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USE OF KHASTAWI DATE SEED EXTRACT IN THE MANUFACTURE OF BEEF BURGER

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Abstract:

This study aimed to manufacture beef burger fortified with alcoholic extract of date seeds of Khastawi variety. Date seeds were extracted using ethanol with a yield of 9.24%, and were added to the burger at two concentrations 0.1 and 0.2%. The effect of adding the extract on the qualitative and sensory characteristics of the burger stored in the refrigerator for 10 days was studied. The results showed that pH values of the samples fortified with the extract ranged between 5.76 and 6.3 for the two concentrations all over the storage period, with a significant decrease after 10 days of storage. The fortified samples showed significant decreases in TBA values after 7 and 10 days of storage, and significant decreases in the total bacterial count in the period of 7 and 10 days of storage, as they decreased to 6.8×10^3 and 7.2×10^3 CFU/g, respectively. The percentage of shrinkage in diameter decreased significantly in the samples fortified with the extract from 6.15 to 10.3% and from 17.1 to 11.5% at 0 and 10 days of storage, respectively. The cooking yield increased significantly in the fortified samples from 72% to 76.5% and from 69% to 75.9% at 0 and 10 days of storage. The water holding capacity increased when fortified with the extract and the increase was significant after 10 days of storage. An improvement was observed in the sensory evaluation scores (color, flavor, juiciness, tenderness and overall acceptability) compared to the control. These results indicate the possibility of using alcoholic extract of Al-Khastawi date seeds in the manufacture of beef burgers due to its antibacterial and antioxidant activity.

Keywords: Khastawi date seed, beef burger, water holding capacity, sensory evaluation.

استخدام مستخلص نوى تمر الخستاوي في صناعة بركر اللحم البقري

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مستخلص:

هدفت هذه الدراسة الى تصنيع بركر اللحم المدعم بالمستخلص الكحولي لنوى التمر من الصنف الخستاوي ، اذ تم استخلاص نوى التمر باستعمال الايثانول وبحصيلة بلغت ٪9.24، ودرس تأثير اضافة المستخلص الى البركر بتركيزين ٪0.1 و٪0.2 في الصفات النوعية والحسية للعينات المدعمة بالمستخلص والمخزونة في التبريد لمدة 10 ايام. بينت النتائج ان قيم pH للبيركر تراوحت بين 5.76 و 6.3 للعينات المعاملة بالمستخلص مع انخفاض معنوي بعد 10 ايام من الخزن. اظهرت العينات المدعمة انخفاضا معنويا في قيم TBA بعد 7 و 10 ايام من الخزن، وانخفاضاً معنويا في العدد الكلي للبكتيريا في المدة 7 و 10 يوم اذ انخفضت الى 6.8×10^3 و 7.2×10^3 و.م.م/ غم على الترتيب. انخفضت النسبة المئوية للانكماش بالقطر معنوياً في العينات المدعمة بالمستخلص من 6. 15 الى 10.3 ٪ ومن 17.1 الى 11.5 ٪ في المدد صفر و 10 يوم من الخزن على الترتيب. ارتفع حاصل الطبخ بصورة معنوية في جميع العينات المدعمة من ٪72 الى ٪76.5 ومن ٪69 الى ٪75.9 في الأيام صفر و 10 يوم من الخزن. اما قابلية حمل الماء فقد ارتفعت عند التدعيم بالمستخلص وكان الارتفاع معنويا في بعد 10 ايام من الخزن، كما لوحظ تحسناً في درجات التقويم الحسي (اللون والنكهة والعصيرية والطراوة والقبول العام) مقارنة بمعاملة السيطرة. تشير هذه النتائج الى امكانية استعمال المستخلص الكحولي لنوى تمر الخستاوي في تصنيع بركر اللحم لامتلاكه فاعلية مضادة للبكتريا ومضادة للأكسدة.

الكلمات المفتاحية: نوى تمر الخستاوي، بركر لحم البقر، قدرة الاحتفاظ بالماء، التقييم الحسي .

1- Introduction

The date palm (*Phoenix dactylifera*) is one of the most important plant species, which belongs to the palm family Arecaceae, which includes more than 240 genera and 4000 species, and is one of the most beneficial plant families to humans after the Gramineae family. The date palm is spread in tropical and semi-tropical regions. They are evergreen, monocotyledonous, dioecious trees (1).Two thousand varieties of dates have been cultivated in an area estimated at about 1,092,104 hectares with a total production of 9,075,446 tons. Egypt is at the forefront of the producing countries, followed by Saudi Arabia, Iran, Algeria, and then Iraq. The date fruit consists of two parts: the fleshy part, which constitutes 85-90%, and the seed, which represents 10-15% of the total weight of the fruit (2). Date juice is a raw material for the manufacture of baker's yeast, vinegar, alcohol, and syrup (3).

Khastawi dates are widely cultivated in the central region of Iraq and come after Zahdi in terms of number. Khastawi constituted 11.1% of the total date production in Iraq, as its production reached 83,578 thousand tons. The productivity of the Khastawi palm variety in the production stage was estimated at about 67.6 kg in 2021(4).

Date seeds are one of the most important wastes of the date industry. They represent a high value in terms of chemical composition and their industrial, food, pharmaceutical and animal feed applications. At the same time, they may cause environmental problems if they are accumulated and neglected (5). Date seeds consist of 75-80% fiber, 10-13% fat, 5-6% protein and 0.9-1.8% ash (6). Since dates are an excellent source of phenolic compounds, they act as antioxidants against free radicals and antibacterial, as free radicals oxidize fats, proteins and nucleic acids. This process leads to heart disease, cancer and various infections that lead to a significant increase in deaths. Eating healthy foods rich in antioxidants reduces these deadly diseases (7).

Date seeds have been used in the manufacture of meat products, especially meat burgers and sausages, with the aim of improving the nutritional content due to their antioxidant activity, in addition to their content of vitamins,

proteins, minerals, fatty acids, amino acids, and bioactive compounds such as carotenoids, polyphenols, flavonoids, and tocopherols (8).Date seeds have several applications in the meat burgers industry, including their use as a substitute for flour or bread crumbs, which improves the texture and flavor, as date seeds give a desirable taste that enhances the sensory properties of the product. Their use also increases the shelf life of the product and reduces the speed of its spoilage, as date pits contain antioxidants, in addition to many health benefits, as date seeds are rich in fiber and lower in calories compared to traditional recipes (5).

Health concerns have become increasingly important due to the increase in the incidence of non-communicable diseases in the past decades, such as cardiovascular diseases and tumors. To address these risks, nutritionists have innovated several healthy solutions, including the use of natural plant-derived materials due to their richness in active compounds. Plants or plant-derivatives have been added to ready-to-eat meat products, such as oats, wheat germ, rice, mushrooms (9)., concentrated tomato juice (10), concentrated tomato waste extract, whole tomato waste powder (11), King oyster mushroom powder (12), and edible mushroom *Agaricus bisporus* (13). Other plant extracts such as laurel leaves and lemongrass extracts (14), chard and watercress extracts (15), parsley extract (16), cauliflower and cabbage extracts (17), , essential oils such as star anise fruits essential oil (18), and plant gums such as basil seed gum, in addition to date seeds and their extracts (19) have been also utilized for the same purpose (20);(21). All these additions led to an improvement in the qualitative and sensory characteristics represented by juiciness, tenderness, flavor and general acceptability of the different types of burgers, whether stored in the refrigerator or frozen, compared to the control treatment.

Since dates´ nutritional importance, wide spread cultivation and high consumption in Iraq, their industry waste especially the seeds of the Khustawi variety were chosen to be utilized in this study. The aims of this work were first to reduce the risks of environmental pollution by making advantage of these neglected accumulated seeds and second to study the possibility of us-

ing date seeds extract as a natural food preservative after distinguishing its impact on the qualitative and sensory characteristics of beef burgers.

2-Materials and methods

Raw material

Khastawi dates were obtained at the date stage (fully ripe) in September 2020 from the orchards of the villages around Fallujah city/Al-Anbar Governorate in Iraq.

Date seeds powder preparation

Khastawi date seeds were separated from the fleshy part manually, washed with distilled water to get rid of the remnants of the attached fleshy part, and dried using an electric thermal oven at a temperature of 55 °C for 48 hours. The dried seeds were ground using a laboratory grinder to obtain a fine powder, which was sieved with 1-2 mm holes-diameter sieve to obtain a homogeneous powder, then placed in clean, sterilized and tightly sealed glass bottle, and stored in the refrigerator at a temperature of 4 °C until use(6).

Preparation of alcoholic extract

Seed's powder (100 g) of the Khastawi variety were mixed with 500 ml of 70% ethyl alcohol and left for 24 hours. at laboratory temperature (20-30) °C. The extract was filtered using Whatman No.1 filter paper. The filtrate was concentrated with a rotary evaporator under vacuum at 40 °C and then was left to dry at room temperature. The dry extract was collected in a clean dark tightly sealed glass containers and store it in the refrigerator at 4 °C (19).

Calculating the yield (Y) of Khustawi dates seeds extract

The percentage of the extraction yield was calculated from the following equation:

$$Yield\ (\%) = (weight\ of\ dry\ extract\ (g)\ /\ weight\ of\ seeds\ (g)) \times 100$$

Manufacture of beef burger

Beef burger were manufactured according to the method described by (21), by mixing pure minced beef (85%), minced abdominal animal fat (15%), pure table salt (1.5%) and spices (0.6%), with the addition of 2% sifted whole wheat flour as a filler. The mixture was divided into three equal parts, each weighing 900 g. The first

part represents the control treatment, the second part was fortified with 0.1% of the date seeds´ alcoholic extract, and the third part was fortified 0.2% of the same extract. Afterword, the samples mixtures were formed into burgers weighing 150 g each, and stored in tightly sealed polyethylene bags. The burgers were then placed in the refrigerator at 4°C until the chemical, physical, microbial, and sensory tests were conducted during the storage periods (0, 3, 7, 10) days.

Chemical tests of beef burger

pH-measurement

The pH of the manufactured burger samples was estimated by homogenizing 10 g of each sample with 90 ml of distilled water separately. After filtration, the pH was measured using a pH-meter according to the method mentioned by (22).

Thiobarbituric acid (TBA) value measurement

The method described by (23). was used to estimate lipid oxidation and the following equation was used to calculate the TBA value:

$$TBA\ (mg\ MDA/kg\ meat) = Optical\ absorbance \times 5.2$$

Total bacterial count estimation

The total bacterial count was estimated using the poured plates method using Nutrient agar, then the plates were incubated at 37°C for 24 hours, and the total number of colonies of each plate was calculated using a colony counter (24) .

Cooking properties

The cooking properties represented by cooking yield and diameter reduction (shrinkage) were determined after grilling the beef burger using an electric grill at a temperature of 220°C for 8 minutes, 4 minutes for each side of the burger according to the method mentioned by (25) and applying the following equations:

$$Cooking\ yield\ \% = \frac{weight\ of\ the\ burger\ \ after\ cooking}{Weight\ the\ burger\ before\ cooking} \times 100$$

$$Shrinkage\ in\ diameter\ \% = \frac{Burger\ diameter\ before\ cooking - Burger\ diameter\ after\ cooking}{The\ diameter\ of\ the\ burgers\ \ before\ cooking} \times 100$$

Water Holding Capacity (WHC)

The water holding capacity was estimated based on the method described by (14) by homogenizing 50 g of beef burger with 50 ml of distilled water for 60 seconds and then separating it using centrifugation at a speed of 5000 rpm for 10 minutes. The water holding capacity was calculated from the following equation:

$$Water\ holding\ capacity\ \% = \frac{weight\ of\ distilled\ water\ added - Weight\ the\ liquid\ after\ centrifugation}{Weight\ of\ the\ sample} \times 100$$

Sensory evaluation

Sensory evaluation was conducted on beef burger by panelists consists of students and professors specialized in this field in the Department of Food Sciences - College of Agricultural Engineering Sciences - University of Baghdad, who have the desire and experience in the field of sensory evaluation of meat products. They were provided with information about the nature of the evaluation of the tested sensory attributes based on the evaluation form mentioned by (26) with a slight modification, as the attributes of color, tenderness, flavor, juiciness, and overall acceptability were evaluated using a 9-hedonic scale ranging from 9 (very desirable) to 1 (very undesirable). The evaluation time, cooking temperature, size of the sample submitted for evaluation, and the time period between one evaluation and another were taken into account. Pieces of bread and a cup of water were provided between one evaluation and another to each of the panelists. The evaluation process was carried out immediately after grilling using a special grill after coating it with oil at a temperature of 180°C, provided that the temperature of the center of the disc is not less than 80°C to achieve homogeneous grilling.

Statistical analysis

The statistical program SAS- statistical analysis system was used to analyze the data to study the effect of different treatments on the studied characteristics according to a completely randomized design (CRD), and the significant differences between the means were compared by choosing the least significant difference (LSD) (27).

3. Results and discussions

Khastawi date seeds´ extract Yield

The results showed that the yield of the alcoholic extract of Khastawi date seeds was 9.24%. The high yield of the alcoholic extracts may be attributed to the high content of compounds which are soluble in alcohol comparing with water, and accordingly it was used in subsequent experiments to manufacture beef burger.

Effect of date seeds alcoholic extract fortification on beef burger stored in the refrigerator

Effect on pH values

Table (1) shows the effect of Khastawi date seeds alcoholic extract fortification on the pH values of beef burger samples stored in the refrigerator. The statistical analysis results showed a significant decreased in the pH values for the 0.2% seed extract-fortified beef burger samples (pH= 6.1) after 10 days of storage, compared with that of the control sample (pH= 6.9). It was noted that the higher the extract fortification ratio, the lower the pH values.

Table (1) Effect of Khastawi date seeds alcoholic extract fortification on the pH values of beef burger stored in the refrigerator

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	5.91	5.95	6.3	6.9	0.87*
0.10%	5.81	5.83	6.1	6.3	0.59 NS
0.20%	5.76	5.77	5.84	6.1	0.56 NS
LSD value	0.49 NS	0.43 NS	0.55 NS	0.78*	---
* P≤0.05					

The results showed that the pH values increased when the storage duration extended, and this increase is significant in the control sample and insignificant in the date seeds alcoholic extract-fortified beef burger samples. The pH value of the control increased from 5.91 at the zero time to 6.9 after 10 days of the refrigerated storage. This increase in the pH values may be attributed to the internal enzymes and the microbial load that causes protein

degradation and the isolation of amine groups (alkaline) during the storage period. These results are consistent with what [19] found in her study of date seeds and the effect of their extracts on beef burger. In general, pH plays an important role in manufacturing processes, affecting the shelf life, color and quality of meat(28).

The results are consistent with what was found by (28), who noticed a decrease in the pH of beef and lamb with an increase in the concentration of added date seed powder. They stated that the decrease in the pH in the treated samples may be attributed to the occurrence of the glycogen decomposition process as a result of the conversion of glycogen into lactic acid, and that increasing the concentration of added date seed powder leads to accelerating the glycogen decomposition process, which accelerates the reduction in the pH of the meat.

The effect on thiobarbituric acid (TBA) values

Table (2) shows the effect of Khastawi date seeds alcoholic extract fortification on thiobarbituric acid values (TBA) of beef burger stored in the refrigerator. The statistical analysis results showed significant differences between the date seeds alcoholic extract-fortified samples and the control sample in storage periods of 7 and 10 days. The TBA value decreased after 7 days of storage from 0.67 mg malondialdehyde/kg meat for the control sample to 0.36 and 0.34 mg malondialdehyde/kg meat for burger samples fortified with 0.1% and 0.2% seeds extract, respectively. The TBA value decreased after 10 days of storage from 0.89 mg MDA/kg meat for the control to 0.47 and 0.45 mg MDA/kg meat for beef burgers fortified with 0.1% and 0.2% seeds extract, respectively. It is also noted from the results that TBA values in beef burgers decreased when the extract-fortification ratio increased. This may be attributed to the presence of natural antioxidants such as phenolic compounds in the alcoholic extract of Khastawi date seeds, which contribute to reducing oxidation. Phenolic compounds are common primary antioxidants in date seeds, and some polyphenolic compounds such as flavonols accumulate in the seeds of different plants and are responsible for the antioxidant activity (22).

Table (2) Effect Khastawi date seeds alcoholic extract fortification on TBA values of beef burgers stored in the refrigerator (mg MDA/Kg)

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	0.22	0.31	0.67	0.89	*0.375
0.10%	0.21	0.23	0.36	0.47	*0.243
0.20%	0.21	0.22	0.34	0.45	0.226 *
LSD value	0.17 NS	0.135 NS	*0.255	*0.236	---
* P≤0.05					

The statistical analysis results showed that the TBA value increased significantly when the storage duration increased, and this increase was significantly evident in the control sample as the TBA value increased from 0.22 mg MDA/kg at the zero time to 0.89 mg MDA/kg on the tenth day of the refrigerated storage. The reason of this increase in TBA is the occurrence of fat oxidation, considering that TBA estimation is one of the most common tests for measuring fat oxidation in meat and its products [25]. The results obtained are consistent with what was stated in the Iraqi standard specification issued by the (29) related to chilled and frozen red meat and poultry products, which confirmed that the TBA value should not exceed 2 mg MDA/kg meat, otherwise the meat is rejected. (30)reported that TBA values ranging from 0.202-0.664 mg MDA/kg are indicative of meat freshness.

The effect on the total bacterial count

Table (3) shows the effect of Khastawi date seeds alcoholic extract fortification on the total bacterial count in beef burgers stored in the refrigerator. The statistical analysis results showed significant differences for beef burgers fortified with date seeds alcoholic extract after 7 and 10 days of the refrigerated storage. The total bacterial count decreased after 7 days to 7.4×10^3 and 6.8×10^3 (cfu/g) in the beef burgers samples fortified with 0.1 and 0.2% alcoholic extract, respectively, compared to those of the control sample in the same period of time, which was 12×10^3 (cfu/g). After 10 days of refrigerated storage, the total bacterial count decreased from 3×10^3 for the control

treatment to 7.5 × 10^3 and 7.2 × 10^3 (cfu/g) for beef burgers fortified with 0.1 and 0.2% of date seeds alcoholic extract, respectively.

Table (3) Effect of Khastawi date seeds alcoholic extract of on the total bacterial count (cfu/g) in beef burgers stored in refrigerator

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	7.5×10^3	$910^3\times$	$1210^3\times$	$1310^3\times$	13.92*
0.10%	$710^3\times$	$7.210^3\times$	$7.410^3\times$	$7.510^3\times$	8.43 NS
0.20%	$6.510^3\times$	$6.610^3\times$	$6.810^3\times$	$7.210^3\times$	7.37 NS
LSD value	7.56 NS	7.502 NS	12.22*	12.47*	---
* P≤0.05					

It is noted that when the concentration of the extract increases, the bacterial count decreases, and that the bacterial count increases significantly with the storage period extending in the control sample and increases insignificantly with its extending in the extract-fortified samples. The reason for this decrease in the bacterial count is due to the effective compounds against bacteria that the extract contains, especially phenolic compounds such as Rutin, Kempferol and Catechin (31) found that phenolic compounds in ginger lead to a reduction in the total count of bacteria, which leads to an extension of the shelf life of manufactured beef burger (32).

Effect on the diameter shrinkage

Table (4) shows the effect of date seed extract fortification on the diameter shrinkage percentage of beef burger samples stored in the refrigerator. The results showed a significant decrease in the diameter shrinkage percentage of beef burger samples, as the diameter shrinkage percentage in the zero time for the control sample reached 15.6%, while it decreased to 10.7% and 10.3% in the 0.1% and 0.2% extracts-fortified samples, respectively. The diameter shrinkage percentage for the control sample increased after 3 days of storage to 15.9%, while decreased in the extract-fortified samples at concentrations of 0.1% and 0.2% to 11.1% and 10.6%, respectively. The diame-

ter shrinkage percentage for the control increased after 7 days of storage, as it reached 16.4% and decreased in the extract-fortified beef burgers treated with extracts at concentrations of 0.1% and 0.2% to 11.5% and 10.9%, respectively. After 10 days of storage, the percentage of shrinkage in diameter increased for control treatments to 17.1%, while it decreased for samples fortified with the extract at concentrations of 0.1% and 0.2% to 11.9% and 11.5%, respectively. The reason for the high shrinkage percentage is due to the increased loss of moisture and fat during cooking, which is reflected in the weight and percentage of shrinkage in diameter. The results are consistent with what (33) reached in their study to improve some functional and nutritional properties of beef burgers using marjoram herb.

Table (4): Effect of Khastawi date seeds alcoholic extract on the diameter shrinkage (%) of beef burgers stored in the refrigerator

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	15.6	15.9	16.4	17.1	2.26 NS
0.10%	10.7	11.1	11.5	11.9	2.47 NS
0.20%	10.3	10.6	10.9	11.5	1.94 NS
LSD value	2.96*	2.88*	3.08*	3.27*	---
* $P \leq 0.05$					

The effect on the cooking yield

Table (5) shows the effect of date seed extracts fortification on the percentage of cooking yield of beef burgers stored in the refrigerator. The statistical analysis results show a significant increase in the cooking yield of the fortified beef burgers compared to the control sample. The cooking yield percentage for the control at the zero time was 72%, which is less than those of the samples fortified with 0.1% and 0.2% seed extract that gave a cooking yield percentage of 75.6% and 76.5%, respectively, in the same period. However, the cooking yield for the control reached 71.3% after 3 days of storage, and decreased after 7 and 10 days of storage to 70.1% and 69%, respectively. The cooking yield increased in the

extract-fortified samples at concentrations of 0.1% and 0.2% after 7 days of storage to 75.2% and 76.1% respectively, while after 10 days it reached 75.1% and 75.9% respectively. The decrease in the cooking yield with the storage time extending is due to the increase in moisture and fat loss during cooking. The results are consistent with what (21) reported in their study on the effect of basil seed gum on the sensory and qualitative characteristics of beef burgers and also consistent with what was found by (19).

Table (5): The effect of Khastawi date seeds alcoholic extract fortification on the cooking yield (%) of beef burgers stored in the refrigerator

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	72	71.3	70.1	69	3.37 NS
0.10%	75.6	75.3	75.2	75.1	2.55 NS
0.20%	76.5	76.2	76.1	75.9	2.48 NS
LSD value	4.41*	4.82*	4.89*	5.06*	---
* P≤0.05					

Effect of adding alcoholic extract of Khastawi date seeds on the water holding capacity of beef burgers stored in the refrigerator

Table (6) shows the effect of date seeds extract on the water holding capacity of beef burgers stored in the refrigerator. The results showed a significant decrease in the water holding capacity with the increase in storage time in the control treatment and the 0.1% treatment and an insignificant decrease in the 0.2% treatment.

Table (6): Effect of Khastawi date seeds alcoholic extract fortification on the water holding capacity (%) of beef burgers stored in the refrigerator

Sample	Storage duration (days)				LSD value
	0	3	7	10	
Control	17.2	16.2	14.6	12.6	3.58*
0.10%	18.4	17.8	16.4	15.7	2.60*
0.20%	18.8	17.9	16.6	16.4	2.43 NS
LSD value	2.19 NS	2.06 NS	2.11 NS	3.05*	---
* P≤0.05					

The results also showed that fortification with the extract led to an increase in the ability of the beef burgers to hold water in an ascending manner according to the increase in the extract added concentration. The water holding values for the control sample in the zero time was 17.2% and increased in the other samples to 18.4% and 18.8% for the 0.1% and 0.2% extract fortified samples, respectively. After 10 days of storage, the water holding capacity in the control was 12.6% and increased in the same period for the samples fortified with 0.1% and 0.2% extract to 15.7% and 16.4%, respectively. The ability of meat to hold water is an important physical property that has a significant effect on the quality of meat and affects the juiciness (20) . The high-water holding capacity of beef burgers fortified with date seed extract may be attributed to the extract's content of antioxidant phenols that protect fats from oxidation by inhibiting the activity of free radicals resulting from oxidation and reducing the permeation of cell membranes surrounding muscle fibers, which increases the ability of meat to hold water. These results are consistent with what (11) found in their study on the effect of tomato lycopene on the chemical and physical properties of beef burgers.

Effect on the sensory evaluation

Table (7) shows the sensory evaluation of beef burgers fortified with Khastawi date seeds alcoholic extract after (zero, 3, 7 and 10) days of storage in the refrigerator, respectively. A significant increase observed in the color characteristic of the fortified beef burgers compared to the control along with increasing the extract concentrations. It is believed that this improvement in color is a result of reducing the transformation in the myoglobin dye as a result of the preservative action of the extract compounds.

The table shows that the flavor values increased significantly over the control at all periods, and the improvement in flavor may be due to reducing oxidation reactions by the extracts. An increase in the values of juiciness and tenderness was also observed for burger samples fortified with the extract. This increase is significant and it is a result of reducing cooking losses and increasing the water load of the meat. The tables show that the overall acceptance of the burger samples fortified

with the extract increased significantly due to the improvement in color, juiciness, aroma and tenderness. Appearance and color are among the most important sensory characteristics in the consumer's choice of meat and meat products, and texture plays an important role in the final judgment on the quality of meat products (34).

Table (7) Sensory evaluation of Khastawi date seeds alcoholic extract fortified beef burgers stored in the refrigerator at different storage periods..

Day0					
Sample	Color	Flavor	Juiciness	Tenderness	**Overall acceptance**
Control	7	7	7	8	**7**
%0.10	8	9	8	8	**8**
%0.20	9	9	8	9	**9**
LSD value	1.53	1.47*	1.05NS	1.14NS	**1.55***
Day3					
Control	7	7	7	7	7
%0.10	8	8	8	8	8
%0.20	9	9	9	9	9
LSD value	1.53*	1.53*	1.53*	1.53*	1.53*
Day7					
Control	7	7	7	7	7
%0.10	8	8	8	8	8
%0.20	9	9	9	9	9
LSD value	1.53*	1.53*	1.53*	1.53*	1.53*
Day10					
Control	7	6	7	7	6
%0.10	8	8	8	8	8
%0.20	9	8	9	9	8
LSD value	1.53*	1.38 *	1.53*	1.53*	1.38*
* P≤0.05					

Conclusion

The ethanolic extract of the Khastawi date seeds showed good antibacterial and lipid antioxidant activities, improved each of sensory properties, cooking yield, and water holding capacity of beef burger, and reduced burger shrinkage.

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