EFFECTS OF AGING ON QUALITY CHARACTERISTICS OF GOAT *LONGISSIMUS DORSI* MUSCLE

Kadim, I.T.[1], Mahgoub, O., Al-Ajmi, D.S. and Al-Maqbaly, R.S.
Animal & Veterinary Sciences Department, College of Agriculture, Sultan Qaboos University ,PO Box 34, Al-Khoud, 123, Muscat, Sultanate of Oman

Background

Goats are the most important livestock for meat production in the Sultanate of Oman. According to the annual statistics report, the number of goat in the year 2000 were 978,816, rating highest in number among other animals in the sultanate of Oman (Ministry of Agriculture and Fisheries, 2000). That leads to an increase in goat meat in the menu of people in Oman. In other countries there is also a tendency towards rapid increase in the demand of goat meat (Gipson, 1998; Stankov, et al., 2002).

Practically no information is available on the general meat quality characteristics of the Omani goats. Although quality of goat meat has relatively minor importance in the marketing of this product in Oman today, but this will not always be the case. Therefore, it is necessary to establish a better understanding of the goat meat quality under Omani condition, which will be practically applicable for other countries as well. This is necessary in order to appreciate the full potential of this important food sources to feed the rapidly growing population.

Experience in developed countries indicates that rising personal incomes and expanding urban markets promote changes in marketing systems, and consumers show a greater appreciation of quality and variety in meat and meat products. One of the essentials of an efficient marketing system is the availability of information on the quality of the product in relation to consumer demand and pricing structure. In order to do this utilizing the advanced technology available, basic information on the quality characteristics of the Omani goat's meat is necessary

Objectives

This study was aimed to evaluate meat quality characteristics of three Omani goat breeds reared in Oman and to investigate the relationships between ageing and quality characteristics (tenderness, color, water holding capacity and pH) of goats *m. longissimus dorsi* muscle.

Methods

The goats used were 1 year-old and reared at the Agricultural Experimental Station at Sultan Qaboos University, with 10 males from each of three breeds (Dhofari, Batina and Jebel-Al-Akhdar). The mean (±SE) slaughter weights of the animal were 29.6±4.62, 29.5±3.47, and 31.5±4.04 kg for Batina, Dhofari and Jebel Al-Akhdar goats, respectively.

The animals were slaughtered at the Municipality slaughterhouse in Muscat (Sultanate of Oman) according to routine slaughter house methods.

The carcasses were kept at 1-3^{0}C for 24 h and then *m. longissimus dorsi* from the lumbar (loin) region was removed from both sides of the carcasses and allocated to different treatments. The left side muscles were frozen at –20^{0}C (1 day ageing), while the right side muscles were kept at chiller temperature 1-3^{0}C for a further 5 days (the 6 day ageing sample) before being frozen at –20^{0}C until processing. Meat quality-related measurements included ultimate muscle pH, tenderness, expressed juice and color were determined on the 1 day and 6 day samples. The ultimate pH was assessed for homogenates 1.5-2 g muscle in 10 ml of neutralised 5-mM sodium iodoacetate containing 150 mN KCl. Chilled muscle samples (13 mm X 13 mm cross section) for assessment of tenderness by the digital Dillon Warner-Bratzler (WB) shear machine were prepared from muscle samples cooked in a water bath at 70^{0}C for 90 min (Purchas, 1990). Express juice was assessed using a filter paper method, as the total wetted area less the meat area (cm^2) relative to the weight of the sample (g). Approximately 60 min after exposing the fresh surface, CIE L^*, a^*, b^* light reflectance coordinates of the muscle surface were measured using a Minolta Chroma Meter CR-300. The L* value relates to lightness; the a^* value to Red-Green hue where a positive value relates to the red intensity; and the b^* value to the Yellow-Blue where a positive value relates to yellow.

Data were analyses using the GLM procedure within SAS (SAS, 1985), with the model containing items for the three breeds and 2 treatments.

Results and Discussion

Means and standard errors for characteristics of the *longissimus dorsi* muscle associated with meat quality are given in Table 1. The *longissimus dorsi* muscle was chosen for its high value as cut of meat and general use as a test muscle. Muscle from Batina breed had significantly ($P<0.05$) higher pH (5.81) than that of Dhofari (5.63) or Jebel-Al-Akhdar breed (5.69). The recorded pH values in the present study were similar to those reported by (Stankov, et al., 2002) for goats. The higher expressed juice, over 34% accounts for its good quality were recorded for the three breeds under investigation. Batina breed had significantly lower expressed juice (34.7%) than that of Dhofari (38.0%) or Jebel-Al-Akhdar (38.0%). Similar values for goats were reported by Stankov, et al., (2002). Differences among the three Omani goat breeds, although significant in a few instances were generally small and unlikely to be practical importance.

Post-mortem ageing imposed on *longissimus dorsi* had the expected effects on shear values, with significantly ($P<0.001$) lower values (5.11 kg) the muscle was aged for an additional 5 days than values (7.42 kg) aged for 1 day. The lower shear values of the aged samples were accompanied by a significantly lower ($P<0.05$) amount of expressed juice and cooking losses (Table 2). It seems possible that this lower expressed juice and cooking loss were a reflection of the dripping loss during the aging period for 6 days at 1-3^{0}C. Similar conclusion have been reached by Moller et al. (1983) with sheep. Moreover, several investigators have shown that the extent of protein breakdown during post-mortem ageing is determined by the duration of the process (Davey, 1983; Kadim, et al. (1993).

Furthermore, there were no differences in the way in which muscles from the three breeds responded to ageing, as indicated by the absence of interaction effects.

Conclusions

The comparative studies of meat quality characteristics in three breeds of goats reared in Oman did not reveal great differences in pH, expressed juice, cooking loss, color and tenderness in *longissimus dorsi*, therefore unlikely to be practical importance. Ageing for 6 days at 1-3^{0}C decreased significantly the shear force values, cooking loss and expressed juice of *longissimus dorsi* muscle of goat.

Pertinent literature

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Table 1. Means and standard errors (SE) for a range of quality characteristics for three breeds of Omani goats (Batina, Dhofari and Jebel-Al-Akhdar) *M. longissimus dorsi* at 1 or 5 days aging.

	Breed						
	Batina		Dhofari		Jebel-Al-Akhdar		SE
Mean	1d	5d	1d	5d	1d	5d	
Ultimate pH	5.80^{b}	5.82^{b}	5.57^{a}	5.68^{ac}	5.66^{ac}	5.71^{bc}	0.040
Warner-Bratzler shear values (kg)	7.47b	4.77a	7.30b	5.33b	7.49b	5.22a	0.552
Cooking loss (%)	25.3^{b}	20.4^{a}	25.7^{b}	22.8^{a}	23.9^{a}	21.4^{a}	1.367
Expressed juice (cm^2/g)	37.0^{b}	32.4^{ac}	38.3^{b}	37.7^{b}	39.8^{b}	$36.1b^{c}$	1.383
Meat color parameters:							
*L** (lightness)	39.1^{a}	40.1^{ac}	40.4^{ac}	40.2^{ac}	40.1^{a}	42.2^{bc}	0.727
*a** (redness)	24.2	24.2	24.7	24.0	24.4	23.5	0.507
*b** (yellowness)	4.8^{abc}	4.3^{a}	5.4^{b}	4.4^{ac}	5.6^{b}	4.7^{abc}	0.361

^{abc} Means in the same row with different superscripts were significantly different ($P<0.05$).

Table 2. Effect of ageing for 1 or 6 days on a range of quality characteristics (means and standard errors (SE)) of goat *longissimus dorsi* muscle.

Mean	1-day ageing	6-day ageing	Significant	SE
Ultimate pH	5.68	5.73	NS	0.023
Warner-Bratzler shear values (kg)	7.42	5.11	***	0.319
Cooking loss (%)	25.0	21.5	**	0.789
Expressed juice (cm^2/g)	38.4	35.4	*	0.798
Meat color parameters:				
*L** (lightness)	39.9	40.8	NS	0.420
*a** (redness)	24.5	23.9	NS	0.293
*b** (yellowness)	5.3	4.6	*	0.208

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