	30	78.09 ± 0.38^{b}	15.91±0.28^{bc}	2.44±0.07^{e}	2.07±0.01^{bc}
	60	75.21 ± 0.57^{a}	16.96±0.24^{d}	2.7± 0.10^{e}	2.18±0.03^{c}
	90	70.00±0.39 ^{a}	17.21±0.32^{ab}	3.15±0.1 ^{b}	2.19±0.01 ^{a}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 11: Effect of different refrigerator storage day on TBA and FFA on karadi meat treated by different concentration of pomegranate peel and Pomegranate seed extract (Mean ± SE):

Treatment	Frozen storage day	TBA	FFA
C	0	0.68±0.002^{d}	0.21±0.008^{a}
	30	0.36±0.01^{b}	0.30±0.01^{bc}
	60	0.42±0.003^{b}	0.35±0.005^{de}
	90	0.44±0.02 ^{c}	0.39± 0.003 ^{b}
PSE	0	0.51±0.01^{c}	0.27±0.007^{b}
	30	0.20±0.02^{a}	0.29±0.008^{bc}
	60	0.42±0.02^{b}	0.30±0.009^{bc}
	90	0.13±0.003 ^{b}	0.32±0.009 ^{a}
PPE	0	0.53±0.01^{c}	0.31±0.01^{cd}
	30	0.21±0.16^{a}	0.32±0.009^{cd}
	60	0.43±0.01^{b}	0.38±0.008^{e}
	90	0.11±0.008 ^{a}	0.41±0.006 ^{b}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 12: Effect of different refrigerator storage day on pH and Water holding capacity on karadi meat treated by different concentration of pomegranate peel and Pomegranate seed extract (Mean ± SE).

Treatment	Frozen storage day	pH value	Water holding capacity
C	0	5.06±0.01^{ab}	43.93±0.44^{de}
	30	5.20±0.03^{cde}	40.70±0.68^{bcd}
	60	5.27±0.30^{de}	37.23±0.48^{a}
	90	5.58±0.006 ^{a}	42.89±0.44 ^{b}
PSE	0	5.17±0.01^{cd}	41.87±0.35^{cd}
	30	5.28±0.03^{de}	46.66±1.71^{e}
	60	5.22±0.02^{cde}	37.90±0.34^{ab}
	90	5.60±0.04 ^{a}	27.73±1.22 ^{a}
PPE	0	5.01±0.02^{a}	42.06±0.34^{cd}
	30	5.14±0.03^{bc}	39.09±0.35^{abc}
	60	5.31±0.02^{e}	37.32±0.42^{a}
	90	5.54±0.01 ^{a}	38.52±1.48 ^{b}

Means having different small letters (a, b, c…) among treatments for each Column are significantly different (P < 0.05).

Table 13: Effect of different concentration of pomegranate peel and Pomegranate seed extract in sensory evaluation scores in LD muscle of Karadi sheep (Mean ± SE):

Che. / Tre.	P.E	Color	Flavor and Aroma	Tenderness	Juiciness	Over all acceptability
Con.	T1	2.80 ± 0.20 ^{a}	2.60± 0.24^{a}	3.00 ± 0.31^{ab}	3.00 ± 0.20^{ab}	2.40 ± 0.24^{a}
PSE	T2	3.20 ± 0.37 ^{a}	3.00 ± 0.44^{ab}	3.80 ± 0.37^{b}	2.80 ± 0.37^{ab}	3.20 ± 0.37^{ab}
	T3	3.80 ± 0.48 ^{a}	3.40 ± 0.24^{ab}	3.80 ± 0.48^{b}	2.80 ± 0.20^{ab}	3.80 ± 0.48^{b}
	T4	3.40 ± 0.40 ^{a}	4.00 ±0.44^{b}	4.00 ± 0.31^{b}	3.40 ± 0.24^{b}	3.40 ± 0.40^{ab}
	T5	3.60± 0.24 ^{a}	3.20 ± 0.20^{ab}	3.80 ±0.20^{b}	3.00 ± 0.54^{ab}	3.60 ± 0.24^{b}
PPE	T6	3.60 ± 0.40 ^{a}	3.60 ± 0.24^{ab}	3.40 ± 0.4^{b}	3.20 ±0.20^{ab}	3.40 ± 0.40^{ab}
	T7	2.80 ± 0.37 ^{a}	2.60 ± 0.40^{a}	3.00 ±0.31^{ab}	2.40 ± 0.24^{ab}	2.80 ± 0.37^{ab}
	T8	3.00 ± 0.31^{a}	3.20± 0.58^{ab}	3.20 ± 0.37^{b}	2.40 ± 0.24^{ab}	3.00 ± 0.31^{ab}
	T9	2.40 ± 0.24^{a}	3.60 ± 0.24^{ab}	2.00 ±0.00^{a}	2.00 ± 0.40^{a}	2.80 ± 0.20^{ab}

Means having different small letters (a,b,c,….) among treatments for each Column are significantly different (P < 0.05).

DISCUSSION

In this study we found that PSE showed decrease of moisture percentage as compared with controls T1 (75.59%). Also decreases of moisture percentage were observed for all treatment except T1 at (30) days frozen (81.74%) which record highest moisture percentage as compared with control and other treatments (table 2). PPE at T7 recorded lower Moisture content as compared with other treatments during (90) days frozen. This finding may be due to opposite linkage between the moisture and other compounds present in meat sample treated by pomegranate peel or seed extraction (Tahir, 1983 and Guo *et al.,* 2003). The decrease in moisture content were recorded for all treatments during storage period processed was confirmed by (Kheder, 2013) after using different Olive leave extraction on karady sheep meat during frozen storage. Other research conducted that in disparity to the emulsion, moisture content in the product with guava powder (1%) was significantly lowers (P < 0.05) than control. This could be due the loss of water/ moisture, temporarily bound by the guava powder (Arun and Rajkumar. 2013).

PSE and PPE showed rise of protein content Table (3). and T2 during (90) days frozen recorded the higher protein content (19.00%) and T2 during (30) days frozen was the lowest protein content (14.18%). These results are probably due to the phenolic components in the plants extracts which improve proteins and meat moisture and prevented water loss (Romans and Ziegler, 1977; Saleh, 2007). The result were confirmed by (Baker I. A. 2012), when reported that protein content increased significantly (P < 0.01) with increase of storage of meat sample treated by Ginger extract and Rosemary extract. On the other hand, (Kheder 2013) showed that significant differences appeared in protein content among meat sample treated by Olive leave extraction during frozen storage.

Significant differences (P < 0.05) observed among the means of Fat (table 4) in meat sample after treated by PSE and PPE, Gradually Fat content increased in all treatments as control with control. (Taban 2015) founded that Treatments T2 and T4 shows decrease in each protein and fat comparing with control. Also Significant differences (P < 0.05) of Fat content reported by (Kheder 2013) in meat sample treated with olive leave extraction during frozen storage at -18°c.

Rise of Ash content were observed in all sample treated by PSE and PPE when compared with control. Arvanitoyannis *et al.* (2000), confirm that significant increase in Ash with increase of storage period due to loss of moisture which in turn made an increase in the total solid content.

The result in table (6) show that there is a significant difference (P < 0.05) among the means of TBA value in karady sheep meat treated by different concentration of PSE and PPE, The results of present study may be related to the antioxidant characteristics of GE (Ginger extraction) (Brunton *et al.,* 2000), which prevented lipid oxidation in the phospholipids rich membranes of meat (Lee *et al.,* 1986; Kim and Lee, 1995; Mendiratta *et al.,* 2000).

PSE and PPE recorded gradually increase in FFA content, the increase in FFA (lipolysis) is a result of the enzymatic hydrolyses of esterifies lipids (Hwang and Regenstein, 1993). Increase in FFA is in agreement with those reported by other investigators (Ucak *et al.,* 2011; Abu-almaaly, 2011). In spite of that, Ucak *et al.* (2011) noticed considerable differences (p<0.01) in FFA between the control and rosemary extraction treated groups.

Generally decrease of pH value was observed in all treatment after treated by different percentage of PSE and PPE at some storage day This result may be due to the presence of some acids like Ellagic acid and its derivatives (Ellagitannis, Punicalagin, Punicalin) in pomegranate peel extracts which may decrease the pH of meat (Tahir, 1983 and Guo *et al.,* 2003). The pH values of raw ground pork meat decreased from 5.88 to 5.61 over storage period (Qin and Zhang 2013).

Pomegranate Peal extraction showed significantly effect in WHC which decreased the WHC value compared with PSE (Table 9) The present results are similar to the findings of previous reports which showed stabilizing effect on thawing and cooking loss and other meat quality with increase ginger extract concentration (Naveena and Mendiratta, 2004; Al-Temimi and Abu-Almaaly, 2011). The meat samples treated with olive leaves extract in low concentration (2%) had lower WHC which might be because of protein lose their buffering capacity (Offer and Trinick, 1983).

The moisture losses happen during later storage periods due to myofibrillar distortion undergone by the meat in the freezer that led to the poor water retention ability of the meat. (Kandeepan and Biswas, 2007b). Similar result was found by (Hama *et al.*, 2018) when indicated that moisture content decreased significantly (P <0.01) with increasing storage for all meat sample treated with pomegranate peel extract. Similar results were found by (Azad and Akter, 2005) and Kandeepan and Biswas (2007a) and Al-penjueni (2008). generally protein content Increased with increase of frozen period. The result was confirmed by (Ageena, 2001) and (Al- Dhaheri, 2012) which reported higher protein content of calve meat and minced beef during frozen storage as a period of storage increased. In present study gradually increase of Fat content observed with gradually increase of frozen storage period value was gradually increased during the increase of storage period (Baker, 2012). Similar result was found by (Kheder, 2013) fat content in karadi sheep meat was increased during frozen storage for (0, 30, and 60). On the other hands, Ash content gradually increased as the period of storage frozen increased same result were founded by (Kheder, 2013), Ageena (2001) and Al-Dhaheri (2012) whom found that Ash content gradually increased as the period of storage frozen increased.

The TBA value decreased significantly in all treatments due to Increase of frozen storage time The results revealed that the meat which treated with Pomegranate Peel extracts showed a preservation effect on meat by inhibiting lipid oxidation due to its antioxidants contents like flavonoids, ellagic acid, catechins and Gallic (Li *et al.,* 2006, Zahin *et al.,* 2010 and Devatkal *et al.,* 2010). TBA value reduced in meat and meat process during frozen storage (Wojciak *et al.,* 2011). After 4 weeks of chilled storage of meat treated with mint leaf extract the TBA value decreased (Kannat *et al.,* 2007).

Increases of FFA content observed with increase of frozen storage days (0, 30, 60 and 90) Present study showed that FFA content increase with increase of frozen period, lower FFA recorded in control at (0) time was (0.21%) and the higher FFA content was (0.41%) recorded by meat sample treated with PPE storage for 90 days frozen. Mahmmod (2014) reported that when compared FFA values of same treatment in different periods, results showed that FFA values increase as storage period increase.

The pH value affected by different frozen storage days, gradually increase of pH value recorded with increase of frozen storage days Hama *et al.* (2018), reported that pH value of karadi ram meat increased with increase of refrigerated storage period, there were significant differences (P<0.01) between storage periods for all treatments. Thus the result revealed that pH values increased with progress in storage period similar result was indicated by Jayesh and Venkataramanujam (2000) and Kandeepan and Biswas (2007a). Increase in pH significantly with prolonged freezer storage may be attributed to the fact that meat undergoes autolysis resulting in a decrease in extract release factor and water holding capacity (Strange *et al.,* 1977). Reduction of WHC percentage was obtained in the present study as a result of different storage period Table (12). Similar result was found by Kheder (2013) when indicated that all karadi sheep meat treated with olive leave extract showed a gradually decrease in WHC as storage time was progressed. Result showed that WHC significantly (P < 0.01) decreased as storage time increased Hama *et al.* (2018).

The karadi sheep meat exhibited higher (P < 0.05) Flavor and aroma, Tenderness and Juiciness in meat treated with PSE at (0.9%). and recorded higher Color and over all acceptability at T3 (PSE 0.6%) compared withT1. These results may be due to that pomegranate extracts contain flavonoid compounds and catechins, which play effective role in myoglobin reduction and maintaining the longest storage period, thus providing meat color protection through delay the met – myoglobin formation (Naveena *et al.,* 2008b). Similar result was found with (Al-Rubeii *et al.,* 2009; Sallam *et al.,* 2010; Zochowska-Kujawska *et al.,* 2013) when used GE (Ginger extraction) to improve the meat quality and the result was improvement in tenderness and juiciness after GE (Ginger extraction) treatment that improvement may be due to proteolytic activity of ginger extract, enhancing meat ability to bind water and decreasing exudative liquid loss during thawing.

CONCLUSION

The study demonstrated the antioxidant effect of pomegranate peel and pomegranate seed extract on karady sheep meat during (0, 30, 60 and 90) days frozen the result confirmed that

1- Chemical and physical analysis indicated that PSE and PPE had high antioxidant activity and retarded the lipid oxidation, which is very important for human health benefit.

2- Improvement of Flavor and aroma, Tenderness, Juiciness, Color and Overall acceptability were observed after treated the meat sample with different concentration of PSE and PPE.

3- Nutritional value of karadi sheep meat was increased after adding PSE and PPE to meat samples which lead to decrease of Moisture content and as a result caused a relative increase in Protein, Fat and FFA.

4- There were significant differences between the sample of meat for chemical and physical treats of meat during different frozen storage time.

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تاثير المستخلص المائي لقشور وبذور الرمان على بعض الصفات الكيميائية والفيزيائية والحسية للحم الضأن الكرادي المخزون بالتجميد

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اجريت هذه التجربة لغرض اختبار تاثيرالمستخلص المائي لقشور وبذور الرمان وفترات الخزن بالتجميد المختلفة على بعض الصفات الكيميائية للحم (نسبة الرطوبة، البروتين، الدهن والرماد) والتراكيب الكيميائية (قيمة الحامض ثايوباربيوتيك و الاحماض دهنية حرة) والصفات الفيزيائية (قابلية حمل الماء وقيمة الاس الهايدروجينى) كذلك تقيم الصفات الحسية للحوم الضان الكرادي خلال فترات الخزن بالتجميد (-١٨°م) (٠، ٣٠، ٦٠ و ٩٠) يوم. استخدمت فى هذه التجربة قطع من عضلة الحبل الطولى الظهرى الطازج وقسمت الى تسعة معاملات بعد نزع الدهون و الانسجة الرابطة. المعامة الاولى السيطرة (بدون معاملة)، معاملة ٢ (تغطيس بـ ٠,٣% مستخلص بذور الرمان)، معاملة ٣ (تغطيس بـ ٠,٦% مستخلص بذور الرمان)، المعاملة ٤ (تغطيس بـ ٠,٩% مستخلص بذور الرمان)، المعاملة ٥ (تغطيس بـ ١,٢% مستخلص بذور الرمان)، المعاملة ٦ (تغطيس بـ ٠,٣% مستخلص قشور الرمان)، المعاملة ٧ (تغطيس بـ ٠,٦% مستخلص قشور الرمان)، المعاملة ٨ (تغطيس بـ ٠,٩% مستخلص قشور الرمان)، المعاملة ٩ (تغطيس بـ ١,٢% مستخلص قشور الرمان) وبواقع ثلاث مكررات لكل معاملة. تم تغميرالعينات باالمستخلص المائي لقشور وبذور الرمان ووضعها فى تبريد (-٤°م) و لمدة ٢٤ ساعة. بعد ذلك تم تجميد العينات بعد وضعها في اكياس من البولي اثيلين وحفظهما تحت درجت الحرارة (-١٨°م) لفترات (٠، ٣٠، ٦٠ و ٩٠) يوم. آظهرت النتائج ان المستخلص المائي لبذور الرمان ادى الى ارتفاع معنوى لكل من البروتين، الدهون، الرماد، الاس الهايدروجينى وصفة التقبل العام مقارنة بالسيطرة. كذلك لوحظ ان المستخلص المائي لبذور الرمان ادى الى انخفاض معنوى فى نسب كل من الرطوبة و حامض الثايوباربيوتك. من ناحية اخرى المستخلص المائي لقشور الرمان ادى الى ارتفاع معنوى فى نسب كل من الدهن، الرماد، حامص الثايوباربيوتك، احماض دهنية حرة، قابلية حمل الماء وصفة تقبل العام كذلك المستخلص المائي لقشور الرمان ادى الى انخفاض معنوى فى نسب كل من الرطوبة، البروتين والاس الهايدروجينى وكذلك ادى الى تحسين صفة الطراوة فى اللحم. المعاملة ٤ (مستخلص بذور الرمان ٠,٩%) ادى الى تحسين صفة النكهة والرائحة، الطراوة والعصيرية فى لحم الضان الكرادى مقارنة بالمعاملة ١ (السيطرة). كذلك المعاملة ٣ (مستخلص بذور الرمان ٠,٦%) سجل تحسن معنوى فى لون اللحم وصفة التقبل العام بشكل عام مقارنة بالمعاملة ١ (السيطرة). من ناحية اخرى لوحظ عند فترات الخزن بالتجميد (٠، ٣٠، ٦٠ و ٩٠) يوم ارتفاع معنوي فى نسب كل من البروتين، الدهون، الرماد، الاحماض دهنية الحرة مع ارتفاع فى قيمة الاس الهايدروجينى.