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**Research Article**

# EFFECT OF ADDING BASIL ESSENTIAL OIL ON CAMEL MEAT BURGER'S SHELF LIFE DURING STORAGE AT FOUR °C FOR NINE DAYS

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**Abstract**

The Effect of basil essential oils on camel meat burgers' quality and shelf life during storage was evaluated. Basil essential oils were selected at a concentration of 10,25, 50 ul. For types of camel, meat burgers were prepared: without essential oil, three burgers with basil essential oil at a concentration (10ul, 25ul, 50ul) stored at 4 C for nine days. Physicochemical and microbiological analyses were carried out periodically throughout storage. The addition of basil essential oils did not affect the evolution of the pH, the moisture content. The basil essential oil managed to slow down the increase of ACC to 6 days slightly. The samples with basil essential oil showed increases of TBA during storage time. Though, no noticeable improvement was observed in the shelf life of the burgers with basil essential oil. It would be too needed to increase the concentration of Essential basil oils on the condition for consumer acceptability.

**Keywords:** Essential oil, Basil, Shelf life, Camel meat, Burger.

## INTRODUCTION

Camel meat is an important source of animal protein in many Asian countries, expressly in areas where the climate adversely impacts other animals' production efficiency. Many Asian countries prefer camel meat to different animal meat kinds because of its medicinal benefits and accessibility (Bekhit and Farouk 2013). Camel meat is healthier because the carcass contains less fat and has lower levels of cholesterol in the fat than other meat animals. Camel meat is also relatively high in polyunsaturated fatty acid in comparison to beef (Askale and Samson, 2017). Essential oils are defined as easy-volatile oil extracted from distillation or evaporation of plants or parts of plants such as (leaves, seeds, stems, bark). It also contains many chemical compounds, and this gives the oil its characteristic fragrance and flavor (UNIDO and FAO, 2005). Essential oils can also contribute to control the growth of both spoilage and pathogenic microorganisms. The antimicrobial activity and antioxidants of essential oils are the in consequence of the phenolic compound's high concentrations like (Thymol, Carvacrol, Eugenol) (Miroslava *et al*., 2019). Basil has pharmacological and economic value and is an important culinary herb. It contains a high proportion of phenolic derivatives, including eugenol and linalool, reported having been used as prooxidants and antioxidants (Kačániová, 2016). Basil essential oil's antibacterial activity is attributed to its high content in linalool and estragole, whereas the antimicrobial spectrum is restricted to Staphylococcus, E. coli. (Hercules and Chrissanthy, 2017).Oregano essential oil is one of the many plant extracts with strong antioxidant effects when added to the meat. The contents of oregano oil, polyphenol; Carvacrol, thymol, p-cymene, and γ-terpinene are the major components responsible for the antioxidant activity oregano essential oil (Al-Hijazeen *et al.,* 2016). The present study's objective was to add basil essential oil on the shelf life of camel meat burgers during storage at four °C for nine days.

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## MATERIALS AND METHODS

### Meat

The camel meat is obtained from the local market in the Qassim region. Fresh lean camel meat muscle (shoulder, age 12 months) obtained from the slaughterhouse. The samples were mince using meat minced (Home mincer) and minced meat used for the processing of camel burger.

**Essential oil**: The essential oil was obtained from Mamlakat altabiea Prince Mohammed bin Abdulaziz Street - Jeddah - Saudi Arabia. Essential oils, Basil (*Ocimum basilicum* L.).

**Preparation of camel burger samples:** The camel burger samples (A1, A2 ,and A3) were prepared as follows: mixing minced camel meat with Spices, Breadcrumbs, Chickpeas flour, and Basil Essential oil. Table (1) the burger (100 g) formed using a burger press after each sample's preparation was individually packaged in polyethylene bags stored at four °C.

**Table 1. Camel burger samples (100g)**

| Ingredients | A1 | A2 | A3 |
|---|---|---|---|
| Minced camel meat. | 70 | 70 | 70 |
| Fat | 15 | 15 | 15 |
| Salt | 2 | 2 | 2 |
| black pepper | 1 | 1 | 1 |
| onion | 1 | 1 | 1 |
| garlic | 1 | 1 | 1 |
| Chickpeas flour | 5 | 5 | 5 |
| Breadcrumbs | 5 | 5 | 5 |
| Basil Essential oil | 0.01 | 0.025 | 0.05 |

A1 = Camel burger sample containing 0.01 ml (10 µl) Basil Essential oils.
A2 = Camel burger sample containing 0.025 ml (25µl) Basil Essential oils.
A3 = Camel burger sample containing 0.05 ml (50 µl) Basil Essential oils.

### Chemical analyses

- Moisture, fat, protein, ash, and pH were determined in burger camel meat (after preparation burger at 0 days) according to (AOAC 2007).

- Measurement of Thiobarbituric acid According to (Ahn *et al*., 1998), meat (5g), 15mL of deionized distilled water (DDW), and 50 µL BHT (7.2%) were added to a 50-mL test tube and homogenized using a Polytron for 15 s at high speed. The meat homogenate (1mL) with the solution (15m MTBA/ 15% TCA, 2mL) was vortex-mixed and incubated in a boiling water bath for 15 min to develop color. After refrigeration for 10 min in ice-water, the samples were mixed again and then centrifuged for 15 min at 2500 × g at four °C. The supernatant was collected, and the absorbance read at 532 nm against a blank containing 1 mL of DDW and 2 mL of TBA/ TCA solution. Thiobarbituric acid values expressed as mg of malondialdehyde per kg of meat.

**Microbiological analysis**

- **Aerobic colony bacterial count (ACC):** The aerobic colony count (ACC) was carried out as the conventionalmethod using plate count agar (Oxoid). After 48 ± two h incubation at 35± one °C, colony-forming units were accounted for and calculated per gram of sample.According to (FDA 2002).
- **Detection of *Escherichia coli*:** Samples dilutions were spread onto plates of medium Sorbitol Mac Conkey agar (Oxoid, England). After 18-24h at 35° C incubation, sorbitol harmful colonies (pale-colored, typical *E. coli*) were serologically testing, according to (FAD 2002).

**Physical analys:** Instrumental Color Determination: According to (Falowo *et al.,* 2019).

- Cooking loss: according to (Dreeling *et al.,* 2000).
- Water holding capacity and plasticity: According to (Wierbicki and Deatherage, 1958).

**Sensory evaluation**

The sensory evaluation form was designed. A 9-mark hedonic scale (9=Excellent, 8=Very very good, 7=Very good, 6=Good, 5=Medium, 4=Fair, 3=Poor, 2=Very poor, 1=Very very poor) used for the valuation of the overall Acceptability. According to (Pearson and Tauber, 1984), Cooked burger and raw camel burger samples were presented to 20 trained and untrained faculty members of the College of Agriculture and Veterinary Medicine.

**Statistical analysis**

The data analyzed using a two-way analysis of variance that was conducted on the experimental results and was multiple comparisons of the means were carried out by using Tukey's test with significance level $p < 0.05$, employing the SPSS Statistical Software, v. 22.0. according to (Hernández-Hernández *et al.,* 2019)

## RESULTS

**Chemical composition of a camel meat burger**

The raw camel meat burger (cold for nine days) is tabulated in a table (2) showed protein, fat, ash, Moisture, and carbohydrate. Results in table (2) Indicated that camel meat contained moisture ranges from (61% to 63 %); these results Disagreed with (Ahmed *et al.,* 2000). Found the camel products were higher in Moisture (73.6%) due to the meat cut change. And agree with (Kadim *et al.,* 2014) found the Moisture from 63% to 79%, depending on the type of camel and the muscle. Protein and fat contents dictate the manufacturing quality of meat. The fat Ranges from 17.7 to 18 %, and the protein range between 15 -16 %. ash ranges 3 to 4.15, on a fresh 100 weight basis, respectively. (Elgasim and Elhag, 1992) found the Camel meat has fat content (2, 6%) that is lesser than that of beef (4, 7%). And (Kadim *et al*., 2008) found the protein content ranges from 20 to 23% (Ahmed *et al*., 2000). Found the ash in camel products (4.13%). According to GCC STANDARDIZATION ORGANIZATION (GSO) (2017), burger meat's moisture content 70 %, and the ash % does not increase.

**Table 2.Chemical composition of a camel meat burger**

| Chemical composition | Control | A1 | A2 | A3 |
|---|---|---|---|---|
| Fat | 17.7 | 18 | 18 | 18 |
| Protein | 16 | 16 | 16 | 15 |
| Ash | 3.08 | 4.15 | 3 | 3 |
| Moisture | 62.62 | 61.1 | 61 | 63 |
| Carbohydrate | 0.59 | 0.7 | 2 | 1 |

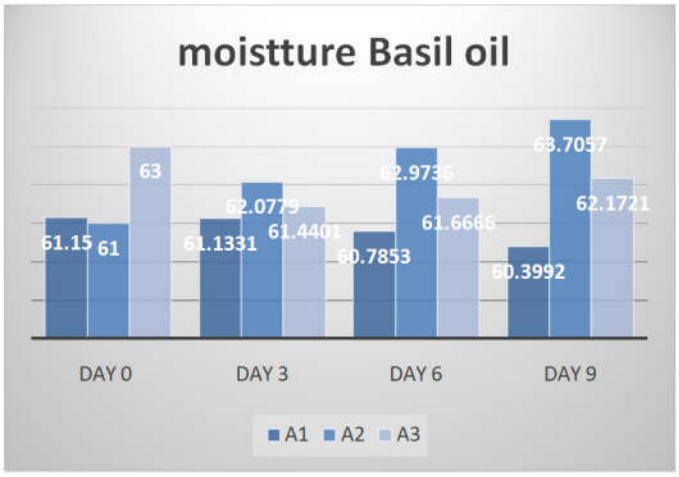


**Fig. 1. Affect Moisture on control sample for a camel burger**

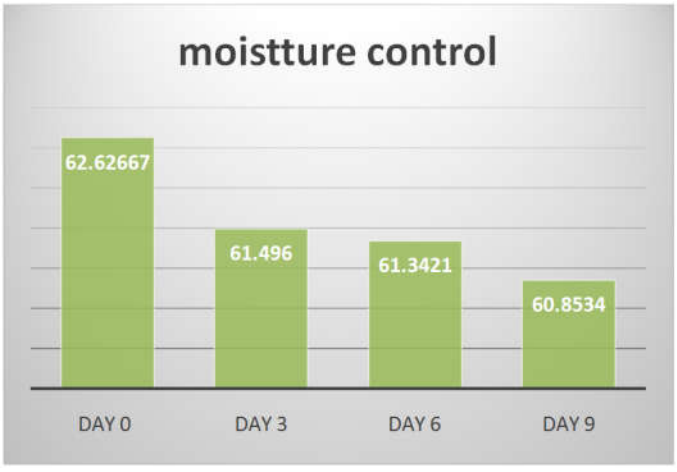


**Fig. 2. Affect Moisture on Basil oil sample for a camel burger**

From all results in Fig(1) and (2), it could be noticed that the moisture content of all the samples (control, A1, A2, A3) at zero-time storage was between 61-63 on a fresh weight basis. Results in Fig(1) showed that the control sample's moisture content dropped at the rate of 1.77 at the progression of cold storage (4° c) at nine days. Results in Fig(2) showed that A1

and A3 samples' moisture content decreased with cold storage progression (4° c) at nine days by 0,65 %, 0.82 %, Respectively of its initial value. The reason is due to Chilled meats and thawed meat products have less Moisture than fresh products. Fig(2) presented that moisture content at zero-time storage of the A2 was 61% at zero time. However, moisture content rises to a rate of 2.70 % in cold storage (4° c) to 9 days. (Yam *et al.,* 2015) Found the Moisture rises from 65,50 in raw camel meat to 78.8 % in hamburger contains 60% camel meat


**Fig. 3. Effect PH on control sample for a camel burger**

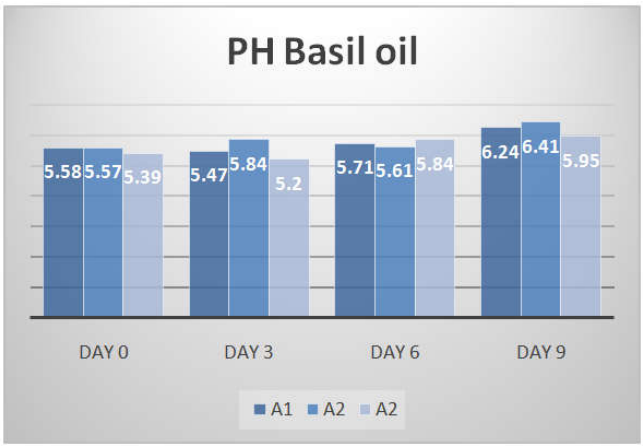


**Fig. 4. Effect PH on basil oil sample for a camel burger**

The Fig(4) illustrated that the PH content at zero-time storage 5.58 % in the A1 sample, 5.57 % in the A2 sample, and 5.39 in A3. Results showed that extending storage time samples to 9 days at four °c was accompanied by a remarkable increase in the PH content regardless of the type of additives used. The results became 6.24, 6.41, 5.95 for A1, A2, A3 respectively that there is a fixed PH percentage pattern, which is increases as the period of storage increases this result in disagreement with that reported by (Karoui & Hassoun, 2017) found significantly lower pH values were observed for the basil group in Mackerel compared to the control groups suggesting that the basil EO treatment may delay pH probably due to antimicrobial effects. Results Fig (5), (6) showed that extending storage time of uncooked prepared samples for nine days at 4°c was accompanied by an increase in TBA level to 3.51malonaldhyde/kg for control sample while samples to additive basil oil were 4.83, 3.88, 4.55 malonaldehyde/kg A1, A2, A3 respectively this result agreed with that reported by (Sharafati-Chalesht ori *et al.,* 2015) found the highest TBA values in the basil oil beef burger 0.25% treatment after day 1.

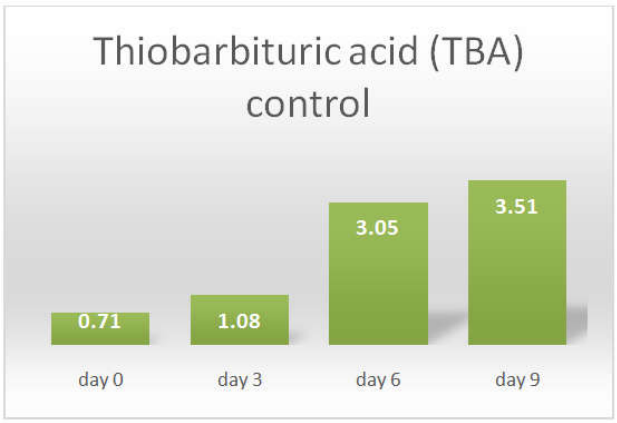


**Fig. 5. Effect Thiobarbituric acid on control sample for a camel Burger**

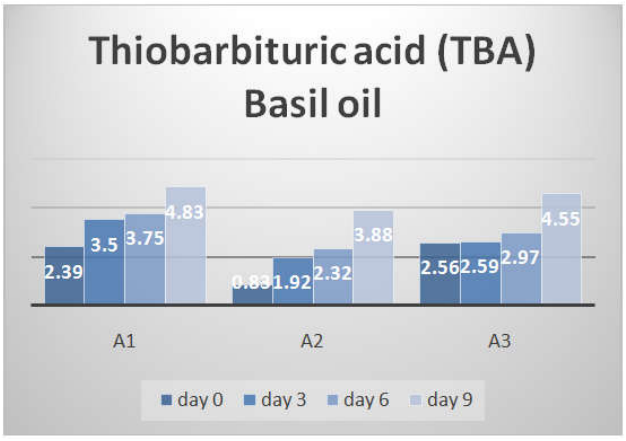


**Fig. 6. Effect Thiobarbituric acid on Basil oil sample for a camel Burger**

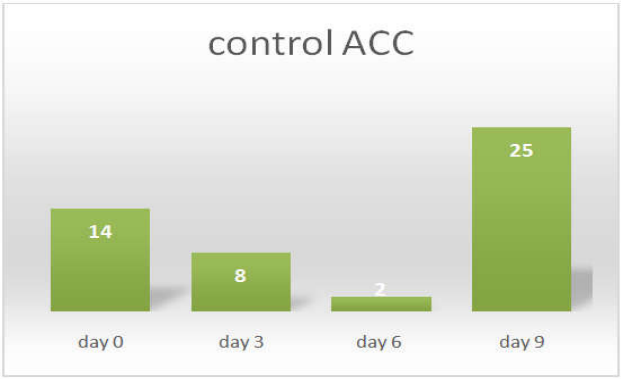


**Fig. 7. Affect ACC on control sample for a camel burger**

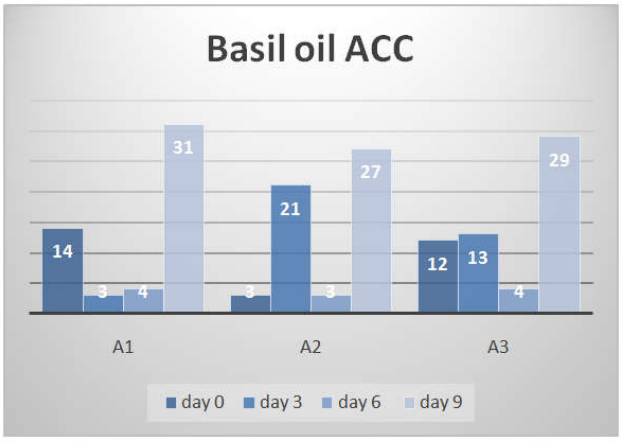


**Fig. 8. Affect ACC on Basil oil samples for a camel burger**

Results in Fig (7) and (8) showed that ACC of the prepared camel burger (control) at zero-time 14 * 10^ (-4) and rise 25* 10^ (-4) at 9day storge. The ACC of the prepared camel burger with additives basil oil was 14, 3, 12 * 10^ (-4) at zero-time storage but register ◌ACC on day three and day 6 Significant decrease increased to 31, 27, 29 *10^ (-4) On a ninth day. A1, A2, and A3, respectively.

***Escherichia coli* detection**

we found that No *E. coli* appearing for nine days storages for all samples control and sample basil and oregano oil with different concentration and this result conform with specifications of Saudi Arabia (Microbiological Standards, 2017 ) and (Sienkiewicz *et al.,* 2013 ) found in research The basil oil showed inhibitory activity against E. coli .and (Boskovic *et al.,* 2019 ) is foundfilms obtained from alginate-based nanoemulsions loaded with TEO exhibited strong antibacterial effects against E. coli and reduced the count of these bacteria by 4.71 logs within 12 h,

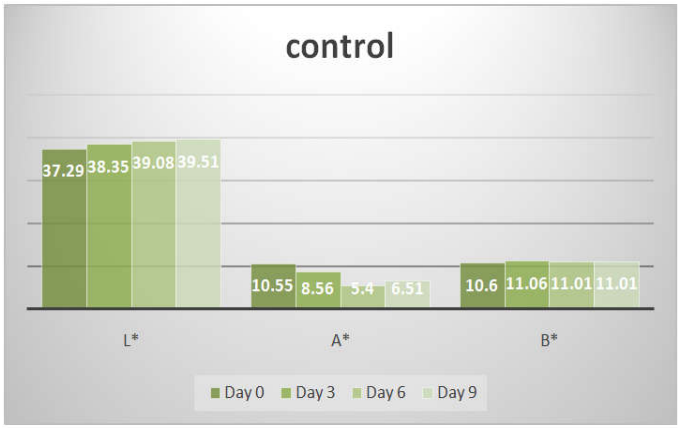


**Fig. 9. Effect color on control sample for a camel burger**

The color of meat is one of the major factors influencing the consumer's choice in the supermarket. Results in Fig(10,11, 12) showed that the color of the camel meat at zero-time storage ranged from 39.62 for the A1 sample to 36,24 for the A2 sample and 39.11 for A3 for the "L*" value and ranged from 8.13 for the A1 sample to 8.97 for A2 sample and 8.51 for A3 sample for "a*" value and ranged from 10.4 for A1 sample to 10.66. for A2 sample and 11.26 for A3 sample for "b*" value in all camel meat basil oil formula. On the other hand, results in the same finger indicated that progression of cold for nine days at 4°c of the prepared camel meat with basil oil samples caused a sharp decrease in "a*" value to 4.22 for A1 sample (%basil oil) – 5,51 for A2 sample (basil oil %) and 4.54 for A3. this result agreed with that reported by (Falowo *et al.,* 2019) in their study also found higher a-value in ground beef from boran and Nguni cattle treated with basil essential oil compared to control and the " L*" value of the nine days stored camel samples was (higher "L*" value) than that of the freshly prepared burger samples since it reached 41.43 for A1. sample (basil oil) to 39,73for A2 sample and 40.65 for A3 in all camel meat burger with basil oil formula. The "b*" value of the nine-day stored camel meat burger basil oil, 11,14 for A1 sample – 9.53 for A2 sample and 10,73 for A3 in all basil oil formula. This result agreed with that reported by (Falowo *et al.,* 2019) found increased L -value in ground beef from boran and Nguni cattle treated with basil essential oil during cold storages for seven days.

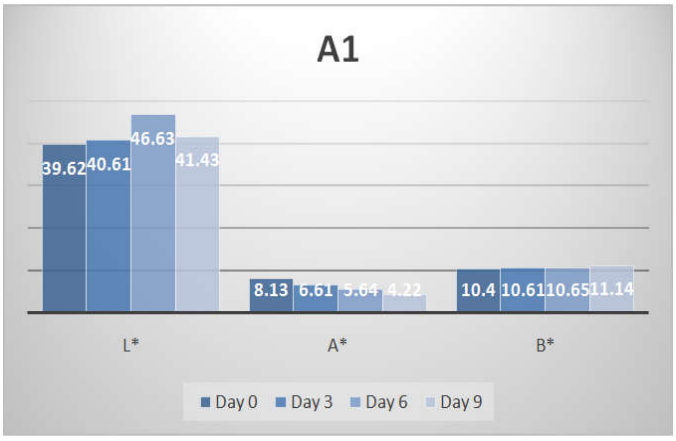


**Fig. 10. Effect color on BASIL oil A1 sample for a camel burger**

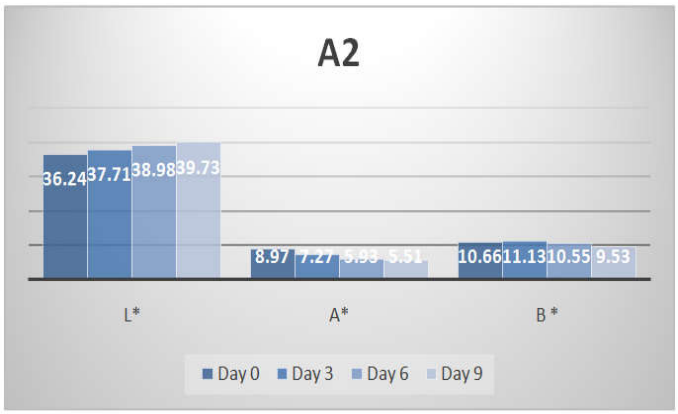


**Fig. 11. Effect color on BASIL oil A2 sample for a camel burger**

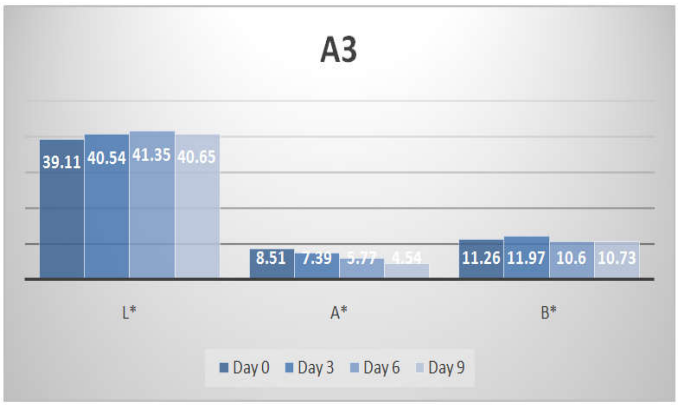


**Fig. 12. Effect color on BASIL oil A3 sample for a camel burger**


**Fig. 13. Effect cook loss on control sample for camel burger**

**Table 3. Data sensory evaluation before cooking**

| Aspects | Mean | Out of | Evaluation |
|---|---|---|---|
| Color | 6.21 | 9 | Good |
| Oder | 6.46 | 9 | Good |
| Texture | 6.89 | 9 | Good |
| Appearance | 6.86 | 9 | Good |
| Overall Acceptability | 6.18 | 9 | Good |

**Table 4. Data sensory evaluation before cooking for the control sample**

| Days | Color | de Oder r | Texture | Appearance | Overall Acceptability |
|---|---|---|---|---|---|
| Evaluation | 6 | 7 | 7 | 6.75 | 6.75 |
| Evaluation | Good | Very Good | Very Good | Good | Good |

**Table 5. Data sensory evaluation before cooking for basil oil**

| Days | Color | de Oder r | Texture | Appearance | overall Acceptability |
|---|---|---|---|---|---|
| Evaluation | 6 | 6.583333333 | 7 | 6.75 | 6.25 |
| Evaluation | Good | Very Good | Very Good | Very Good | Good |

**Table 6. Data sensory evaluation before cooking for basil oil with concentrate**

| | Color | de Oder r | Texture | Appearance | overall Acceptability |
|---|---|---|---|---|---|
| A1 | 6 | 7 | 7 | 6.75 | 6.25 |
| | Good | V Good | V Good | V Good | Good |
| A2 | 6 | 6.75 | 7 | 6.75 | 6.25 |
| | Good | Good | V Good | Good | Good |
| A3 | 6 | 6 | 7 | 6.75 | 6.25 |
| | Good | Good | V Good | Good | Good |

**Table 7. Data sensory evaluation after cooking**

| Aspects | Mean | Out of | Evaluation |
|---|---|---|---|
| Color | 7.44 | 9 | V good |
| Hardness | 6.74 | 9 | Good |
| Chewiness | 6.59 | 9 | Good |
| Juiciness | 6.67 | 9 | Good |
| Flavor | 6.49 | 9 | Good |
| Overall Acceptability | 6.28 | 9 | Good |

**Table 8. Data sensory evaluation after cooking for the control sample**

| Cmn1 | Color | Hardness | Chewiness | Juiciness | Flavor | Overall Acceptability |
|---|---|---|---|---|---|---|
| Evaluation | 8.05 | 7.55 | 7.45 | 7.95 | 8.25 | 7.5 |
| Evaluation | VV Good | V Good | V Good | V Good | VV Good | V Good |

**Table 9. Data sensory evaluation after cooking for basil oil**

| Cmn1 | Color | Hardness | Chewiness | Juiciness | Flavor | Overall Acceptability |
|---|---|---|---|---|---|---|
| A1 Evaluation | 8.1 | 7.55 | 7.2 | 7.55 | 7.3 | 7.1 |
| A2 Evaluation | 7.5 | 6.9 | 7 | 6.95 | 7 | 6.7 |
| A3 Evaluation | 6.55 | 5.75 | 5.65 | 5.6 | 4.6 | 4.95 |
| Basil Oil Evaluation | 7.383 | 6.733 | 6.616 | 6.7 | 6.3 | 6.25 |
| Basil Oil Evaluation | V Good | Good | Good | Good | Good | Good |

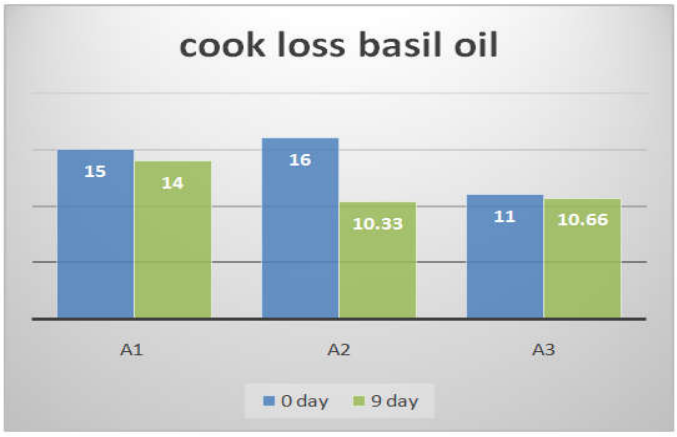


**Fig. 14. Effect cook loss on basil oil sample for camel burger**

Fig (13, 14) showed the cooking loss of the prepared camel burger (control) at zero time 13 % and 12 % at 9day storge. Cooking loss of the prepared camel burger with additives basil oil was between 16- 11% at zero-time storage and 14 -10 % at 9day storage. Loss of weight occurred during cooking mostly due to Moisture. This result agrees that (Ibrahim and Nour, 2010) found the decrease in cooking loss was not significant. The A2 had the highest cooking loss among the samples, probably because more fluid was lost during cooking due to the higher fat content; this result agrees with that reported by (Yam *et al.,* 2015), which found decreased cooking loss was significant. WHC of control and samples were determined during cold storage at 4°c for nine days and resulted in a finger (15,16). The Fig showed that the area of water released from camel burger samples was 4.5 at zero time and 4.6 in the last storge time. Though camel burger samples whit different

concentration basil oil was (A1, A2, and A3) 4.3 4.2, 5.4 respectively and decrease to 4.1,4.2, 4.2 respectively after nine days of storage at 4°c indicating high WHC.


**Fig. 15. Affect WHC on CONTROL sample for a camel burger**

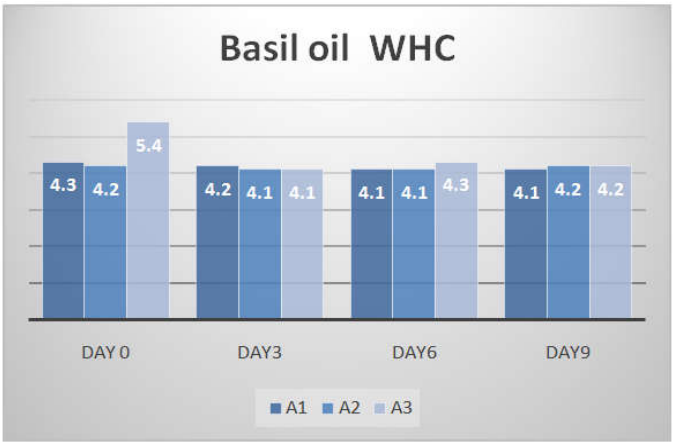


**Fig. 16. Affect WHC on BASIL OIL sample for a camel burger**

**Sensory evaluation**

**The sensory effect evaluation before cooking burger**

Table (3) describes the mean and evaluation of each aspect of the food before cooking, we found that we have a good overall evaluation before cooking. We can also find that we have a good evaluation for three out of the four aspects: oder, texture, appearance, and color. From the table (4), which describes the mean and evaluation of each aspect of the food before cooking for the control sample, we found a good overall evaluation before cooking. We can also find that we have a very good evaluation for three out of the four aspects: oder and texture, while we have a good evaluation of the color and appearance. The table (5) and (6), which describes the mean and evaluation of each aspect of the food before cooking for basil oil and his concentrations (A1, A2, A3), we found a good overall evaluation before cooking for basil oil.

**The sensory effect evaluation after cooking the burger**

Table (7) describes each food aspect's mean and evaluation after cooking; we found a good overall evaluation after cooking. We can also find that we have a good evaluation for four out of the four aspects: hardness, chewiness, juiciness, and flavor, while we have only one very good evaluation of the color. The table (8) and (9), which describes the mean and evaluation of each aspect of the food after cooking for basil oil and his concentrations (A1, A2, A3), we found that we have a good overall evaluation after cooking for basil oil in general and very good evaluation for A1 and good for A2, but only concentrate (A3) has a Fair overall evaluation.

**Conclusion**

Meat and meat product is very exposed to microbial, which affects the safety and quality characteristics. Fat oxidation is the cause of deterioration in meat quality during storing it and processing it; Basil essential oils showed good antimicrobial properties against E. coli and ACC at (10, 25, 50 ul) concentration. However, basil Eos may be an instrument for extending camel meat's shelf life and keeping their quality for a longer time. We recommend a concentration between 10 and 25 ul of basil oils to be tested for consumer acceptability

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