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Full Length Research Paper

The effect of *Acacia karroo* supplementation and thermal preparation on meat sensory characteristics of the indigenous Xhosa lop-eared goat genotype

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The objective of the current study was to determine the effect of *Acacia karroo* supplementation and thermal preparation on consumer sensory scores of meat from indigenous Xhosa lop-eared goat breed. 18 castrated four-month-old Xhosa lop-eared kids were kept at the University of Fort Hare Farm until slaughter. Sample cuttings for meat tasting were made from the Longistimus dorsi muscle. *A. karroo* supplementation improved meat tenderness and juiciness. There were no (P > 0.05) significant effects of *A. karroo* supplementation on meat flavour of the supplemented goats. Thermal preparation and consumer background had a significant (P < 0.05) effect on meat sensory characteristics. Results from this study show that *A. Karroo* supplementation and thermal preparation have an effect on meat quality attributes such as tenderness and juiciness.

Key words: Boiling, roasting, consumer sensory scores, thermal preparation, consumer background.

INTRODUCTION

Consumer decision on the quality of meat is based on meat palatability components such as tenderness, juiciness and flavour (Tshabalala et al., 2003; Muchenje et al., 2008a; Xazela et al., 2011). There is a relationship between meat sensory characteristics and meat quality measurements such as pH, colour and cooking losses (Muchenje et al., 2008a). Sensory characteristics are used by consumers to decide on meat quality and there is a relationship between sensory characteristics and consumer acceptability (Muchenje et al., 2008a, 2010). Some of the factors that affect meat palatability components are diet (Arsenos et al., 2009), breed (Muchenje et al., 2008b; 2009a, b), age (Simela, 2005), ageing, fatness and muscle location (Sebsibe, 2006).

Meat juiciness is the wetness during first bite and sustained juiciness likely due to fat in meat. Its sensation in chevon is closely related to the quantity and composition of the intramuscular fat (Muchenje et al., 2008a) and age of an animal (Simela et al., 2008). Meat juiciness together with flavour and meat tenderness accounts for the overall eating quality. Flavour is the most important component of the eating quality of meat after cooking and is affected by lipid content (Webb et al., 2005; Calkins and Hodgen, 2007), cooking method, age and gender (Webb et al., 2005), oxidation, myoglobin and pH (Calkins and Hodgen, 2007).

Meat tenderness is a function of the collagen content, heat stability and the myofibrillar structure of the muscle (Muchenje et al., 2009a) and is the most important sensory characteristic of meat (Strydom et al., 2000; Sebsibe, 2006). Tenderness varies with the animal species (Muchenje et al., 2008a), while the consumer sensory characteristics have shown that it is less in goats since they have less intramuscular fat because they deposit more fat around visceral organs than in the carcass (Swan et al., 1997). The consumer background

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is important and needs to be considered in the assessment of preference and quality of meat (Worch et al., 2010). Dyubele et al. (2010) reported no significant effect of consumer age and gender on meat sensory characteristics. However, there is a significant difference in the perception of consumer tribes of meat sensory characteristics (Dyubele et al., 2010). The way consumers perceive meat depends on several factors including the animal's diet. The cooking method is also among the factors affecting consumers' decision on the quality of meat. Nour et al. (1994) reported that the cooking method affects meat quality attributes such as cooking losses and thawing.

Many studies have been conducted on the effect of diet on the meat quality of ruminants (Priolo et al., 2005; Mapiye et al., 2009). *Acacia karroo* is among the browse plants which have been studied (Mapiye et al., 2009, 2010; Marume, 2010; Bakare and Chimonyo, 2011). *A. karroo* is a plant species which is abundant in most communal rangelands in South Africa and is preferred by goats. It is a browse plant which is characterised by its high crude protein (CP) and mineral contents (Devendra and Sevilla, 2002; Kahiya et al., 2003; Mokoboki et al., 2005). *A. karroo* supplementation has been reported to improve nutritional status, growth performance and carcass traits (Mapiye et al., 2009; Arsenos et al., 2009). This leads to heavier carcasses thus improving quality and quantity of meat produced (Arsenos et al., 2009). The Xhosa lop-eared genotype is among the goat genotypes recommended for meat production because it has a big framed body and is highly resistant to parasitic infections (Xazela et al., 2011).

Xazela et al. (2011) studied the sensory characteristics of meat from four goat breeds while authors such as Marume (2010) and Bakare and Chimonyo (2011) conducted studies on the Xhosa lop-eared goat breed. Of these authors, none studied the effect of *A. karroo* supplementation and thermal preparation on meat sensory characteristics of the Xhosa lop-eared goat breed. Hence, the objective of the current study was to determine the effect of *A. Karroo* supplementation and thermal preparation on meat sensory characteristics of the Xhosa lop-eared goat breed.

MATERIALS AND METHODS

Study site description

The study was conducted at the University of Fort Hare Honeydale Farm. The farm is 520 m above sea level and is located 32.8°S and 26.9°E. The farm receives an average annual rainfall of 480 mm and has a mean annual temperature of 18.7°C. It is situated in the false Thornveld of the Eastern Cape. The topography of the area is generally flat with a few steep slopes. The vegetation is a mixture of several trees, shrubs and grass species. The predominant plant species on the farm are *A. karroo, Themeda triandra, Panicum maximum, Digitaria eriantha, Eragrostis* spp., *Cynodon dactylon* and *Pennisetum clandestinum*.

Collection and nutrient composition of *A. karroo* browse plant

18 castrated four-months-old goats with a mean body weight of 13.5 ± 0.31 kg (mean ± S.E.) and a mean body condition score (BCS) of 3.3 ± 0.16 (mean ± S.E.) were kept with their mothers on natural pastures and after 60 days, moved to open sided barns where they were fed on 500 g/head/day of *Medicago sativa* hay. The goats were then randomly split into two balanced treatment groups, one of which was supplemented while the other was not. The supplemented group was fed individually with an additional 20 g/head/day of fresh daily collected *A. karoo* leaves in feeding troughs.

Animal management

Fresh leaves of *A. karroo* were hand harvested each day and dried for the determination of nutritional composition such as DM, crude protein (CP), crude fibre (CF), ether extract (EE) and tannin levels in the leaves according to the official methods of analysis of the Association of Official Analytical Chemists (AOAC). The dried leaves were fed to goats individually in feeding troughs for the period of 60 days. The Folin-Ciocalteau assays described by Terrill (1992) were performed to determine the total polyphenolic content of the dried *A. karroo* whilst the butanol-HCl assay as described by Giner-Chavez et al. (1997) was done to determine the condensed tannins (CT). The approximate analysis and tannin levels of *A. karroo* leaves are shown in Table 1.

Slaughter procedure

After eight weeks, all the goats were humanely slaughtered complying with the local regulations of animal welfare. In the morning of the day of slaughter, the goats were transported from the Honeydale farm to the Adelaide commercial abattoir which was 60 km away. The goats were electrically stunned and immediately bled. The carcases were kept in the refrigerator overnight at a temperature of -4°C. Sample cuttings for meat tasting were made from the Longistimus dorsi muscle.

Meat sample preparation

The meat samples were prepared using two thermal treatments: boiling and roasting. An average period of 45 min was used for cooking and roasting of the meat. Salt was added to taste.

Meat sensory evaluation

Meat sensory evaluation was done from boiled and roasted meat. A meat consumer sensory characteristics evaluation was done by individuals from different tribes (Xhosa, Shona, Ndebele and Zulu), different age groups (≤ 20, 21 to 25, 26 to 30, ≥ 30) and gender (female, male). Tasters were taught how to evaluate the meat samples and complete the available forms. The tasters were requested to rinse their mouth with drinking water after each taste so as to limit crossover or residual effect of the treatments. A meat sensory characteristic evaluation form containing an eight-point rating scale of meat characteristics was used to give scores to different meat sensory characteristics. Sensory characteristics that were evaluated were: aroma intensity (AI) where a score of 1 is extremely bland and a score of 8 is extremely intense, initial impression of juiciness (IJ) at score 1 extremely dry and score 8 = extremely juicy, sustained impression of juiciness (SJ) at score 1 is extremely dry and score 8 is extremely juicy, first bite (FB) at score

Table 1. Nutritional composition of the experimental diets (% DM basis).

Component	*Acacia karroo*
Dry matter	91.9
Crude protein	23.2
Crude fibre	25.9
Neutral detergent fibre	50.2
Acid detergent fibre	28.9
Ether extract	3.95
Calcium	4
Phosphorus	0.08
Ash	5.1
CT (Butanol-HCl assay)	2.1
Total phenolic (Folin assay)	0.5

1 is extremely tough to score 8 being extremely tender), muscle fibre and overall tenderness (MFT) at score 1 being extremely tough and score 8 is extremely tender, overall flavour intensity (OF) at score 1= extremely bland to score 8 = extremely intense, amount of connective tissue (ACT) at score 1= extremely abundant to 8 = none, and off- flavour (ATF) at score 1= none and score 8 = extremely intense.

Statistical analysis

The general linear model procedure of the SAS (2003) program was also used to determine the effects of *A. karroo*, age, gender, tribe and thermal preparation on meat sensory characteristics of goats. The model is:

$$Y_{ijkl} = \mu + D_i + (C_j \times D_i) + (C_j \times T_k) + (C_j \times G_i) + (C_k \times A_j) + E_{ijkl}$$

where, Y_{ijkl} = response variable (aroma intensity, initial impression of juiciness, first bite, sustained impression of juiciness, fibre and overall tenderness, amount of connective tissue, overall flavour intensity and relevant a-typical flavour), μ = overall mean common to all observations, D_i = effect of *A. karroo* supplementation, $C_j \times T_k$ = effect of thermal treatment and tribe, $C_j \times G_i$ = effect of thermal treatment and gender, $C_k \times A_j$ = effect of thermal treatment and age, E_{ijkl} = random error.

RESULTS

The effect of *A. karroo* supplementation on the sensory characteristics of meat from Xhosa lop-eared goats is shown in Table 2. Meat from the supplemented goats had significantly higher (P <0.05) sensory scores than the one from non-supplemented goats. There were no significant effects (P > 0.05) of *A. karroo* supplementation on meat flavour and off-flavour scores. Table 3 shows the effect of *A. karroo* supplementation and thermal preparations (cooked and roasted meat) on sensory characteristics of meat from goats. The highest (P < 0.05) scores for meat juiciness and tenderness were recorded in cooked meat from *A. karroo* supplemented goats. Roasted meat had the lowest (P < 0.05) sensory scores across the treatment groups. The cooked meat from supplemented and non-supplemented goats had higher (P < 0.05) sensory scores than the roasted meat.

The effects of thermal preparation and consumer gender on meat sensory characteristics are shown in Table 4. Female consumers gave higher (P < 0.05) sensory scores for all sensory characteristics for both cooked and roasted meat. Both male and female consumers gave higher (P < 0.05) sensory scores for the cooked meat than the roasted meat. Table 5 shows the effect of tribe and thermal preparation on the sensory characteristics of meat from Xhosa lop-eared goats. The highest (P < 0.05) sensory scores for aroma intensity, first bite and amount of connective tissue and sustained impression of juiciness in cooked meat were given by the Shona consumers while the Zulu consumers gave high sensory scores for overall flavour, off-flavour and muscle fibre and overall tenderness from cooked meat. Ndebele and Xhosa consumers gave the highest (P < 0.05) scores for initial juiciness and muscle fibre and overall tenderness, respectively from the cooked meat.

Consumer age group had a significant effect (P < 0.05) on the meat sensory scores across thermal preparations (Table 6). The sensory scores for cooked meat were generally higher (P < 0.05) than those for roasted meat across age groups. The consumer age group between 26 to 30 years old gave the highest (P < 0.05) sensory scores for aroma intensity, initial juiciness, sustained juiciness, muscle fibre and overall tenderness from the cooked meat. The highest (P < 0.05) sensory scores for overall flavour and off-flavours from the cooked meat were given by consumer age group between 21 to 25 years and consumers less than 20 years old, respectively while the highest (P < 0.05) sensory scores for first bite and amount of connective tissue from the cooked meat were given by consumers more than 30 years old.

DISCUSSION

Supplementation with dietary protein particularly from browse trees in the diet of ruminants produces carcasses of good quality (Arsenos et al., 2009; Mapiye et al., 2009). In the current study, the positive effect of *A. karroo* supplementation on meat sensory characteristics, particularly meat tenderness and juiciness from the supplemented goats is attributed to the effect of *A. karroo* nutrient composition (Mapiye et al., 2009). The *A. karroo* browse plant is reported to be a good source of proteins and minerals (Mokoboki et al., 2005; Ngongoni et al., 2007) which are the dietary requirements for the development of meat sensory attributes.

Meat juiciness is directly related to the intramuscular fat content of the meat (Webb et al., 2005; Muchenje et al., 2009c; 2010), however, it is highly affected by animal species (Tshabalala et al., 2003; Muchenje et al., 2008a).

Table 2. Effects of *A. karroo* supplementation on meat sensory characteristics of Xhosa lop-eared goat breed.

Parameter	AK	NS	Significance
AI	4.3 ± 0.30	4.5 ± 0.30	NS
IJ	4.9 ± 0.24	3.8 ± 0.24	*
FB	4.5 ± 0.26	4.1 ± 0.26	*
SJ	5.1 ± 0.24	4.2 ± 0.24	*
MFT	4.5 ± 0.23	4.1 ± 0.23	*
ACT	3.9 ± 0.24	3.9 ± 0.24	NS
OF	4.2 ± 0.27	4.3 ± 0.27	NS
ATF	2.2 ± 0.29	3.2 ± 0.29	NS

AI = aroma intensity; IJ = Initial juiciness; SJ = sustained juiciness; MFT = muscle fibre and overall tenderness; ACT = amount of connective tissue; OF = overall flavour score; ATF = off-flavour score; AK= *Acacia karroo* supplemented; NS= not supplemented. *= significant different (P< 0.05); NS = not significant (P> 0.05).

Table 3. Effect of *A. karroo* supplementation and cooking methods on sensory scores of Xhosa lop-eared goat genotype.

Sensory characteristic	Unsupplemented		*Acacia karroo* supplemented	
	Cooked	Roasted	Cooked	Roasted
Aroma intensity	4.9 ± 0.41^{b}	4.1 ± 0.41^{a}	4.6 ± 0.41^{b}	3.9 ± 0.42^{a}
Overall flavour	4.6 ± 0.37^{b}	4.0 ± 0.38^{a}	4.4 ± 0.37^{ab}	3.9 ± 0.38^{a}
Initial impression of juiciness	4.8 ± 0.33^{b}	2.7 ± 0.33^{a}	5.1 ± 0.33^{b}	2.9 ± 0.33^{a}
Sustained impression of juiciness	5.2 ± 0.33^{b}	3.2 ± 0.33^{a}	5.5 ± 0.33^{b}	3.6 ± 0.33^{a}
First bite	5.1 ± 0.36^{b}	2.9 ± 0.37^{a}	5.8 ± 0.36^{c}	3.3 ± 0.37^{a}
Amount of connective tissue	4.4 ± 0.34^{b}	3.3 ± 0.34^{a}	4.3 ± 0.34^{b}	3.6 ± 0.34^{a}
Muscle fibre and tenderness	4.8 ± 0.32^{b}	3.4 ± 0.32^{a}	5.3 ± 0.31^{b}	3.6 ± 0.32^{a}
Off-flavour score	3.4 ± 0.40^{b}	2.9 ± 0.41^{a}	3.2 ± 0.40^{ab}	2.6 ± 0.41^{a}

^{abcd}, Means with different superscripts in the same row are significantly different ($P < 0.05$).

Table 4. The effect of gender group and cooking method on meat sensory characteristics of the Xhosa lop-eared goat genotype.

Sensory characteristic	Female		Male	
	Cooked	Roasted	Cooked	Roasted
Aroma intensity	5.5 ± 0.39^{b}	4.6 ± 0.40^{a}	4.1 ± 0.39^{a}	4.1 ± 0.40^{a}
Overall flavour	4.7 ± 0.36^{b}	4.5 ± 0.37^{ab}	4.1 ± 0.36^{a}	4.1 ± 0.37^{a}
Initial impression of juiciness	5.3 ± 0.32^{c}	3.7 ± 0.32^{a}	4.8 ± 0.31^{b}	3.2 ± 0.32^{a}
Sustained impression of juiciness	5.5 ± 0.32^{b}	4.1 ± 0.32^{a}	5.1 ± 0.31^{b}	3.7 ± 0.32^{a}
First bite	5.5 ± 0.35^{b}	3.7 ± 0.35^{a}	4.9 ± 0.34^{b}	3.5 ± 0.35^{a}
Amount of connective tissue	4.3 ± 0.32^{b}	$3. 8 \pm 0.33^{a}$	4.2 ± 0.32^{ab}	3.8 ± 0.33^{a}
Muscle fibre and tenderness	5.1 ± 0.30^{c}	4.0 ± 0.31^{a}	4.6 ± 0.30^{b}	3.7 ± 0.3^{a}
Off-flavour score	3.6 ± 0.39^{b}	2.8 ± 0.39^{a}	3.5 ± 0.38^{b}	2.8 ± 0.39^{a}

^{abcd}, Means with different superscripts in the same row are significantly different ($P < 0.05$).

In the current study, meat juiciness had generally lower sensory scores across treatment groups. This could be because chevon has been reported to be less juicy, especially for sustained juiciness (Tshabalala et al.2003), since goat carcasses have low fat content (Simela, 2005). But, the meat juiciness scores from the *A. karroo* supplemented goats were significantly higher ($P < 0.05$) than the meat juiciness scores of meat from the non-supplemented goats. The difference, in the improvement in meat juiciness scores from the *A. karroo* supplemented

Table 5. Sensory scores for the effect of tribe and cooking method on meat sensory characteristics of the Xhosa lop-eared goat breed.

Sensory characteristic	Xhosa		Shona		Zulu		Ndebele	
	Cooked	Roasted	Cooked	Roasted	Cooked	Roasted	Cooked	Roasted
AI	4.9 ± 0.25^{b}	4.6 ±0.25^{b}	5.9 ± 0.68^{c}	4.7 ± 0.79^{b}	4.8 ± 0.61^{b}	3.7 ± 0.55^{a}	4.7 ± 1.16^{b}	3.8 ± 1.16^{a}
OF	4.9 ± 0.23^{b}	4.5 ± 0.23^{ab}	5.0 ± 0.62^{b}	4.4 ± 0.72^{ab}	5.1 ± 0.56^{b}	3.7 ± 0.51^{a}	3.6 ± 1.06^{a}	3.8 ± 1.06^{a}
IJ	5.1 ± 0.21^{b}	3.4 ± 0.21^{a}	5.0 ± 0.55^{b}	3.5 ± 0.64^{a}	5.9 ± 0.49^{c}	3.2 ± 0.45^{a}	6.1 ± 0.95^{c}	3.1 ± 0.94^{a}
SJ	5.6 ± 0.20^{b}	3.7 ± 0.21^{a}	6.1 ± 0.55^{c}	4.0 ± 0.63^{a}	5.9 ± 0.49^{bc}	3.5 ± 0.44^{a}	5.4 ± 0.94^{b}	3.6 ± 0.94^{a}
FB	5.9 ± 0.22^{c}	2.9 ± 0.22^{a}	6.1 ± 0.60^{c}	3.5 ± 0.69^{a}	5.8 ± 0.54^{c}	3.6 ± 0.49^{a}	4. ± 1.03^{b}	3.4 ± 1.03^{a}
ACT	4.7 ± 0.21^{bc}	3.3 ± 0.21^{a}	5.3 ± 0.56^{c}	3.9 ± 0.65^{a}	4.6 ± 0.50^{b}	3.8 ±0.45^{ab}	3.5 ± 0.96^{a}	3.5 ± 0.96^{a}
MFT	5.8 ± 0.19^{c}	3.3 ± 0.19^{a}	5.7 ± 0.52^{c}	3.8 ± 0.61^{ab}	5.8 ± 0.47^{c}	3.4 ± 0.43^{a}	3.6 ± 0.89^{a}	4.0 ± 0.89^{b}
ATF	3.4 ± 0.24^{bc}	3.0 ± 0.25^{b}	3.7 ± 0.66^{c}	4.4 ± 0.77^{d}	4.3 ± 0.59^{d}	3.7 ± 0.54^{c}	2.9 ± 1.14^{b}	0.3 ± 1.14^{a}

^{abcd}, Means with different superscripts in the same row are significantly different ($P < 0.05$). AI = aroma intensity; IJ =initial juiciness; SJ = sustained juiciness; MFT = muscle fibre and overall tenderness; ACT = amount of connective tissue; OF = overall flavour score; ATF = off-flavour score.

Table 6. The effect of age and cooking method on meat sensory characteristics of Xhosa lop-eared goat genotype.

Sensory characteristic	≤20		21 to 25		26 to 30		≥30	
	Cooked	Roasted	Cooked	Roasted	Cooked	Roasted	Cooked	Roasted
AI	5.3 ± 0.51^{bc}	4.7 ± 0.50^{b}	5.0 ± 0.42^{b}	3.9 ± 0.42^{a}	5.7 ± 0.63^{c}	4.1 ± 0.64^{a}	4.2 ± 0.51^{a}	4.1 ± 0.52^{a}
OF	4.5 ± 0.46^{b}	3.9 ± 0.46^{a}	4.9 ± 0.38^{c}	3.9 ± 0.39^{a}	4.8 ± 0.58^{c}	3.9 ± 0.59^{a}	4.4 ± 0.47^{ab}	4.6 ± 0.48^{bc}
IJ	5.6 ± 0.41^{c}	2.9 ± 0.41^{a}	5.5 ± 0.34^{c}	3.4 ± 0.34^{ab}	5.7 ± 0.51^{c}	3.6 ± 0.52^{b}	5.3 ± 0.42^{c}	3.2 ± 0.42^{a}
SJ	5.6 ± 0.41^{c}	3.4 ± 0.41^{a}	5.2 ± 0.34^{c}	3.7 ± 0.34^{a}	6.2 ± 0.51^{d}	4.3 ± 0.52^{b}	5.8 ± 0.41^{cd}	3.5 ± 0.43^{a}
FB	5.6 ± 0.45^{cd}	2.9 ± 0.45^{a}	5.3 ± 0.37^{c}	3.3 ± 0.37^{a}	5.7 ± 0.56^{d}	3.9 ± 0.57^{b}	6.0 ± 0.46^{d}	3.2 ± 0.46^{a}
ACT	4.1 ± 0.42^{ab}	3.7 ± 0.41^{a}	4.6 ± 0.35^{bc}	3.7 ± 0.35^{a}	4.5 ± 0.52^{b}	3.4 ± 0.53^{a}	4.9 ± 0.43^{c}	3.6 ± 0.43^{a}
MFT	5.4 ± 0.39^{c}	3.5 ± 0.39^{a}	4.7 ± 0.32^{b}	3.6 ± 0.32^{a}	5.4 ± 0.49^{c}	4.2 ± 0.49^{b}	5.4 ± 0.39^{c}	3.2 ± 0.40^{a}
ATF	4.3 ± 0.49^{c}	2.5 ± 0.49^{a}	3.6 ± 0.41^{b}	2.8 ± 0.41^{a}	2.8 ± 0.62^{a}	2.1 ± 0.63^{a}	3.6 ± 0.50^{b}	4.0 ± 0.51^{bc}

^{abcd}, Means with different superscripts in the same row are significantly different ($P < 0.05$). AI = aroma intensity; IJ =initial juiciness; SJ = sustained juiciness; MFT = muscle fibre and overall tenderness; ACT = amount of connective tissue; OF = overall flavour score; ATF = off-flavour score.

supplemented goats could be attributed to the effect of *A. karroo* supplementation since it is known to improve the resilience of meat producing animals (Arsenos et al., 2009; Marume, 2010) and is a source of proteins (Mokoboki et al., 2005).

In the current study, there was no significant effect of *A. karroo* supplementation on meat flavour. Several authors have reported diverse results on the effect of diet on meat flavour.

Bowling et al. (1978); Melton (1983); Berry (1988) reported a significant effect of diet on meat flavour while Bidner et al. (1985) and French et al. (2001) reported no significant effect of diet on meat flavour. The variety of results could be due to the variety of feedstuff used, such as silage and

pasture (Melton, 1983), corn diets to corn silage diets (Berry et al., 1988), grass and grain-fed (French et al., 2001). The results may be influenced by the type and intensity of fatty acid developed. For example, when levels ofpolyunsaturated fatty acids (PUFA) become too high, off-flavours can develop, especially during cooking (Elmore et al., 2002; Muchenje et al., 2010).

There was a significant effect ($P < 0.05$) of thermal preparation on meat sensory characteristics scores. The highest sensory scores for cooked meat, not the roasted meat reported in the current study could be attributed to the difference in cooking losses from the two thermal preparations. This could be the result of the extent to which protein denaturing takes place and is assumed to be higher in roasted meat than in cooked meat (Garcia-Segovia et al., 2006). Therefore, with higher protein losses there will be higher cooking losses since protein was reported to increase water binding properties (Jama et al., 2008). However, lower sensory scores could result since higher cooking losses result in lower juiciness and less tender muscle (Sheard et al., 2005). Dyubele et al. (2010) also reported a significant effect of thermal preparation on sensory scores of chicken where the roasted meat had higher sensory scores than the cooked meat. The argument could be attributed to the effect of animal species (Muchenje et al., 2008a). Differences observed on meat sensory characteristics between cooked and roasted meat can be associated with consumer experience and familiarity with a particular thermal preparation of meat (Sveinsdóttir et al., 2009; Xazela et al., 2011). Normally, communal home meat preparation is through cooking. Therefore, with the lack of experience for roasted meat, consumers might not properly identify differences among sensory characteristics of roasted meat. The effect of consumer background was also studied in the current study.

There is also a significant effect of consumer age, gender and thermal preparation on meat sensory scores. The highest sensory scores recorded by female consumers in the current study is in agreement with the findings by Simela (2005), Dyubele et al. (2010) and Xazela et al. (2011) who all reported a significant effect of consumer gender on sensory characteristics, where females reported higher scores of meat juiciness than males consumers. Different tribes reported different intensity in sensory scores across sensory characteristics of cooked meat. This can, however, be associated with consumer familiarity with and availability of goat meat (Sveinsdóttir et al., 2009) and the influence of the consumer's country of origin (Shabalala and Mosima, 2002).

Preference for animal species for meat production is directly affected by consumer background (Sañudo et al., 2007). The differences between and within countries might be explained by different consumption patterns of chevon. However, its consumption is affected by religious restrictions (Jaturasitha, 2004). For instance, in some countries such as South Africa, consumption of chevon is assumed to be more suitable for traditional ceremonies (Mahanjana and Cronje, 2000; Ayalew et al., 2003; Rumosa-Gwaze et al., 2009).

Conclusion

A. karroo supplementation significantly improved the tenderness and juiciness of meat from goats. However; there were no significant effects of *A. karroo* supplementation on chevon flavour and off-flavours. Thermal preparation affected meat quality attributes, where cooked meat had higher sensory scores than the roasted meat. Background had an effect on the consumer's perception of meat quality attributes.

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