

Shelf Life Improvement of Camel Meat Treated With Potassium Sorbate 0.3%

Hussein, M.A.¹, El-Ghareeb, W.R.¹ and Lotfy, O.O.²

¹Food Control Department, Faculty of Vet. Med., Zagazig University, Zagazig, Egypt

²Vet Clinic, Faculty of Vet. Med., Zagazig University, Zagazig, Egypt

elged2010@yahoo.com

Abstract: This study was performed to evaluate the use of potassium sorbate 0.3% as a preservative for minced camel meat. Fresh camel meat (thigh muscle) (n=80) samples were collected from different butcher shops in Zagazig city, Egypt and examined microbiologically for total mesophilic aerobic plate count, total Enterobacteriaceae count, total *Staphylococcus aureus* count and total mould and yeast count. The log mean values \pm SE of examined microorganisms were log 6 \pm 4.9, log 3.3 \pm 2.1, log 3.3 \pm 2.0 and log 2.5 \pm 1.5, respectively. The effect of potassium sorbate 0.3% on microbial load and sensory characteristics of refrigerated camel meat (4 \pm 1° C) was studied. The results indicated a significant reduction especially in the total mould and yeast count. Thus, the microbiological shelf-life of camel meat was significantly extended to 8 days (samples treated with potassium sorbate 0.3%) as compared to the control samples, meat pH level was maintained and surface discolouration was minimal in treated meat samples as compared to control. On the other hand, this method of preservation is applicable, easy to be transported and prepared, cheap and available in markets. Public health significance of bacterial contamination of camel carcasses was discussed and suggestive measures for improvement of the microbial quality of camel carcasses were mentioned.

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1. Introduction

Camel meat could be a cheap option to meet the growing needs for meat in developing countries, especially for low income population groups. Nowadays, public health concern associated with microbial food safety has arisen. Numerous epidemiological reports have implicated meat and meat products as the major factors responsible for illnesses caused by food-borne pathogens. Highly perishable foods such as meat provide excellent conditions for the growth of hazardous microorganisms. Several studies have been carried out on the physical, chemical characteristics, sensory properties and nutritive values of camel meat (El-Faher *et al.*, 1991; Elgasim and Al-Kanhal, 1992 and Kadim *et al.*, 2008). Camel meat is one of the toughest kinds of meat, and differs from beef in the higher content of connective tissue (Chomanov & Humaliyeva, 1999). Meat has a microbial flora from different sources. Also, several methods have been proposed for decreasing the microbial flora to a standard allowance for increasing the shelf-life and decontamination of microbial pathogens including cooking, freezing, fermenting, salting, smoking, drying, and pickling (Al-Sheddy *et al.*, 2004; Kalalou *et al.*, 2004). Also, the effect of gamma irradiation on microbial load, chemical and sensory characteristics of camel meat has been evaluated by Al-Bachir and Zeinou, 2009. An alternative approach

could be the use of organic acids and salts (such as potassium sorbate) to improve the microbiological safety and shelf-life of the camel meat. The usefulness of different methods in controlling microorganisms and improving the storability of different kinds of meat are well studied, but information about the effect of organic salts treatment on the safety and storability of camel meat is still very limited. As well as several meat products from various animals (pork, beef, sheep & chicken) had been studied to improve and modernize their processing. Little work had been done to determine the microbiological and sensory characteristics of camel meat. Therefore, the objective of this study was to evaluate the quality of fresh minced camel meat and to investigate the possibility of extending the shelf life of chilled minced camel meat using potassium sorbate 0.3% as an organic salt during storage at 4° C.

2. Material and Methods

1. Sample preparation:

1.1. Camel meat preparation

A total of 10 kg camel meat was purchased from different local commercial sources in Sharkia Governorate, Egypt and transported in ice box containing crushed ice to the Meat Hygiene Laboratory, Department of Food Control, Zagazig

University. Fresh camel meat samples were subjected for organoleptic and microbiological analyses.

1.2. Minced camel meat preparation

Camel meat pieces (1 kg each) were deboned, sliced and minced in a sterile meat mincer (2–4 mm grinder plate) (control groups).

The test groups treated with potassium sorbate 0.3% (El Nasr Pharm. Chem. Co., Egypt), was added during mixing and gently swirled with a sterile glass rod. Fresh minced camel meat was divided into three batches. Each tray of camel meat is considered as a replicate. Subsequently, the samples were individually placed in sterile polyethylene bags, labeled and stored at 4 ± 1 C. Camel meats from the 3 groups were sampled at storage days 0, 3, 5, 7. Latter during passing time the changes of meat pieces were studied from the point of bacterial load such as bacterial count, sensational characteristics such as color, tenderness, smell and taste and physiochemically such as development of acidity (pH).

2. Organoleptic examination:

The panelists were served 1 sample at a time and asked to rate each sample using a modified 8-point hedonic scale. The hedonic scale included the attributes of appearance (like to dislike), texture (tender to tough), flavor (like to dislike), juiciness (moist to dry), and overall acceptability (like to dislike). Colour, odour, taste and consistency of samples were done by the naked eye appearance and by using boiling and roasting test according to Gracy *et al.* (1999).

3. Determination of physico-chemical parameter (pH)

The pH of the samples was measured by a pH meter (Crison Micro pH 2000).

4. Microbiological evaluation

Three replicates from each sample, treated and non-treated were aseptically opened, and 10 g of whole camel meat were transferred to a sterilized glass bottle containing 90 ml of sterile peptone water 0.1%. Samples were homogenized in a Waring blender (Waring Products division, New Hartford Conn.USA) initially for a few seconds at low speed then for 2 min at high speed. Further dilutions were made as far as 10^6 according to method previously discussed method (AOAC, 1990). Microbiological analyses were carried out after 1, 3, 5 and 7 days during the chilling storage period. Samples were examined bacteriologically for Aerobic Plate Counts, Enterobacteriaceae count, *Staphylococcus aureus* count and total mould and yeast count on each of the

predetermined sampling days during the refrigerated storage. Aerobic Plate Counts were determined by surface spreading of 0.1 ml of the sample homogenate, at selected dilutions, onto duplicate sterile plates of pre-poured and dried standard plate count agar (Oxoid, CM463), then the plates were incubated for 48 hrs at 35° C (APHA, 1992). Enterobacteriaceae counts were enumerated by the pour-plating method on violet red bile glucose agar (VRBA; Difco Laboratories Inc., Detroit, Michigan, USA). The plates were overlaid with a virgin layer of the same growth medium before incubation at 37° C for 24 hrs (ICMSF, 1978). *Staphylococcus aureus* were enumerated by spreading 0.1 ml of different dilutions of each sample over Baird-Parker agar (BPA) base (Oxoid,UK) supplemented with egg yolk-tellurite Emulsion (Oxoid, UK) and incubated at 37° C for 24–48hrs (Andrews, 1992). Total mould and yeast were enumerated according to Kacánieová, 2003.

5. Statistical analysis:

All values are presented as means \pm SE and all measurements were carried out in triplicates. All microbial counts were converted into base-10 logarithms of colony forming units per g of camel meat samples (log CFU / g). Data was subjected to one-way analysis of variance (ANOVA) among the different treatments. Significant differences among the means were determined by Tukey Honestly Significant Difference (HSD) test.

3. Results and Discussion

The result in table (1) revealed that the log mean aerobic plate counts, total enterobacteriaceae count, *Staphylococcus aureus* count and total mould and yeast count of camel meat were $\log 6 \pm 4.9$, $\log 3.3 \pm 2.1$, $\log 3.3 \pm 2.0$ and $\log 2.5 \pm 1.5$ CFU/g, respectively (Table 2). Nearly similar findings were recorded by Hamdy, 1989 and Kalalou, 2004 while lower values were recorded on cattle carcasses by Elmoosalami, 1988, Mira, 1989 and Samaha and Draz, 1993. This may be attributed to the hygienic status adopted inside the slaughter halls. However, total viable count has always been used as indicator to the hygienic condition inside the slaughter halls. The aerobic plate count is of great significance for judging of the hygienic conditions under which the meat was produced. It gives a good idea about the keeping quality of meat (Miskimin *et al.*, 1976). Etzel (1973) reported that the keeping quality of meat was persisted till the APC was reaching 3×10^7 CFU/cm² while Sovandia (1962) found that changes in odour could be noticed when the count was reaching 10^7 CFU/cm². The presence of enterobacteriaceae indicates presence of toxigenic bacterial

contamination in food which is a public health hazard (ICMSF, 1978).

Staph. aureus count were lower than that obtained by Hafez (1995) on cattle carcasses and Al – Dughaym and Yassien (2001) on camel carcasses, but higher than the value obtained by Hamdy (1989) on camel carcasses. It has been reported by many investigators (Meyer, 1975; Niskanen & Normal, 1979; and Eley, 1992) that when the count of coagulase positive staphylococci reached 10^5

bacteria/g of product, it is sufficient to cause toxicosis to consumer. The presence of *Staph. aureus* on food articles points to a possible contamination from the skin, mouth, nose of food-handlers. The inadequately cleaned equipment may be a source of contamination (ICMSF, 1978). Al-Tarazi *et al.* (2009) found *Staph. aureus* in 92 % in fresh camel meat samples with mean count of $4.3 \times 10^4 \pm 1.2 \times 10^4$ CFU/g.

Table (1): Log values of mean count \pm SE (CFU/g) of microbial load of fresh camel meat (n=20).

Microbial load	Count range	Mean count \pm SE (CFU/g)
Total bacterial count (TBC)	2 - 6.6	6.0 \pm 4.9
Enterobacteriaceae count (EBC)	2.6 - 3.8	3.3 \pm 2.1
<i>Staph. aureus</i> count	2.6 - 3.5	3.3 \pm 2.0
Total mould and yeast count (TMY)	1.7 - 3.0	2.5 \pm 1.5

The data generated from Tab. (2) indicated that the samples of camel minced meat was decomposed after 5 days of chilling preservation while that treated

with pot. Sorbate 0.3% has a longer shelf life (8 days) and this consider as a marketable significance.

Table (2): Organoleptic of untreated and treated minced camel meat samples.

Criteria	Fit for human consumption	Border line	Decomposed
Untreated samples (control)	0 – 4 th day	4 – 5 th day	At 6 th day.
Treated by pot. Sorbate 0.3%	0 – 6 th day	6 – 7 th day	At 8 th day.

The ultimate pH of muscle is a major determinant of meat quality and is largely determined by the depletion of glycogen and accumulation of lactic acid pre- and post-slaughter. The range of the ultimate pH values of dromedary camel meat ranged between 5.7 and 6.0 (Kadim and Mahgoub, 2006). Results achieved from Table (3) showed a pH drop from 6.4 ± 0.045 to 6.2 ± 0.07 in 5 day's storage in the untreated samples (control). The pH was around 7.2 after the same period in treated samples with potassium sorbate.

Table (3): Mean pH values of untreated and treated minced camel meat samples.

pH	Untreated samples	Treated samples
Zero day	5.9 \pm 0.023	5.8 \pm 0.021
3 rd day	6.1 \pm 0.03	5.8 \pm 0.04
5 th day	6.4 \pm 0.045	6.2 \pm 0.07
7 th day	6.6 \pm 0.034	6.3 \pm 0.032

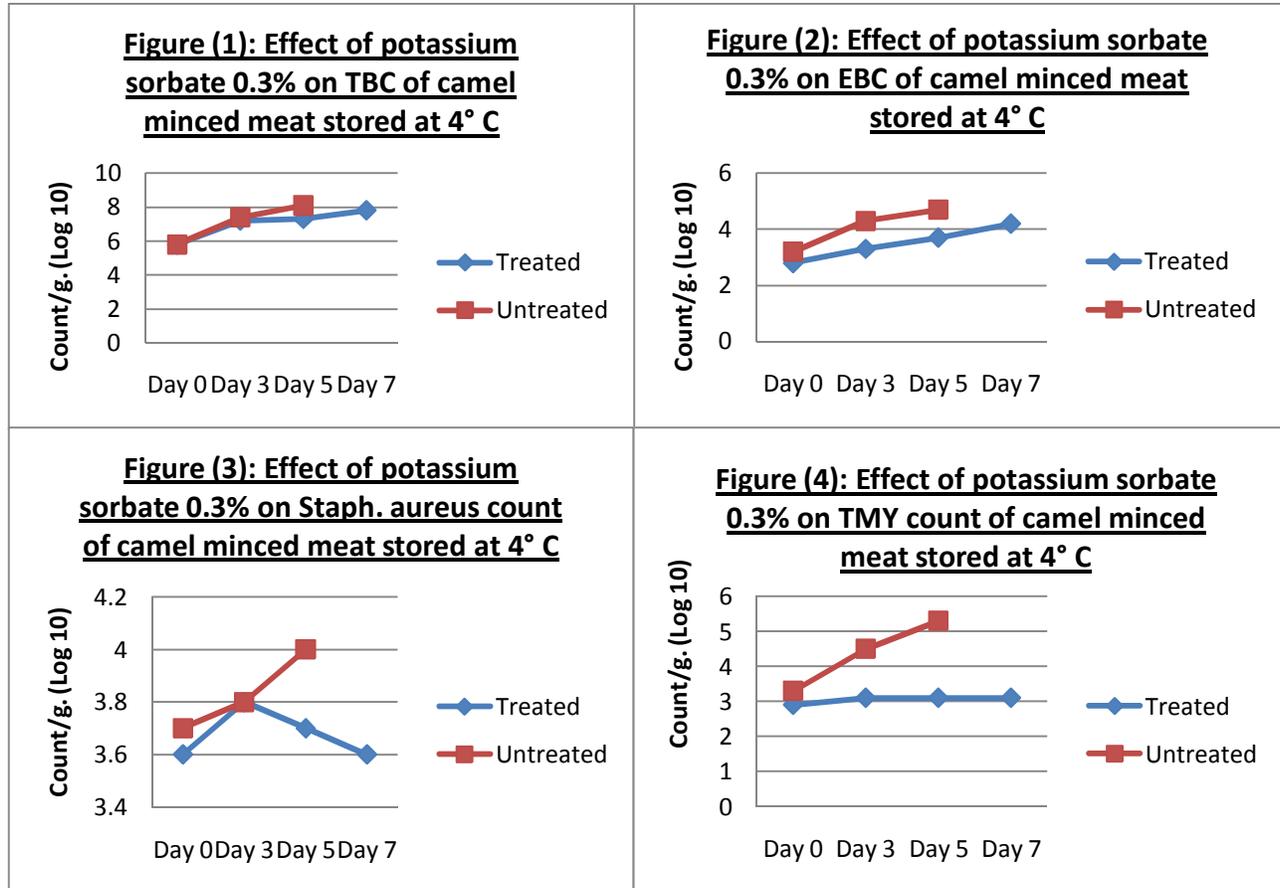
The microbial profiles (Table 4) reported in this study showed that samples treated with potassium sorbate 0.3% had a significant decrease in total aerobic plate counts, Enterobacteriaceae and yeasts &

moulds count which were completely eliminated after 8 days. Standard plate counts indicated a considerable decrease during the storage period which showed a high count during the 5th day of the process (log 8.1 ± 6.9 CFU/g), counts decreased drastically to reach levels around log 7.8 ± 6.7 CFU/g after 7 days at 4°C (Figure, 1). The same decrease pattern was also observed for the enterobacteriaceae (Figure, 2) and *Staphylococcus aureus* (Figure, 3) The former was decreased from log 4.7 ± 3.7 CFU/g to less than log 3.7 ± 3.3 CFU/g at 5th day (with reduction percent of 89.6%), and the later were reduced from log 4.0 ± 3.3 to less than log 3.6 ± 2.9 CFU/g (with reduction percent of 46.4%) at the end of the process. There are no specific standards for permissible number of *S. aureus* in fresh or raw meat; however, 10^3 CFU/g is the highest permissible count of *S. aureus* commonly specified by the international agencies (Sally&Mark, 2003). The minimum number of 5×10^6 CFU/g *S. aureus* is required to produce a sufficient amount of enterotoxin to cause Staphylococcal food poisoning (Garbutt, 1997). Yeasts & moulds were completely reduced at the end of the process (with reduction percent of 98.3%) (Figure, 4)

Table (4): Effect of potassium sorbate 0.3% on the bacterial load of camel minced meat stored at 4° C

Storage period	Untreated samples				Treated samples			
	TBC	EBC	<i>Staph.aureus</i> count	TMY	TBC	EBC	<i>Staph.aureus</i> count	TMY
Zero day	5.8±5.2	3.2±2.6	3.7±3.0	3.3±2.4	5.8±4.8	2.8±2.3	3.6±2.9	2.9±1.8
3 rd day	7.4±6.4	4.3±3.1	3.8±3.3	4.5±3.7	7.2±6.0	3.3±2.5	3.8±3.3	3.1±1.9
5 th day	8.1±6.9	4.7±3.7	4.0±3.3	5.3±4.5	7.3±6.4	3.7±3.3	3.7±2.8	3.1±2.3
7 th day	R	R	R	R	7.8±6.7	4.2±3.3	3.6±2.9	3.1±2.0

R: Rejected (no further analyses were made).



Conclusion

The obtained results of this study suggest that potassium sorbate 0.3% may be used to improve microbial quality in camel meat and increase its shelf-life from 4 days (control) to 8 days (treated samples). Potassium sorbate 0.3% did not cause any adverse effect on the quality characteristic of camel meat in the conditions studied or on sensory evaluations that measured within days of treatment. On the other hand, this method of preservation could be considered as an easy and economic way of preservation of camel meat during transportation to the retail market.

Corresponding author

Hussein, M.A
Food Control Department, Faculty of Vet. Med.,
Zagazig University, Zagazig, Egypt
elged2010@yahoo.com

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