



## **Effect of Freezing Storage Period on the Physical Properties and Sensory Characteristics of Sausages Manufactured From Camel Meat**

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### **ABSTRACT**

The objective of the present experiment was to evaluate the effect of freezing storage period (0, 7, and 14 days at -18°C) on the physical and sensory characteristics of camel sausages. Twenty kilograms of fresh camel meat and 3kg of camel subcutaneous fat which purchased directly from market were used. PH, oxidative rancidity (TBA value), cooking loss, water holding capacity (WHC), objective color and sensory evaluation were determined. Data were statistically analyzed using analysis of variance by SPSS version 10.05-computer program. Increasing the storage period from day one to 14 days at -18°C resulted in a significant ( $P<0.05$ ) improvement of the WHC, increase of the PH and oxidative rancidity-TBA values. Cooking loss, drip loss percentages and lightness ( $L^*$ ) decreased significantly ( $P<0.05$ ) while shrinkage and redness ( $a^*$ ) decreased not significantly. Sensory panel rating of tenderness, juiciness and acceptability increased not significantly with increasing the added level of camel meat and aging period. Colour and flavour were more desirable at day 1 and 7 than at 14 days.

**Keywords:** Camel Meat, Sausage, Freezing, Quality properties

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### **INTRODUCTION**

Camel meat is described as tough, coarse, watery and sweetish in taste which may be attributed to the fact that camel meat is mainly obtained from old camels. Processing of camel meat increases the tenderness, taste and palatability of the products (Muaawia and Ahmed, 2002). Sausages are manufactured from lower-value meat to produce a higher-value product (Ockerman, 1986). Storage of camel meat for up to seven days resulted in an improvement of the water holding capacity and juiciness of camel meat and products (Kafe, 2001; Fathielrhman, 2005; Ghadam 2008). A high ultimate pH in camel muscles as a result of pre-slaughter stress has an

effect on colour, tenderness, WHC, cooking time, flavor, and drip loss which influences consumer acceptance of dromedary meat (Kadim *et al.*, 2006). The objective of this study was to evaluate the effect of freezing storage period (0, 7, and 14 days at -18°C) on the physical properties and sensory characteristics of sausages manufactured from camel meat.

### **MATERIALS and METHODS**

**Source of experimental meat:** The meat from the round cut and subcutaneous fat of mature camel (4-5) were purchased from Abuzaid meat market (camel meat and 3 kg of fat. Then the samples were labeled wrapped and kept in freezer at (-18°C) over night until used.

**Sausage preparation:** Sausages were prepared according to the procedure of Kramlich *et al.*, (1973) the meat and fat were mixed in the ratio of 80/10. The stuffed casings were divided into links by twisting; 10cm in length. The finished sausages were divided into 3 groups according to the freezing storage periods (0,7 and 14 days) packaged in polyethylene bags and frozen for analysis.

PH values of sausage samples were determined by blending 10 gm of the sample with 100ml distilled water at high speed for one minute before pH measurement on laboratory pH. The sausage colour components lightness (L\*) redness (a\*) and yellowness (b\*) were recorded using Hunter Lab Tristimulus colorimeter model D2 m-2. Subsequently these samples were frozen and stored for cooking loss. Water holding capacity (WHC) was determined according to the procedure described by (Grauard and Hamm, 1953). Cooking loss: The frozen sausage samples were thawed in refrigerator for overnight, weighed and fried in a pan using vegetable oil at constant temperature (90°C) for 5 minutes with continuous turning of the samples then freed from oil using absorbent kitchen paper, allowed to cool, weighed and kept for sensory evaluation. The difference in weight of samples before and after cooking was recorded as the total cooking loss and expressed as a percentage of weight before cooking. The difference in the total length of sausage samples before and after cooking was recorded as the shrinkage and expressed as a percentage of length before cooking. The difference in weights before and after freezing and thawing was taken as drip loss and was expressed as a percentage of weight before freezing. The oxidative rancidity

of sausage samples was determined using 2- thiobarbituric acid (TBA) method as described by Hoyland and Taylor (1989). Samples for sensory evaluations were presented to an eight-member panel for evaluation of colour, tenderness, juiciness and flavour on an 8-point scale, 8 being extremely desirable and 1 being extremely undesirable Parrish *et al.* (1973).

Statistical Analyses: Data were statistically analyzed using analysis of variance using SPSS version 10.05-computer program

## RESULTS AND DISCUSSION

**pH measurement:** PH values increased significantly ( $P < 0.05$ ) with increasing the storage period to 14 days but this increase was not significant ( $P > 0.05$ ) between day zero and seven (Table 1). This might be caused by the increase in concentration of soluble materials and the subsequent precipitation of salt. These results agree also with Fathi El-rhman, (2005) who reported that the PH values of frankfurters increased after 42 days of storage at -18c.

**Water properties:** Increasing the freezing storage period to day 14 resulted in a significant ( $P < 0.001$ ) decrease of the WHC values which means that WHC improved with increasing the storage period (Table 1). This function was reflected on the other water parameters, cooking loss%, shrinkage% and drip loss% which were decreased significantly ( $P < 0.05$ ) with prolonging the freezing storage period to 14 days. This could be due to the superior WHC and low fat content of camel meat which explained the adaptation ability of camel to dry habitat and also due to the protein denaturation during the storage period. These results are in conformity with Nesimi *et al.*, (2003), Kafe, (2001) and Ghada (2008).

**Table 1: Effect of freezing storage period at -18°C on water properties and pH of sausages manufactured from camel meat**

Parameter	Storage period (days)			SE	L S
	0	7	14		
WHC (ratio)	1.39 <sup>c</sup>	1.23 <sup>b</sup>	1.12 <sup>a</sup>	0.02	***
Cooking loss%	18.04 <sup>c</sup>	16.66 <sup>b</sup>	14.30 <sup>a</sup>	0.24	***
Drip loss%	2.54 <sup>c</sup>	2.11 <sup>b</sup>	1.67 <sup>a</sup>	0.11	**
Shrinkage%	8.78 <sup>a</sup>	8.01 <sup>a</sup>	7.09 <sup>a</sup>	0.66	NS
PH	5.59 <sup>a</sup>	5.63 <sup>a</sup>	5.71 <sup>c</sup>	0.03	**
TBA value (mg/ml)	0.03 <sup>a</sup>	0.05 <sup>b</sup>	0.07 <sup>c</sup>	0.01	**

In this and subsequent tables

\*: P<0.05. \*\*: P<0.01. \*\*\*: P<0.001. NS: Non-significant.

SE: standards error of the mean. <sup>abc</sup>Mean values in the same row having different superscripts, differ significantly (P<0.05).

**Oxidative Rancidity:** TBA values increased significantly (P<0.05) with prolonging the freezing storage time of camel meat sausages to day 14 (Table 1). Accordingly oxidative rancidity increased significantly with increasing storage time from day one to day 14. This could be attributed to the differences in the degree of fat saturation. Saturated and unsaturated fatty acids are predominant in meat fat the results were in line with Fathi El-rhman, (2005) and Ghada (2008).

**Objective Colour Measurement:** The Lightness (L\*) values decreased significantly (P<0.05), redness (a\*) decreased not significantly (P>0.05) and the yellowness (b\*) increased significantly (P<0.05) with increasing the freezing storage time from day one

to 14 days (Table 2). But this decrease was not significant (P>0.05) between day one and day seven of the storage period. This means that fresh sausage manufactured with camel meat can maintain its colour for 7days if kept at -18°C. These results were supported by Mona, (2002) and Al-Qadi, (2007).

**Subjective sensory assessment:** Although the sensory panel rating of tenderness, juiciness and acceptability increased with increasing storage time for all the treatments evaluated, the differences were not significant (P>0.05) (Table 3). These findings agreed with Mansour and Ahmed, (2002) who reported that processing of camel meat increase the tenderness, taste and palatability of the products.

**Table 2: Effect of storage period at -18°C on color measurements of sausages manufactured from camel meat**

Parameters	Storage Times (days)			SE	L S
	0	7	14		
Lightness L*	33.78 <sup>a</sup>	32.87 <sup>ab</sup>	32.09 <sup>b</sup>	0.35	**
Redness a*	13.37 <sup>a</sup>	13.36 <sup>a</sup>	12.57 <sup>a</sup>	0.68	NS
Yellowness b*	8.79 <sup>a</sup>	9.76 <sup>b</sup>	10.49 <sup>c</sup>	0.21	**

**Table 3: Effect of freezing storage period at -18°C on sensory evaluation of camel meat sausages**

Parameters	Storage period (days)			SE	L S
	0	7	14		
Tenderness	5.62	5.77	5.80	0.18	NS
Flavor	5.54	5.42	5.33	0.13	NS
Juiciness	5.25	5.65	5.63	0.14	NS
Colour	5.68	5.54	5.25	0.13	NS
Acceptability	5.42	5.65	5.73	0.10	Ns

## CONCLUSION

The result indicated that camel meat had acceptable function properties appropriate for manufacturing emulsion type products, thus camel meat can be processed as beef meat.

## REFERENCES

- Al-Qadi, W. (2007). The daily star Egypt, fifth business roundtable with the government of Egypt turning Egypt into priority market for international business Cairo.
- Fathi-Elrhman, A.S. (2005). *Effect of Fat Type and Packaging Method on Camel Frankfurter*. M.Sc thesis University of Khartoum
- Ghada, A.I. (2008). *Physical and Chemical Properties of Burgers Manufactured with Different Level of Camel Meat*. Msc. thesis, university of Khartoum
- Grauard, F. and Hamm, R. (1953). Techniques for measuring water holding capacity in muscle foods; a review of methodology. *Meat science*, **23**: 235-252.
- Kadim, I.T. Mahgoub O.W., Al-Marzoogi S. Al-Zadjali. K. Annamalai, M.H. (2006). Effects of age on composition and quality of muscle longissimus thoracis of Omani Arabian camel (*Camel dromedarius*). *Meat Science*, **73**: 619-625.
- Kafe, S.L. (2001). Tenderization of desert camel meat. M. Sc, Thesis university of Khartoum.
- Mansour, M.E., and Ahmed, S.M. (2002). Advanced technology in camel meat processing. *Camel News Letter* No (19): 27.
- Mona, K. (2002). *Effect of Refrigeration Storage on the Shelf life of the Processed Meat*. M.Sc. thesis. Faculty of Animal Production, University of Khartoum, Sudan.
- Nesimi, A. and Mukerrem, K. (2003). The influence of marination with different salt concentrations in the tenderness, water holding capacity and bound water content of beef. *Turkish Journal Veterinary and Animal Science*, **27**: 1207-1211.
- Ockerman, H.W, and Leon Crespo, F (1982). Physicochemical changes occurring during storage of precured beef blends at different temperatures and two levels of salt. *Journal of Food Science*, 47(3): 849-857
- Parrish, Jr., F.C., Olson, D.G., Miner, B.E and Rust, R, E (1973) Effect of degree of marbling and internal temperature of doneness on beef rib steaks. *Journal of Animal Science*, **37**: 430 - 434.
- Ikhlas Ahmed Nour, and Mahassin Abd Elgany Elsharif (2015). Effect of Freezing Storage Period on the Physical Properties and Sensory Characteristics of Sausages Manufactured From Camel Meat. *Sud. J. Sci. Tech.* **16**(Suppl.): 49-52.

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