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The Effects of Preservation Periods on Meat Characteristics of Camel and Cattle

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Abstract: The aim of this study was to examine the effects of days of preservation (day 1, 7, 14 and 21) on some selected chemical analysis of camels (*Camelus dromedarius*) and cattle (*Bos indicus*) and on Water Holding Capacity (WHC) and rancidity. Four kilograms were obtained from the local market, trimmed off fat and only 3 kg left for further processing. Statistical differences at $p<0.05$ were observed in moisture, fat % and ash between camel and beef. With highest figures obtained in camels in term of moisture and ash; protein showed insignificant difference. As for the WHC, significant variations in day one are evident, with camel showing the highest, almost about times that of cattle. Day one showed that camel has a WHC more than 2 times that of cattle, with the percentage reduced with the advancement of period of preservation. Clear increase in rancidity in both camel and cattle was observed in day 21 and the first three intervals showed little increase, with no species variations.

Key words: Camel, cattle, meat preservation, WHC, rancidity

INTRODUCTION

Meat is the food essential for human growth and development, as it provides proteins, energy, vitamins and some minerals and this contributes to health and vigor. However, meat is the food item that spoils most rapidly. The camel is a good source of meat in areas where the climate adversely affects other animal's production efficiency. The potential of the camel as a meat producer has received little attention. Meat is usually sold and consumed fresh in the Sudan and other tropical countries due to the lack of advanced technology of meat preservation. Chilling of meat preserve the meat and enhance the quality attributes. Meat preservation is an important phase in meat production as it prevents microbial contamination and extends shelf life.

The demand for camel meat appears to be increasing especially in arid regions. Camel meat is healthier as they produce carcasses with less fat as well as having less levels of cholesterol in fat than other meat animals (Al-Ani, 2004) and the quality of meat from young camels is comparable to beef (Knoess, 1977). However, with only a few exceptions, meat is a by-product of the camel, coming mainly from old animals (Wilson, 1984). Traditionally, meat comes mostly from seven years and above males and females that are primarily kept for milk, racing and transportation rather than for meat production (Kurtu, 2004). Therefore, the general consumers view is that camel meat is unacceptably tough. Thermal processing, curing and smoking may be considered as the three most commonly encountered operations in meat preservation and processing (Kurtu, 2004). Postmortem storage of meat slightly above its freezing temperature (Aging) results in an increase in tenderness and flavour due to changes in muscle proteins but also results in weight loss via evaporation. Research on improving the quality and shelf life of camel meat in Sudan is vital to maximize the potentials from this valuable animal. Therefore, this study was designed to assess the effect of storage (1, 7, 14 and day 21) on selected chemical analysis in both camels (*Camelus dromedarius*) and cattle.

MATERIALS AND METHODS

Sample collection: The samples of camel's and beef meat used in this study were obtained from the local market, Saug Elnagga, West of Omdurman, Khartoum state. These samples weight 4 kg from the camel and beef meat each. They were taken from Topside muscle. The meat was trimmed from the fat and divided into 4 subgroups, the first group directly analysis to determine the moisture, fat, ash and protein content of raw meat. These proximate analyses were determined according to the methods of the Association of Official Analytical Chemists. Rest of the group, they were stored at -18°C inside foil of plastic, for three different intervals, 7, 14 and 21 days. And they were subjected to the same analysis as for the first group. Water Holding Capacity (WHC) was estimated using Trout (1988) method, by putting 0.5 g of the minced meat on a litumus paper and by putting a weight of 25 kg for 2 min. WHC was estimated using the equation: The area of outer circle-the area of the inner circle/the area of inner cycle. The rancidity was estimated spectrophotometrically using a thiobarbituric acid at wavelength of 538 according to the equation: reading of the×7.8/weight of the sample

RESULTS AND DISCUSSION

The camel in Sudan is estimated to be around 3.3 million and contribute much to the economy. It is exported to neighboring countries as live animals; however there is a need to improve meat productivity to look for possible meat products export. Nevertheless, there is no modern camel meat processing industry in the country for domestic or export purposes.

Table 1 shows the mean percentage of the chemical analysis of Topside muscle of both camels (*Camelus dromedarius*) and cattle. Statistical differences at $p<0.05$ were observed in moisture, fat % and ash between camel and beef. With highest figures obtained in camels in term of moisture and ash; protein showed insignificant difference. The very low fat recorded in day 7 for the camel is due to error during processing the sample for the analysis. The mean protein reported here ranging from 19.82-22.2 for camel is similar to value reported by Dawood (1995) lower than those reported by Cristofaneli *et al.* (2004). This level of protein indicates that the camel meat is a source of high quality protein in harsh climate arid regions. For meat of better quality, it is recommended to slaughter camels between 1 and 3 years of age (Al-Ani, 2004).

The moisture, protein, fat and ash ranged from 64.4-76.7, 18.6-25.0, 1.1-10.5 and 1.0-1.4%, respectively in Omani camels. The percentage of protein decreased and that of fat increased with increasing camel age. Camel meat is healthy and nutritious as it contains low fat as well as being a good source of minerals. Age is an important factor in determining meat quality and composition (Kadim *et al.*, 2006).

Figure 1 presents the effects of storage period in days on WHC in both camels (*Camelus dromedarius*) and cattle. Significant variations in day one are evident, with camel showing the highest, almost about times that of cattle. Day one showed that camel has a WHC more than two times that of cattle, with the percentage reduced with the advancement of period of preservation. Water Holding Capacity (WHC) is important for both consumers and processors; from the consumers' point of view, WHC influences many quality traits such as nutritional value, appearance and palatability. For the processing industry, WHC greatly impacts the economic value of weight for fresh meat products and the yield in processed products: the more water remains in meat, the heavier weight of the meat, the better. Offer and Knight (1988) indicated that water content was 76.29 for protein 21.03, fat 0.94 and ash 1.19%. The percentage of water lost is inversely related to WCH and this is clearly indicated in Fig. 1, the species variations in this content are related to

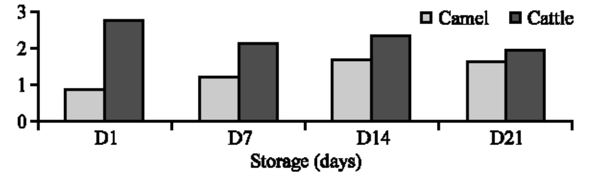

Fig. 1: The effects of storage period (days) on Water Holding Capcity (WHC) in camels (*Camelus dromedarius*) and cattle

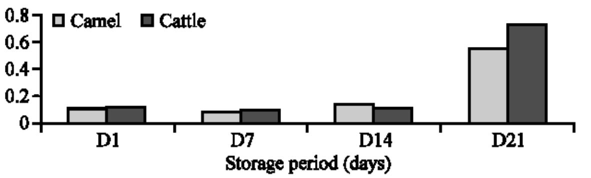

Fig. 2: The effects of storage period (days) on rancidity of meat in amels (*Camelus dromedarius*) and cattle

Table 1: Mean percentages of proximate analysis of topside muscle of camels (*Camelus dromadarius*) and Cattle (*Bos indicus*) as affected by days of preservation

Intervals/ species	Protein		Fat		Moisture		Ash	
	Camel	Cattle	Camel	Cattle	Camel	Cattle	Camel	Cattle
D1	21.05^{aw}	21^{wa}	0.92^{wa}	0.78^{bw}	77.75^{aw}	75.05^{aw}	0.84^{aw}	0.85^{aw}
D7	22.2^{aw}	23.6^{aw}	0.5^{ax}	1.04^{bx}	78.9^{aw}	75.15^{aw}	0.96^{aw}	0.99^{aw}
D14	20.87^{aw}	29.5^{bx}	0.95^{ay}	0.84^{ax}	76.8^{aw}	74.9^{aw}	0.96^{aw}	0.92^{aw}
D21	19.82^{aw}	20.07^{ay}	1.52^{az}	1.88^{ay}	77.2^{aw}	76.4^{aw}	1.12^{aw}	1.02^{aw}

^{a,b}Means on the same row having different superscripts are significantly different at $p<0.05$, ^{w,x,y,z}Means on the same column having different superscripts are significantly different at $p<0.05$

the difference in pH. Water contents were slightly more in female as compared to male (Zia-Urrahman *et al.*, 1998). Temperature had a greater effect on fat and water holding capacities than the holding time. The research results could be used for modeling of heat and mass transfer of hamburger patties during cooking and lead to more accurate temperature prediction of the patties (Pan and Singh, 2001).

Figure 2 describe how storage at day 1, 7, 14 and 21 affected the rancidity in both camel and cattle meat. Clear increase in rancidity in both camel and cattle was observed in day 21 and the first three intervals showed little increase, with no species variations. The increase in the period of the preservation resulted in sharp increase in the rancidity in both camel and cattle; this may be attributed to the increase in unsaturated fatty acids. Meat with a high fat content is susceptible to lipid oxidation, a reaction between light and fat lipids, which leads to rancidity, noticeable by a bad smell and a yellowish tinge. Oxidation of meat fats due to improperly wrapped meat also is one of the causes of rancidity. Positive attributes, such as beef flavour or overall liking, decreased throughout display, whereas negative attributes, such as abnormal and rancid flavour, increased. Lipid oxidation is a major factor in meat quality. In order to relate human perceptions of lipid oxidation, as determined by a trained taste panel, to a chemical measurement of oxidation. The correlations between sensory and analytical attributes were high. TBARS were a good predictor (Campo *et al*., 2006).

Llama and alpaca slaughtered at similar age showed different carcass characteristics; llama can be more easily bred as animal for meat production. Both llama and alpaca meats low fat (0.49%) and cholesterol (51.1 mg 100 g^{-1}) levels compared with other red meat animals (Cristofanelli *et al*., 2004). The desert camel (*Camelus dromedarius*) constitutes an important source of meat in arid areas (Knoess, 1977; Yousif and Babiker, 1989). However, the potential of the camel as a meat producer has received little attention. Shalash (1979) reported that camel meat varies in amount, composition and quality with age, sex and feeding. Generally, the meat of young camels (below three years) is comparable in taste and texture to beef (Knoess, 1977). Camel meat is also consumed as ground meat. Much of the research on this product has been concerned with fat content and indicated that consumers seem to prefer beef patties containing more than 16% fat (Cross *et al*., 1980).

Compared to other livestock, the camel is unique for having an exceptional ability to survive and thrive under adverse climatic conditions such as high ambient temperatures, low rainfall and scarcity of feed. Therefore, it offers an ideal animal for animal production in arid and semi-arid regions of the world. The camel is a good source of meat in areas where the climate adversely affects other animal's production efficiency. There is a need to change this perception through sound research on ways to improve the quality of meat and applying genetic selection as done for cattle.

The mean moisture of 71% was lower than the values (73-78%) reported by Shalash (1988) for Saudi camels and Cristofaneli *et al.* (2004) for llama and alpaca. The data on meat quality in general differ due to variations in pre- and post-slaughtering handling or age of animals. Camel meat could be much leaner than meat produced by other species such as sheep, cattle or pig (Al-Ani, 2004) especially if it is slaughtered at a young age.

Miller *et al.* (1968) found a decrease in the water-holding capacity as fat levels increase due to an increase in the ratio of moisture to protein. Younger camels had significantly ($p<0.05$) higher values than older animals. Age of camel has an important influence on the composition and meat quality and should be taken into consideration when slaughtering camels for meat consumption. Camel meat is a good source of protein (Wilson, 1984) containing 19.6 g 100 g^{-1} of the raw product (Kilgour, 1986).

CONCLUSION

It is interesting to note that the research on camel meat in Sudan is very little, though the camel is an important animal species, to improve this situation; more studies need to be plan for better use of camel meat and also by describing means of improving the quality and the acceptability of camel meat. It could be concluded that and due to consumers may have different reactions to a products' overall acceptance sensory evaluation is unquestionably important before large-scale production of any food product. Thus, the present study was aimed at identifying the most acceptable camel meat products, which in turn may enable manufacturers to adjust the processing conditions to optimize acceptability.

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