

RELATIONSHIP BETWEEN MUSCLE TYPE AND MEAT QUALITY PARAMETERS IN BOAR × RED SOKOTO GOAT

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ABSTRACT

This study is aimed at evaluating the quality (water holding capacity and pH) in Supraspinatus (SS), Semimembranosus (SM) and Longissimus (LD) muscles of Boar × red Sokoto goat. A total of ten samples, replicated 5 times in a Completely Randomized Design (CRD) were used in the present study. The samples were stored under chilling condition for a period of seven days where ultimate pH, drip loss and cook loss were evaluated. The results indicated non-significant ($P > 0.05$) differences in drip loss (SS 1.63 and 4.78%) (SM 1.49 and 5.35%) and (LD 1.94 and 4.04%) at day 0 and 7 ageing periods respectively. However, cook loss differed significantly ($P < 0.05$) in all muscles at day 7 period (SS 18.63, SM 20.99 and LD 12.20). Similarly, pH values show significant ($P < 0.05$) differences in all the muscles at day 0 (SS 6.88, SM 6.99 and LD 6.59) whereas at day 7, similar ($P > 0.05$) result was recorded. It was concluded that LD muscle could be considered as superior muscle than SS and SM muscles in terms of processing quality having lower cook loss values and pH. Therefore, LD muscle could be regarded as muscle of choice considering the importance of low pH values in relation to meat quality traits and shelf-life.

Keywords: Muscle, anatomical position, quality traits, consumer, Goats

INTRODUCTION

According to Devendra and Gandhi (2015) there is growing demand for goat meat because its quality attributes are concordant with the present-day consumer's demand. Despite the importance of goat meat in human diet, little attention has been paid to the impact of processing conditions on its physicochemical properties.

It is therefore, important to address quality concerns about goat meat, particularly attributes such as water holding capacity (WHC) and pH as they determine the economic index of the product. The conditions of low pH and high temperatures in post-mortem muscle reduce the water-binding capacity of meat, an effect attributed to the denaturation of muscle proteins, particularly myosin. The denaturing conditions usually arise when the pH decline is very rapid but can also occur when normal rates of pH decline combine with very slow chilling (Offer and Knight, 1988). WHC is the ability of fresh meat to retain its own water and the water released can be described as drip, purge, weep, exudates or cook loss. Low water holding capacity reduces meat yield during processing (Lawrie and Ledward, 2006).

It is against these backdrop that this work was conducted to evaluate the relationship between muscle type and meat quality parameters in Boar × Red Sokoto Goat.

MATERIALS AND METHODS

Description of the experimental location

This study was conducted in the physical laboratory of the Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto. Sokoto state is located at the extreme north-western part of Nigeria between longitudes 4°8'E and 6°54'E and latitudes 12°N and 13°58' N (Mamman *et al.*, 2000).

Experimental animals and diet

A total of ten intact Boar x Sokoto red goats of between 6 and 7 months old with an average weight of 16.0 kg $\pm$ 0.6 managed in a commercial breeding centre in Niger state. Diets were served in the morning (9:00 am) and afternoon (3:00 pm) while fresh water was given adlibitum. The experimental diet fed to the animals was formulated according to the recommended standard (NRC, 2007)

Sample collection and preparation

Fifteen muscle samples from Boar x Sokoto red goat were collected and prepared according to the procedure of Mohammad and Naimeh (2011). Samples were frozen and transported to Sokoto state under the liquid nitrogen storage. Briefly, samples were removed from the *Supraspinatus* (SS), *Semimembranosus* (SM) and *Longissimus dorsi* (LD) muscles and sliced into three equal subsamples and packaged in an hermetically sealed plastic bag and then randomly assigned to aging periods of 0 and 7 days and stored at chilling temperature (4°C) for subsequent pH, cooking loss and drip loss measurements.

Experimental design and physico chemical analysis of muscles

The design employed for this experiment is a Completely Randomized Design (CRD), one way analysis of variance with a number of samples representing the replicates while SS, SM and LD muscles representing the treatments. The pH, drip loss and cook loss were determined according to the method described by Garba *et al.* (2019).

Data analysis

The data were analyzed using the General Linear Model (GLM) procedure of Statistical Analysis System (SAS) package version 9.2 software (Statistical Analysis System, 2012, SAS Institute Inc., Cary, NC, USA) and statistical significance was set at $P < 0.05$. Significant differences between means were detected using Duncan's multiple range tests.

RESULTS AND DISCUSSION

The drip loss results obtained from this study indicates non significance ($P < 0.05$) differences between muscles at respective ageing periods (Table 1). Our result is in agreement with the finding of Kadim *et al.* (2006) who reported non-significant in drip loss due to the effect of muscles and interaction with transportation. Drip loss is generally considered undesirable from both economic and consumer acceptability perspective (Troy and Kerry, 2010). Generally, goat muscles have low intramuscular fat content, hence they tend to have low drip loss (Cassey, 1992). Thus, regarded as an added advantage to meat processors and retailers.

Table 1: Water holding capacity and pH values of the three muscle types

Parameter	Ageing Period	SS	SM	LD	SEM	P-value
Drip loss (%)	0	1.63	1.49	1.94	0.1989	0.2897
	7	4.78	5.35	4.04	0.6807	0.3662
Cooking loss (%)	0	22.34	26.54	19.23	1.9518	0.0541
	7	18.63 ^a	20.99 ^a	12.20 ^b	1.8356	0.0057
pH (unit)	0	6.88 ^a	6.99 ^a	6.59 ^b	0.0990	0.0381
	7	6.50	6.53	6.47	0.0843	0.7441

^{ab} Means bearing different letters within a row are statistically different ($P < 0.05$)

The average cooking loss of SS, SM and LD muscles appeared to be non-significant ($P < 0.05$) at day 0 ageing period. However, the cooking loss results at day 7 ageing period revealed that SM and SS had higher cooking loss compared to LD muscles. Our result is within the reported normal range for goat muscles (Kadim *et al.*, 2006). Factors such as time, temperature, ultimate pH and the type of muscle affect cooking loss (Abdullah and Musallam, 2007).

High cooking loss results in low water holding capacity which is an index for determining the cooking yield of meat. Cooking loss can generally be used as a measure of the juiciness of meat, with low cooking losses being associated with greater retention of meat fluids (water and/ or lipid) and thus with enhanced juiciness of final product (Sebsibe, 2008).

The mean ultimate pH results obtained from this study indicates significant ($P < 0.05$) differences between the muscle samples at day 0 while statistically similar at day 7 ageing period. Besides being not significantly different, it was also observed that there was higher pH at day 0 muscle samples compared to day 7 of ageing. This is in agreement with the findings of Sazili *et al.* (2011) who reported higher pH in sheep at day 0 muscle samples compared to those subjected to 1 and 7 days of conditioning.

The average pHu value in this study for all the muscles correspond to reported values for muscles of various goat breeds by Simela *et al.* (2004). Muscle ultimate pH (pHu) is known to influence meat quality characteristics such as colour, water holding capacity and tenderness (Lawrie and Ledward, 2006). Purslow (2005) reported that the pH of most animal muscles decline from basic to acidic as the ageing days increases as depicted in our result.

CONCLUSION

Muscle from LD could be considered a better muscle than SS and SM muscle in terms of processing quality having lower cook loss values. Results of pH show lower value in LD muscle compared to both SS and SM, which implies low acidity. Therefore, LD muscle could be regarded as muscle of choice considering the importance of low pH values in relation to meat quality traits and shelf-life.

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