Effects of Storage Time on Some Characteristics of Packed Camel Meat in Low Temperature

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Abstract: The objective of this research was to determine the effects storage time on chemical, physical and microbial characteristics camel meat. In this study longissiums muscles of camel meat were excised and stored at 4±1ºC. pH, DL, WHC, shear force values, microbial contamination and sensory Characteristics were determined. The study also indicated that time storage had no significant effect (p>0.05) on pH with samples stored at 4±1ºC shear force increased over time but not significantly (p<0.05). Total Plate Counts (TPC), Pseudomonas sp., and yeasts and molds significantly increased with time. After 14 days, Total viable counts for packed camel meat reached about 7 log cfu g. DL increased over time while WHC decreased during storage. In summary, packaging of fresh camel meat accompanied by refrigeration storage enhanced product shelf life for 12 days without undesirable and detrimental effects on its sensory acceptability.

Key words: Camel meat, meat quality, microbiological load, WHC

INTRODUCTION

Camel is one of the most fundamental pillars of the national economy and food security for many countries in the world, because it occupies a very important role in providing an important part of human food, especially meat, in order to fulfill the shortfall in the increasing demand for meat due to the rapid growth of human population and the increase of the demand for the foodstuffs. The camel is a good source of meat in areas where the climate adversely affects other animal’s production efficiency. Camel can provide a substantial amount of high quality meat. The demand for camel meat appears to be increasing due to health reasons, as they produce carcasses with less fat as well as having less cholesterol and relatively high polyunsaturated fatty acids than other meat animals (Knoess, 1977; Mukasa-Mugerwa, 1981; Elgasim et al., 1987; El-Faer et al., 1991; Elgasim and Alkanhal, 1992; Rawdah et al., 1994; Dawood and Alkanhal, 1995). Highly perishable foods such as meat provide excellent conditions for the growth of hazardous microorganisms. With the harsh environment and the absence of refrigeration, the shelf life of such meat is expected to be very short. Microbial contamination can lower the quality of fresh minced camel meat; shorten its shelf life and result in economic loss and probably health hazards. Low temperature storage is one of the primary preservation methods to maintain meat freshness, because the rates of microbiological, chemical and biochemical changes are reduced at decreased temperatures. In addition, Gill (1996) affirmed that the principal factors to be addressed in the preservation of chilled meat are the retention of an attractive, fresh appearance for the product displayed, and the retardation of bacterial spoilage (Gill, 1996). Several studies have been published concerning the physical characteristics, chemical composition, sensory properties and nutritive values of camel meat (El-Faer et al., 1991; Elgasim and Alkanhal, 1992; Dawood and Alkanhal, 1995; Dawood, 1995; Elgasim and Elhag, 1992). No data have been published on the changes of camel meat characteristics during storage time. Our objective was to investigate the Effects of Storage Time on Some Characteristics of Camel Meat under refrigeration.

MATERIALS AND METHODS

Sample preparation: Camel meat samples from six one-humped Iranian breed camels were obtained at a slaughter house (Tehran, Iran) 1 h after slaughtering and used separately as replications for preparation of samples (three separate replicates). The samples were wrapped in clean sterile polyethylene bags and transported in a clean cool box containing ice cubes to the laboratory of the Department of Food Science and Technology. Muscle samples were cut cylindrically (5 cm diameter and 10 cm length). Any visible fat was removed from the muscle tissues. Measurements of pH, Drip loss and tensile...
results and discussion

Chemical and physical quality:

**pH:** The pH variations for camel meat according to the storage time have been shown Table 1. The effect of storage time on the characteristics of camel meat has not been previously investigated, but similar observations on...
Table 1: Values (means ± SEM) of some characteristics of camel meat preserved in low temperature during storage time

<table>
<thead>
<tr>
<th>Time/treatment</th>
<th>pH</th>
<th>WHC</th>
<th>DL</th>
<th>SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>5.65±0.03 a</td>
<td>46.43±0.65 a</td>
<td>2.54±0.41a</td>
<td>8.84±0.48a</td>
</tr>
<tr>
<td>Day 6</td>
<td>5.66±0.04 a</td>
<td>42.30±0.49b</td>
<td>2.63±0.54a</td>
<td>7.59±0.51a</td>
</tr>
<tr>
<td>Day 12</td>
<td>5.66±0.02 a</td>
<td>39.75±0.54bc</td>
<td>4.26±0.62b</td>
<td>5.31±0.44b</td>
</tr>
<tr>
<td>Day 18</td>
<td>5.74±0.03 a</td>
<td>40.44±0.39c</td>
<td>4.61±0.48b</td>
<td>3.97±0.67b</td>
</tr>
</tbody>
</table>

a, b, c: values in the same column with different superscript are significantly different (p<0.05)

Fig. 1: Changes (log cfu/g) in total viable count, (a) pseudomonads, (b) LAB (c) molds & yeasts, (d) during storage in camel meat

Table 2: Time and treatment pH WHC DL SF

<table>
<thead>
<tr>
<th>Time/treatment</th>
<th>pH</th>
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Drip loss: The water drip from the samples was monitored through the storage period. The results can be seen Table 1. Drip loss significantly (p<0.05) increased with storage, in samples. Similar findings were reported by Payne et al. (1998). The increase in drip with storage time is explained by water loss from the muscle due to degradation of muscle proteins caused by the spoilage mechanisms. In addition, DL increased significantly in the first 12 days after packing but then remained constant in samples (DL values oscillated between 2%, at 1 day post-packing, and 4% at 18 days post-packing). This is in agreement with Zarate and Zaritzky (1985), who indicated that most of the exudates are lost from primal cuts within the first two weeks of their preparation.

Shear force: Many factors contribute to the eating quality of meat and the perception of taste, with tenderness being considered as one of the most important attributes (Wheeler et al., 1990; Koohmaraie et al., 1991). An objective measure of tenderness is the force required to shear a standardized piece of meat with low shear values being desirable. The tensile strength test is best suited for structural investigations rather than to predict sensory evaluation of tenderness. It is a useful test in conjunction with other methods. The test can be carried out on raw or cooked meat. Results will be affected by sample size and strain rate, but the latter effect is small. Shear force values are shown Table 1. Analysis of variance showed that aging of meat affected SF in all treatments, as has been found in other studies where post mortem aging increased meat tenderness (Pinkas et al., 1978; Jeremiah et al., 1997). Shear force values tended to decrease (p<0.05) with ageing in camel meat samples.

Microbial quality: The mean log values of TVC, pseudomonas spp., LAB, coliform and molds and yeasts from samples packed of fresh camel meat during storage at 4±1°C are shown Fig. 1. During storage, these microorganisms significantly increased samples. TVC of camel meat was about 4.7 log cfu/g and the number of total count increased as the storage time increased in Fig. 1. After 6 days, Total viable counts for packed camel meat reached about 6.5 log cfu/g. Of the phychrotrophic bacteria, pseudomonas spp. are gram negative bacteria dominated at refrigeration temperatures and considered as one of the main spoilage microorganisms in meat and poultry (Jay, 2000). In camel meat, pseudomonas spp. reached 5.8 log cfu/g after 6 days in camel meat samples and was more numerous than the other microorganisms in the microbial flora because these organisms grow faster and have greater affinity for oxygen than the others (Jay, 2000).

The number of LAB counts of camel meat samples stored under low temperature increased to 5.5 log cfu g on day 6 and to 7.5 log cfu/g on day 18, respectively. In this study, the number of E. coli and coliform was less than 3 log cfu/g in all camel meat samples throughout the
Table 2: Sensory attributes of camel meat preserved in low temperature during storage time

<table>
<thead>
<tr>
<th>Time/treatment</th>
<th>Appearance</th>
<th>Odor</th>
<th>Texture</th>
<th>Overall quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>7.86a</td>
<td>7.75a</td>
<td>8.40a</td>
<td>8.31a</td>
</tr>
<tr>
<td>Day 6</td>
<td>6.19b</td>
<td>7.03ab</td>
<td>7.61ab</td>
<td>6.89b</td>
</tr>
<tr>
<td>Day 12</td>
<td>6.08c</td>
<td>6.39b</td>
<td>6.77ab</td>
<td>6.02c</td>
</tr>
<tr>
<td>Day 18</td>
<td>4.48d</td>
<td>5.54b</td>
<td>6.18b</td>
<td>4.66d</td>
</tr>
</tbody>
</table>

a, b, c, d: values in the same column with different superscript are significantly different (p<0.05)

storage period (results not shown). The number of yeasts counts of camel meat samples increased to 2.5 log cfu/g on day 6 and to about 3 log cfu/g on day 18, respectively.

Sensory quality: The camel meat was also evaluated for changes in surface color, texture, and odor by semi-trained panelists. The sensory attributes of camel meat during storage at 4±1°C are shown Table 2. Storage time effect within treatment indicated that surface discoloration increased (p<0.05) especially at day 12 in packed samples. Data from sensory analysis confirmed those from microbiological tests. Panelists rejected packed samples after 12 days storage at 4±1ºC, where samples reached or exceeded the spoilage onset (107-108 CFU/cm²). However, packed samples were acceptable to day 12. Intensity of meat color is related to the levels of myoglobin. By the end of the storage time all packed samples had acceptable texture. The acceptable samples were described as having good appearance or natural odor without any sign of rancidity.

CONCLUSION

In this study we have observed the evolution of the main parameters that affect camel meat quality (pH, drip loss and shear force). In general, there were no differences among groups for pH and Tenderness increased with aging time. In addition, the formation of water drip suggests that it not possible to maintain initial meat quality of this breed. As a result, the packed camel meat under low temperature developed less off-flavors and essentially no rancidity within the storage time tested (12 days). In summary, packaging of fresh camel meat accompanied by refrigeration storage enhanced product shelf life for 12 days without undesirable and detrimental effects on its sensory acceptability.

ACKNOWLEDGMENT

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