



Variation in the sensory profile of South African Dorper lamb from extensive grazing systems



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ABSTRACT

Descriptive sensory analysis was used to determine the variation in the sensory profiles of extensively produced South African Dorper lamb. The *Longissimus thoracis et lumborum* and subcutaneous fat of lambs from seven different farms in South Africa were assessed by rating its sensory attributes, determining proximate composition and measuring pH, thaw loss, cooking loss and Warner-Bratzler shear force. Discriminant analysis grouped treatments in terms of sensory and physical characteristics. The Northern Cape farms [except for Hantam Karoo/Calvinia (HK/CAL)] clustered closely with less discrimination and were rated highest ($P \leq 0.05$) in lamb-like characteristics, tenderness and juiciness. Mutton-like, sheep wool and herbaceous attributes were prominent for HK/CAL, while Rûens (RU) and Free State (FS) received high ratings for mutton-like, oily and barnyard/kraal attributes. These groupings are likely owing to dietary differences between the regions. The results suggest the possibility of region of origin classification for South African lamb such as Karoo lamb with herbaceous attributes related to a fragrant Karoo plant diet.

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1. Introduction

In South Africa several extensive sheep grazing systems, varying on account of diet, exist. Sheep farming is a dominant enterprise in 82.0% of the Northern Cape province, mainly due to the limitation of alternative farming ventures (Cloete and Olivier, 2010). It also comprises the largest area of the “Karoo”. The Karoo constitutes a variety of different vegetation types which form part of about 30% of the total area of South Africa (Vorster and Roux, 1983; Bramley et al., 2009). The name Karoo is derived from the indigenous Hottentot name, Karu, which means dry or arid land (Vorster and Roux, 1983). This semi-arid region has a low carrying capacity of less than one large stock unit per 40 ha, where the natural pasture for the lambs varies from grassy, dwarf shrublands (Nama-Karoo biome) to dwarf, succulent shrubs (succulent Karoo biome) (Vorster and Roux, 1983; Cloete and Olivier, 2010). Lamb produced extensively within this region is also known as “Karoo lamb”, which is known for its typical sensory characteristics attributable to the free-ranging conditions and the grazing on fragrant indigenous plants (Karoo bushes) (Estler et al., 2006). Apart

from the vast Karoo region, the sheep industry comprises fairly intensive enterprises in the pasture-cropping regions and intensive horticultural areas of South Africa (Cloete and Olivier, 2010). The Swartland (western seaboard) and Overberg (southern seaboard) regions of the Western Cape have a typical Mediterranean climate, where sheep production is coordinated with winter grain cropping (Cloete and Olivier, 2010). In the Overberg region, lucerne/alfalfa (*Medicago sativa*) is typically cultivated in the pasture phase and serves as feed for sheep. Small grain stubble is another characteristic feed of the region, which may also form part of the diet (Cloete and Olivier, 2010). Although less known, lamb produced within this region is known as “Rûens lamb”, where the typical diet of the sheep produced within the Rûens shale renosterveld region gives the lamb meat its unique sensory qualities. Sheep farming is also practised in the Free State grasslands region. This region consists of plains with summer rainfall and vegetation mainly consisting of Kimberley thornveld (Savanna biome) and to a lesser extent that of the Western Free State clay grassland (grassland biome) (Cloete and Olivier, 2010). Variation in the sensory profile of sheep meat is expected across South Africa based on the dietary differences linked to the variation in vegetation within the regions.

The effect of diet on the sensory characteristics of sheep meat is widely documented (Rousset-Akrim et al., 1997; Fisher et al., 2000; Young et al., 2003; Fraser et al., 2004; Almela et al., 2010;

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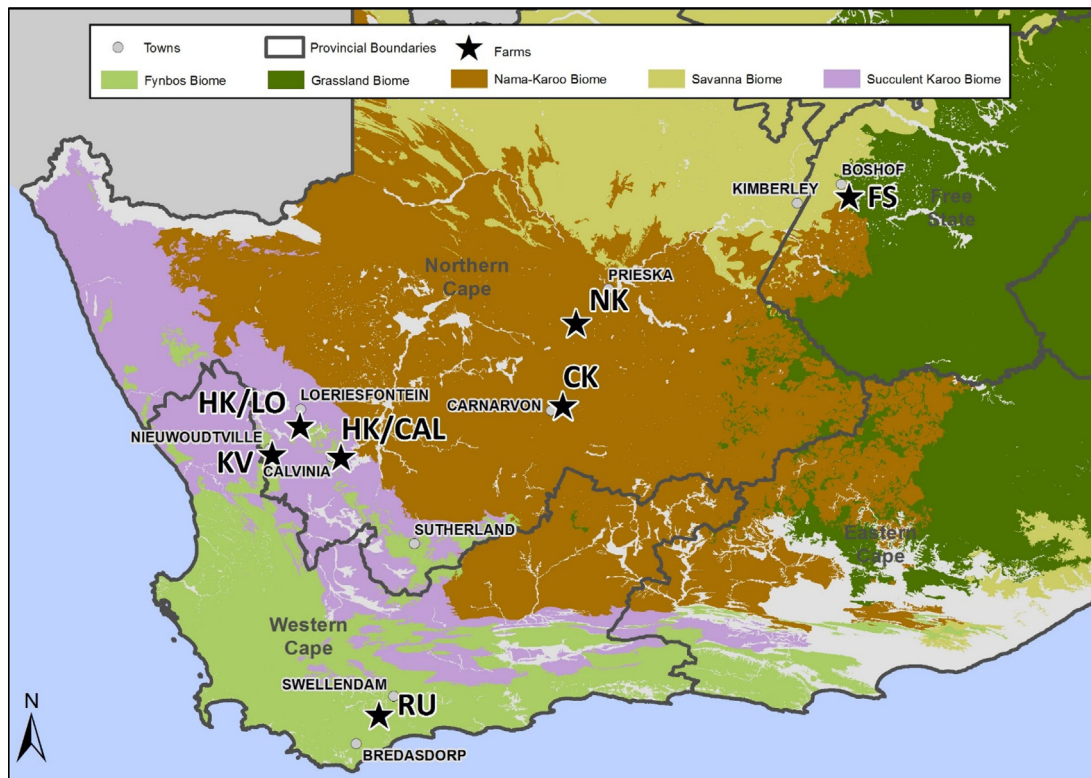


Fig. 1. Map of the different biomes related to the seven farms selected. (CK) Central Karoo; (NK) Northern Karoo; (HK/LO) Hantam Karoo/Loeriesfontein; (KV) Knersvlakte; (HK/CAL) Hantam Karoo/Calvinia; (RU) Rûens; (FS) Free State. Map supplied by Western Cape Department of Agriculture, South Africa, [Mucina and Rutherford, 2006](#).

[Resconi et al., 2010](#)). Increased mutton and sweet-associated flavour attributes have been associated with pasture-fed lambs ([Rousset-Akrim et al., 1997](#); [Young et al., 2003](#)). [Priolo et al. \(2002\)](#) and [Borton et al. \(2005\)](#) found a high lamb flavour in stall-fed lambs compared to grass-fed lambs, while the grass-fed also had more liver and less fatty flavours. Lucerne-fed lambs have received high ratings for oily or fattiness ([Young et al., 2003](#)). Opposing results also exist as [Fraser et al. \(2004\)](#) found that pasture-type has no significant effect on meat flavour. It is suggested that the variation in diet can alter the composition of the meat, affecting the aroma and flavour precursors, which consist of compounds derived from the muscle tissue, fat tissue and intramuscular fat ([Madruga and Mottram, 1995](#); [Spanier et al., 2004](#)).

The effect of diet on the fatty acid composition of ruminant meat is largely responsible for the variation in sensory profiles. Sheep finished on pasture or fed linseed oil had higher concentrations of linolenic acid (C18:3 *n*-3) with high sensory scores for lamb flavour, and low scores for abnormal flavour (i.e. taints) ([Fisher et al., 2000](#); [Nute et al., 2007](#)). However, sheep finished on concentrate or fed protected lipid supplement (PLS) had higher concentrations of linoleic acid (C18:2 *n*-6) with low scores for lamb flavour, and high scores for abnormal flavour. These results are consistent with other research findings ([Fisher et al., 2000](#); [Sañudo et al., 2000](#); [Elmore et al., 2005](#)). The transfer of some plant secondary metabolites such as condensed tannin and terpenes from forage to meat and fat have also been studied ([Priolo et al., 2004](#); [Schreurs et al., 2008](#)). The latter and other volatiles obtained from the diet directly influence the aroma and flavour of meat. [Cornu et al. \(2001\)](#) suggest the use of terpenes, from natural grasslands and subsequently found in meat, as food tracers or markers of the geographical origin.

Within South Africa, the Merino is the dominant sheep breed closely followed by the Dorper ([Cloete and Olivier, 2010](#)). Although breed has been known to influence flavour ([Sink and Caporaso, 1977](#); [Young et al., 1993](#); [Fisher et al., 2000](#)), [Cloete et al. \(2012\)](#)

found no sensory differences ($P > 0.05$) in the sensory attributes of the meat from Merino, Dohne Merino, South African Mutton Merino (SAMM) and Dorper rams and ewes. This was likely since all the sheep were raised on the same planted pasture diet, resulting in very similar fatty acid profiles and hence similar sensory characteristics. It was essential to select one breed of sheep for the purpose of this study as [Brand \(2000\)](#) concluded that the grazing habits between breeds (i.e. Merino and Dorper) grazing natural pastures vary. Contrary to the findings of [Cloete et al. \(2012\)](#), this could result in dietary and consequently sensory differences in the meat.

There is limited published results on the sensory profile of South African Dorper lamb from extensive grazing systems. It is essential to explore how diet, linked to the typical vegetation of the farm, affects the sensory profile of the meat and fat. Thus, the aim of this study was to determine the variation in sensory profiles of South African Dorper lambs from farms with different vegetation types raised under extensive grazing systems. Lambs from farms within the Northern Cape, Free State and Western Cape provinces of South Africa were included in the study.

2. Materials and methods

2.1. Experimental layout

Dorper lambs ($n = 10$) were sourced from seven different farms in South Africa ([Fig. 1](#)), each unique in terms of its vegetation and the extensive grazing conditions. Each farm represents a treatment where ten slaughter-ready lambs were sourced. Lambs were raised extensively on natural vegetation within the vicinity of the farm. Plant samples were collected from the farms after the lambs were slaughtered. Plants were collected from the vicinity last grazed before death or, when the field was depleted, from a field similar to that of the original grazing area (less than 1 km away). The farmers were questioned upon the typical diet which the animal followed

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