POST MORTEM AGING AND FREEZING OF CAMEL MEAT (A COMPARATIVE STUDY)

R. Shariatmadari* and M. Kadivar

Department of Food Science and Technology, Isfahan University of Thechnology, Isfahan, 84156, Iran, r_shariatmadari@yahoo.com

Keywords: camel meat, physico-chemical properties, ageing, frozen storage

Introduction

Regarding the great impact of meat (as the major source of nutrients) in the human diet, high meat prices and its deficiency particularly in developing countries, introduction of cheaper sources of meat, such as that of camel, will serve consumers' interest. A fattened camel at an age of 7 years can produce a carcass of about 260 kg with a meat / bone ratio of 3.0 (Yousif, 1989). Elgasim *et al.*, (1987) concluded that the carcass characteristics were equal to those of other red meat animals. The meat of camels 3 years old or less is comparable in taste and texture to beef (Knoess, 1977). It is also nutritionally the same as common sources of meat (Elgasim and Alkanhal, 1992). Despite this potential, the quality of camel meat has received little attention. There is even a notion about its toughness and lower quality among consumers. However, in spite of this notion, no data have been published on the comparison of its physicochemical attributes with other common sources of meat. Moreover, aging and freezing which have profound effects on meat have not been widely studied in this regard. The objective of this study was to investigate the changes in various physicochemical properties of camel meat during aging and freezing compared with those of beef.

Materials and Methods

Three year old Iranian Zaboli camels (n=3) or hybrid Holstein cows (n=3), were randomly selected from two different slaughterhouses. Cows were stunned (150 to 180 mV) before slaughtering. Intact samples from leg (5 kg) were obtained within 45 min after slaughtering and stored at *ca* 15°C before subsampling. Each sample was then subsampled at 5h postmortem to determine the physicochemical properties of the fresh meat. The rest of each primary sample was subdivided in two lots. One lot which was used to determine the effect of postmortem aging on physicochemical properties, was refrigerated at 4 °C until further sampling at 24, 72 and 168 h postmortem. Analysis included measuring pH, tenderness (Smith *et al.*, 1978), water holding capacity [WHC] (Jauregui *et al.*,1981) and cooking loss [CL] at 5, 24, 72 and 168 h post mortem; tyrosine and TBA values (Strange and Benedict, 1977) and colour (L, a and b values) at 5, 72 and 168 h post mortem. The second lot of each sample was used to investigate the effects of freezing on the same characteristics. This lot was stored at -20°C for a maximum period of five months and subsampled at months 2 and 5 of storage. At each measuring time, samples were thawed for 24 h at 4°C. Data were compiled in split plot design format and analysed by analysis of variance and Duncan's multiple range test using SAS statistical analysis software. All measurements were taken in duplicate.

Results and Discussion

ANOVA indicated no significant difference between species for physicochemical properties except in pH (Table 1 and 2). Mean pH was higher in camel meat relative to beef ($p<0.05$). Also, for most of the factors, fresh camel meat and beef (5 h postmortem) were similar. However, differences in pH, tyrosine, TBA and "a" values were evidenced ($p<0.05$, Table 1). Aging caused significant differences: tenderness, CL, Tyrosine value, TBA value, colour L, a, and b values increased, whereas pH and WHC decreased (Table 1). As table 1 shows, during 72 h aging, tenderness, tyrosine value, colour L, a, and b values showed higher increases in camel meat relative to beef, so that camel meat was found to be more tender and brighter with higher "b" value at 72 h compared to the beef ($p<0.05$). This could be an indicator of a higher rate of proteolysis in camel meat during the initial stages of aging beef. Camel meat also showed lower TBA values than beef at different aging intervals. Frozen storage affected all parameters except tenderness and colour significantly (Table 2). WHC and pH decreased, whereas, CL, tyrosine and TBA values increased by freezing. In the frozen state, camel meat and beef were similar in all parameters except cooking loss and redness; although fresh camel meat had a smaller "a" value than beef, during frozen storage the redness of camel meat in contrast to the beef, showed a significant increase resulting in camel meat being found redder than beef after 5 months storage ($p<0.05$, Table 2). This can be attributed to the reduced oxygen consumption rate due to low freezing temperature leading to deeper oxygenated layers of meat and delayed oxidation. Camel meat showed higher amounts of cooking loss than beef during frozen storage ($p<0.05$).

Table 1: Physicochemical properties of meat as influenced by species and storage time during aging period.

	Aging time (h)	pH	Shear force (KgF)	WHC (expressible moisture)	CL (%)	Tyrosine value (mg/g)	TBA value (OD)	L	a	b
species(p<)		0.035	0.065	0.367	0.702	0.716	0.410	0.095	0.595	0.166
Aging(p<)		0.0001	0.0001	0.0001	0.0001	0.001	0.031	0.002	0.002	0.0001
Camel Meat	5	6.33 [a]	6.917 [a]	37.14 [d]	15.24 [d]	0.33 [d]	0.031 [c]	37.98 [bc]	9.43 [c]	7.18 [c]
	24	5.79 [cd]	5.317 [bc]	41.17 [cd]	13.40 [d]	-	-	-	-	-
	72	5.9 [bc]	5.093 [cd]	46.06 [ab]	20.32 [ab]	0.44 [abc]	0.033 [c]	43.20 [a]	12.70 [a]	12.04 [a]
	168	5.66 [dc]	3.857 [d]	49.67 [a]	22.22 [a]	0.48 [ab]	0.038 [b]	43.03 [a]	12.26 [ab]	12.51 [a]
Beef	5	6.02 [b]	7.173 [a]	37.26 [d]	15.91 [cd]	0.40 [c]	0.038 [ab]	35.33 [c]	11.25 [b]	8.06 [c]
	24	5.6 [e]	7.120 [a]	44.02 [bc]	18.47 [bc]	-	-	-	-	-
	72	5.63 [e]	6.390 [ab]	46.22 [ab]	18.50 [bc]	0.43 [bc]	0.040 [ab]	38.98 [b]	11.42 [ab]	10.25 [b]
	168	5.57 [e]	4.837 [cd]	49.91 [a]	21.24 [ab]	0.51 [a]	0.042 [a]	39.52 [b]	12.54 [ab]	11.14 [ab]

1- Means within a column with different superscripts differ significantly (p<0.05) according to Duncan's multiple range test

Table 2: Physicochemical properties of meat as influenced by species and storage time during frozen storage.

	Frozen time (m)	pH	Shear force (KgF)	WHC (expressible moisture)	CL (%)	Tyrosine value (mg/g)	TBA value (OD)	L	a	b
Species(p<)		0.046	0.284	0.628	0.245	0. 113	0.407	0.874	0.606	0.575
Frozen storage(p<)		0.0001	0.514	0.0001	0.0001	0.010	0.010	0.560	0.141	0.460
Camel meat	0	6.33 [a]	6.917	37.14 [b]	15.24 [d]	0.33 [c]	0.031 [b]	37.98	9.43 [c]	7.18
	2	5.71 [c]	7.373	45.72 [a]	29.92 [ab]	0.50 [ab]	0.108 [ab]	-	-	-
	5	5.50 [cd]	6.657	50.97 [a]	30.80 [a]	0.46 [abc]	0.160 [a]	34.01	12.45 [a]	8.17
Beef	0	6.02 [b]	7.173	37.26 [b]	15.91 [d]	0.40 [bc]	0.038 [b]	35.33	11.25 [ab]	8.06
	2	5.53 [cd]	7.770	46.17 [a]	24.75 [c]	0.53 [ab]	0.196 [a]	-	-	-
	5	5.42 [d]	6.757	46.96 [a]	27.00 [bc]	0.57 [a]	0.130 [ab]	37.76	9.84 [bc]	8.43

1- Means within a column with different superscripts differ significantly (p<0.05) according to Duncan's multiple range test

Conclusions

Meat quality was found to be mainly affected by aging and freezing rather than by species. Fresh camel meat and beef were similar in all parameters except pH, tyrosine, TBA and "a" values. Positive aging-related changes in tenderness and colour occurred earlier in camel meat compared to beef. It also showed less TBA values throughout aging period than beef. Considering the importance of tenderness, colour and lipid oxidation for meat consumers, it could suggest a possible advantage for camel meat.

References

Elgasim, E. A. and Alkanhal, M. A. (1992). Proximate composition, amino acids and inorganic mineral content of Arabian camel meat: Comparative study. Food Chem., 45: 1-4.

Elgasim, E. A., Elhag, G. A. and Elnawawi, F.A. (1987).Quality attributes of camel meat. Second Progress Report, the Scientific Council, King Faisal University, Alhasa, KSA.

Jauregui, C. A. and Regenstein, J. M. (1981). A simple centrifugal method for measuring expressible moisture, a water-binding property of muscle foods. J. Food Sci., 46: 1217, 1273.

Knoess, K. H. (1977). The camel as a meat and milk animal. World Anim. Rev., 22: 3-8.

Smith, G. C., Culp, G. R. and Carpenter, Z. L. (1978). Postmortem aging of beef carcass. J. Food Sci., 43: 823- 826.

Strange, E. D. and Benedict, R. C. (1977). Evaluation of rapid tests for monitoring alterations in meat quality during storage. J. Food Protect., 40: 843- 847.

Yousif, O. K. And Babiker, S. A. (1989). The desert camel as a meat animal. Meat Sci., 26: 245- 254.