

**Perceptions of rural consumers and the quality of mutton at purchase points in the
Eastern Cape Province, South Africa**

By

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December 2012

Declaration

I, **Rani Zikhona Theodora**, vow that this dissertation has not been submitted to any University and that it is my original work conducted under the supervision of Prof. V. Muchenje. All assistance towards the production of this work and all the references contained herein have been duly accredited.

Rani Zikhona Theodora

Date

Approved as to style and content by:

Prof. V. Muchenje (Supervisor)**December 2012**

Abstract

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The objective of the study was to determine perceptions of rural consumers on mutton quality, and the quality of mutton at purchase points in the Eastern Cape Province, South Africa. The study was conducted in five different municipalities (Buffalo City, Nkonkobe, Ngqushwa, Lukhanje and Amahlathi). A survey was conducted where a sample of 215 consumers were randomly selected and interviewed, either at point of purchase or as they left the shops. The survey was not limited to the shoppers only but also extended to households from the villages. Questions on some of the most important meat quality cues were compiled. The physico-chemical quality of mutton purchased from different shops was also determined. Forty different shops and butcheries selling mutton from all the selected municipalities were visited. Different parts of mutton samples were bought. Physico-chemical qualities of mutton such as colour (L^* - lightness, b^* - redness and a^* - yellowness) and meat pH measurements were taken at points of purchase. Cooking loss and tenderness evaluations were later done at the Meat Science laboratory at the University of Fort Hare. The results indicated that price was one of the major factors affecting the purchasing decisions of consumers. Thirty four percent of the consumers preferred mutton as compared to other protein sources, even though they were not buying this type of meat because it was not affordable to them. Both male and female consumers suggested that more sheep farmers need to be established in order to reduce the levels of imported mutton into South Africa. They also highlighted that selection programmes that will result in efficient sheep production and reduced mutton prices need to be implemented. Meat at points of purchase was affected by season resulting in lower

lightness ($L^*24.7\pm0.49$) values in winter and higher ($L^* 32.2\pm0.49$) in Spring. The class of shop did not have an effect on meat quality attributes. Trotter had high values of lightness ($L^*30.4\pm2.78^a$), redness ($a^*30.4\pm2.78^a$), yellowness (13.1 ± 1.08^a), pH (6.3 ± 0.12^a), tenderness (24.9 ± 3.69^b) and cooking loss (39.5 ± 4.38^{ab}). The number of days from when the meat was put on the shelves to the time when it was purchased for consumption (days to purchase) had a significant ($P<0.05$) negative correlation with the Warner Braztler Shear Force (WBSF) values and lightness of the meat. Significant negative ($P < 0.05$) correlations between pH and colour of the meat (L^* , a^* and b^*) were also observed. It was concluded that rural consumers perceive the quality of mutton as the best and that the physico-chemical quality of meat purchased from different shops was different, largely based on the part of meat, meat storage conditions and not necessarily on the class of the shop.

Key words: Consumer perceptions, days to purchase, meat parts, meat quality, place of purchase, price of mutton

List of abbreviations

a* - Redness

b*- Yellowness

Br – Brisket

CL% - Cooking loss percentage

L*- Lightness

SAS - Statistical Analysis System

T°C - Temperature

Tr – Trotter

WBSF – Warner Braztler Shear Force

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Dedication

I dedicate this thesis to my late mom; Nikiwe Eubertha Rani, my Grandma “Mamiya” and the rest of the Rani family.

Chapter 1: Introduction

1.1 Background

Perception is defined as a process in which individuals select, organise and interpret information using appropriate body stimuli (Novak, 2011). Bryhni *et al.* (2002) states that to launch a product successfully, it is important to analyse which parameters influence demand for products. Quality is an important factor in a highly competitive market (Du and Sun, 2005). Consumers subjectively evaluate quality and it has become increasingly important to optimally align the quality of food with consumer demands, expectations, and desires (Bryhni *et al.*, 2002). Worldwide, consumers have their own preferences for meat depending on their background, social status, cultural and religious beliefs (Dyubele *et al.*, 2010; Troy and Kerry, 2010; Vimiso *et al.*, 2012). Perceptions of meat by consumers are determined by its quality. Factors such as appearance, juiciness, taste, tenderness, price, package appearance, colour, size, brand name and food safety all influence consumers' decisions to purchase meat in the retail store (Vimiso, 2010). The International Organization of Standardization (ISO) defines quality as the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (ISO 8402, 1986). Steenkamp (1990) proposed that perceived meat quality has three dimensions such as preference in terms of evaluative judgement, the interaction between the subject and the object, hence meaning comparing it in terms of other products and lastly, consumption in terms of being valued by the consumer.

The link between quality perceptions of consumers and physical product requires knowledge of the quality evaluation of the consumers. In the mind of an average consumer about to purchase meat: colour and freshness are determining factors. The colour of fresh meat is of the utmost importance in meat marketing since it is the first quality attribute seen by the consumer who uses it as an indication of freshness and wholesomeness (Renerre and Labas,

1987; Calkins and Hodgen, 2007). At the point of sale, colour and colour stability are the most important attributes of meat quality and various commercial approaches have been used to meet the general consumer expectation, that an attractive bright red colour is compatible with long shelf-life and good eating quality (Hood and Mead, 1993). However, Taylor (1996) believes that in reality, the colour of fresh meat is not well correlated with the eating quality, hence the consumer still expects lamb to have a brick red colour or chicken to have that even pink colour.

At the point of purchase, there are different supply chains which handle their meat differently (refrigeration and retention length) and the presentation of fresh red meats with appropriate colour at retail level is of utmost importance, as consumers will discriminate negatively against meat that does not appear to match expectations or that is discoloured. According to Liu *et al.* (1995), discoloured meat cannot be sold unless it is significantly discounted or minced. However, consumers come from different backgrounds. Mpofu (1997) states that there are those who are classified as high class, middle class and those living under the poverty datum line. Consumers classified as high class are those types of consumers who can afford to buy everything, even if a product is at a higher price. Their purchases are not determined by the amount of cash available. Middle class consumers are at least able to afford to purchase what they want, though they might not afford some expensive products. Consumers living under the poverty datum line are those whose majority of purchases are determined by the amount of disposable cash available, such that most of the expensive products they cannot afford.

The background perception on meat quality of these different categories of consumers is expectedly diverse. It has to be taken into cognisance that consumers do not necessarily

purchase meat from the same class of shops. For an example, a consumer living in a suburb might purchase meat from top class shops or butcheries unlike a consumer coming from a village or rural town who might purchase meat from a small ordinary butchery or from the entrepreneurs selling meat in the streets. Consequently, there will be differences on how consumers value or judge quality when purchasing meat. The information that consumers consider more important in their selection of the product depends on personal, situational and product characteristics (Verlegh and van Ittersum, 2001). Therefore their perceptions on meat quality attributes and on physical chemical quality cannot be the same.

1.2 Problem statement

Mutton is important in South Africa especially in the Eastern Cape (Chulayo, 2011). From South Africa, the Eastern Cape is the biggest contributor of local sheep meat. The province produces about 30% of retail mutton, yet the region has been identified with low consumption rates of mutton (Sainsbury, 2009). Additionally, South African sheep farmers are faced with ever increasing input costs and low product price increases, resulting in the profit margins becoming smaller and smaller (Hoffman, 2003). Local farmers feel that they need to run their enterprises in the most effective manner in order to survive economically. Given the increasing economic pressures on sheep farmers, it is evident that red meat industry should give its necessary attention, in a bid to find ways of addressing the challenge of low mutton consumption rate. Research on consumer perceptions on mutton are part of the relevant approaches towards addressing this issue. The foregoing thus spurred the undertaking of this study.

Some research has been conducted on consumer perception of beef at purchase points (Brunso *et al.*, 2005; Robles *et al.*, 2009) however, there is little research on the perceptions of consumers of mutton at purchase point. There are also many studies which have been conducted on the physico-chemical quality of meat prior to purchase (Muchenje *et al.*, 2008; Miranda *et al.*, 2010; Vimiso, 2010; Chulayo, 2011; Gajana, 2011). However, research on the physico-chemical quality of meat at point of purchase is lacking. This study therefore focused on consumer perception and physico-chemical quality of mutton at points of purchase.

1.3 Justification

It should be borne in mind that meat occupies an important part of the household food shopping budget (INE, 1997). This study attempted to ascertain the consumer perception and the quality of mutton at purchase points in the Eastern Cape, South Africa. Very little has been done on the perception of consumers on mutton quality at purchase points. The novelty of the study is that it is the first of its kind to focus on rural consumer perception and the quality of mutton at purchase point in the Eastern Cape, South Africa. It is imperative that the meat industry takes consumer perceptions and behaviour into consideration because any negative perception of any meat product has an influence on the profitability of the industry. There is a link between consumers and supplies of mutton meat, and that link is the perception of the consumers. This study was aimed at ascertaining the meat quality supplied by the suppliers and the perceptions of the consumers.

1.4 Objective

The broad objective of this study was to reveal the perceptions of consumers on how they judge the quality of meat at the point of purchase, and then relate them to the physico-chemical quality that has been measured at the point of purchase and see if they match.

Specific objectives were to:

1. Determine perceptions of rural consumers on the quality of mutton in the Eastern Cape Province, South Africa.
2. Determine the physico-chemical quality of mutton purchased from different shops in the Eastern Cape Province, South Africa.

1.5 Hypotheses

The null hypothesis tested was the perceptions of consumers, how they judge the quality of meat at points of purchase, is not related to the physico-chemical quality of meat that has been measured at points of purchase.

Specific Hypothesis:

1. Perceptions of rural consumers on mutton quality in the Eastern Cape Province, in South Africa, are similar.
2. The physico-chemical quality of mutton purchased from different shops in the Eastern Cape Province, South Africa, is similar

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Chapter 2: Literature review

2.1 Introduction

In the past, “Food Quality” was more related to safety, sensory and shelf-life aspects of food products. More recently it is associated with nutrition, well-being and health. The basic definition of quality, as associated with food, relates to food as fit for human consumption or in its ability to satisfy stated or implied needs. According to Robles *et al.* (2009), the quality of meat (like that of any other food product) is difficult to define, but what is certain is that, it is a critical factor in a highly competitive meat industry. When consumers purchase meat, they receive different types of information that affect their choice prior to consumption. The information that consumers consider more important in their selection of the product depends on personal, situational and product characteristics (Verlegh and van Ittersum, 2001).

In general perception is an opinion of something viewed by an individual or community. Consumer perceptions change but it is difficult to predict this change because of the complex dynamics which drive the change. Perception not only relates to basic senses such as visual, flavour and taste attributes, but also to formed learning or experiences (Brunso *et al.*, 2002). When consumers have to make a purchasing decision, more than one factor will be used. The most important of these factors is the physico-chemical quality of the meat. The physical and chemical components of meat are the colour, pH, cooking loss, and tenderness of the meat (Muchenje *et al.*, 2009a). The question is, :how does one predict the quality of the meat just by looking at it. This chapter reviews the consumer perceptions on mutton quality and relate these perceptions to the physico-chemical quality measured at points of purchase.

2.2 Consumer perception on meat quality

Meat has been found to occupy an important part of the food shopping budget universally (INE, 1997). It has been identified as a universally valued and sought after source of human nutrition (Beardsworth and Bryman, 2004). However, consumers still find it difficult to define the quality of meat. Among different types of meat, each consumer has got its own preference of meat depending on their background, culture and age although it is important to give out what most consumers prefer. Troy and Kerry (2010) stated that perceptions of consumers on meat and meat products has a direct impact on the profitability of the meat industry and should consumers have a negative perception of any meat product, their purchasing behaviour is affected negatively which tends to have a negative impact on the profitability of the meat industry. Therefore, in order for consumers to willingly purchase and consume a particular food type, their perceptions must be positive towards it. Weissnar (2012) stated that consumers are increasingly concerned to know where food comes from and how it is produced. In reality, consumers when purchasing meat do not consider background information of the animal, they care about what they are buying and taking home. At points of purchase, the background information of an animal is not available.

At the point of purchase, consumers use what is known as “attributes” when purchasing meat, hence in the context of food and particularly meat, it is normally understood that consumer perception of meat relates to its quality in a broad sense and the most important attribute in choosing a product is quality. Meat quality can refer to some of the following attributes: carcass characteristics and composition; meat characteristics such as colour, marbling, pH and eating quality characteristics including tenderness, juiciness and flavour (Bredahl *et al.*, 1998; Muchenje *et al.*, 2009a). These attributes, are considered to be the most important

characteristics by which consumers judge meat quality (Grunert *et al.*, 2004; Dyubele *et al.*, 2010). According to Glitsch (2000), quality judged at the point-of-purchase highlights the role of "quality in the shop". This includes both what are known as extrinsic cues and intrinsic cues. Traditionally, perceptions of meat quality were described in terms of these cues (Mannion *et al.*, 2000). At points of purchase, consumers use intrinsic cues: colour, leanness and marbling and extrinsic cues: quality assurance, place of purchase and price (Glitsch, 2000). After purchase, consumers tend to form eating quality expectations: tenderness, flavour and juiciness and the correctness of the production process (Glitsch, 2000; Grunert *et al.*, 2004). In this study, the focus was at purchase points and how consumers perceive the quality of mutton.

2.3. Mutton in the Eastern Cape Province of South Africa

In South Africa there are about 25 million sheep with an average per capita consumption of lamb and mutton pegged at 3.6 kg/year. According to South African information, South African sheep farming is concentrated in the Northern and Eastern Cape, Western Cape, Free State and Mpumalanga, with around 50% of the country's sheep being fine-woolled Merinos. However, the Free State government says that 5.1 million or about 20% of the 25 million sheep in South Africa are found in the Free State with the Eastern Cape contributing the largest portion of sheep being slaughtered. The Eastern Cape is the biggest producer of retail mutton, with a contribution of 30% of the total mutton produced locally as shown in Figure 2.1. According to Samra *et al.* (2007), the highest consumption of mutton in South Africa is the Western Cape Province (29.9 %).

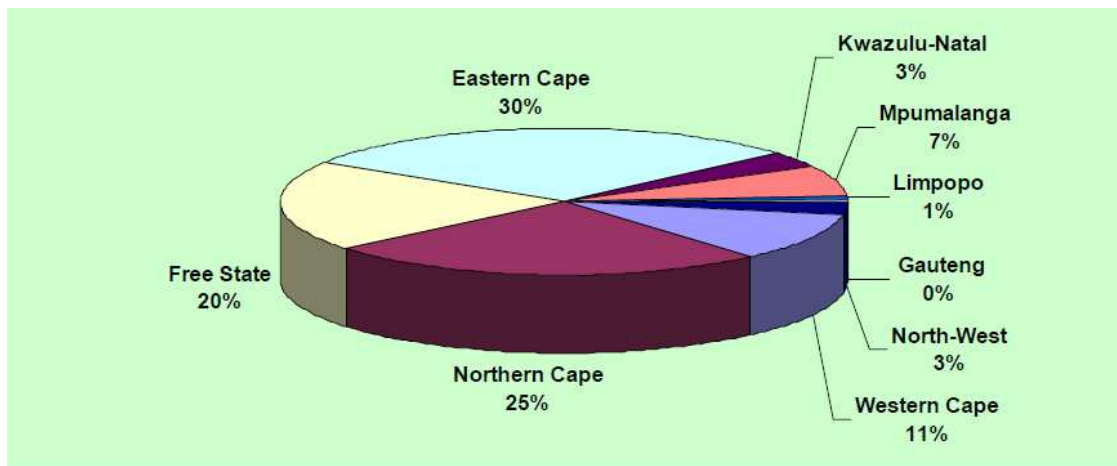


Figure 2. 1: Provincial distribution (%) of live sheep in South Africa.

Source: South African Agricultural Statistics (2008).

South Africa hosts a wide range of sheep breeds which have developed and adapted over many years to produce food and wool. South Africa is a net importer of red meat. Almost all sheep meat imports are from Australia and New Zealand. The total imports of sheep meat amounted to close to 50 000 tons in 2007, compared with 40 000 tons in 2006. This is but one of the reasons why mutton and lamb is more expensive than other types of meat. It is an unfortunate situation, considering the demand for lamb and mutton in the country. In a research paper authored by Christine Leighton (2007) from the Agricultural Research Council Livestock Business Division - Animal Production, it was noted that, “South Africa is one of the few countries in the world that find the flavour of lamb and mutton desirable and are prepared to pay more for it”.

The gross value of mutton production is depended on the price and quality of meat produced. Over the past years the average gross production value amounted to millions. As shown in Figure 2.2, from 1998- 2007 the gross value of mutton production increased continuously and

declined a bit in 2008. The declining sheep numbers and rapid population growth in South Africa are what has led to an increase in demand and subsequent shortages in the supply of mutton. The declining of sheep numbers can mainly be due to predation and stock theft (Agric Stats, 2008).

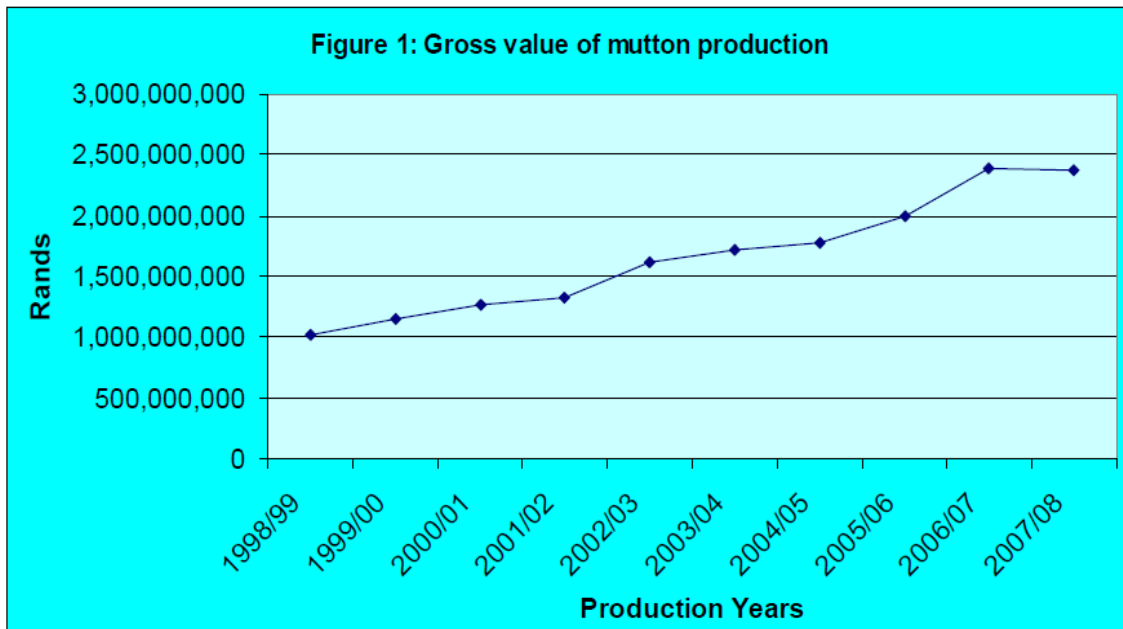


Figure 2.2: The gross value of mutton production in South Africa

Source: South African Agricultural Statistics (2008)



Figure 2.3: Total production of mutton and sheep slaughtered in South Africa. Source: Agricultural statistics (2008).

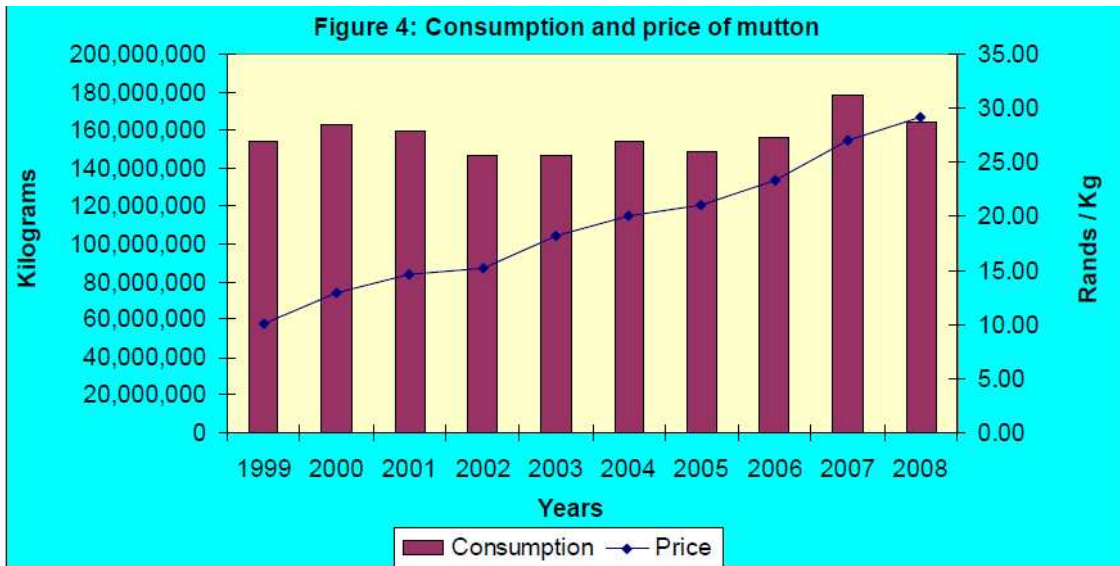


Figure 2. 2 : Total production of mutton and sheep slaughtered in South Africa.

Source: Agricultural statistics (2008).

Most of the mutton produced in South Africa is consumed locally. Figures 2.1 to 2.4 shows how important mutton is in South Africa, especially in the Eastern Cape. This is why there is a need to carry out a study in a bid to unearth the forces behind trends of mutton production in relation to mutton consumption in the Eastern Cape.

2.4 Importance of quality cues at point of purchase

When making food purchasing decisions at points of purchase, different attributes prior to purchase are considered (Engel *et al.*, 1995). Consumer expectations for product quality are based on intrinsic and extrinsic values. Speed (1998) stated that consumers are less able to judge the quality of the product before purchase and need to rely on the product's extrinsic attributes in order to infer its quality. Extrinsic cues such as quality assurance, place of purchase and price (Glitsch, 2000) can be identified as one of the essential cues at points of purchase. Price is probably the best-known extrinsic quality indicator. It becomes more important when information about other attributes is lacking and there is a risk of making the wrong choice. According to Dodds and Monroe (1985) and Monroe and Krishnan (1985) when comparing two similar products, the higher-priced alternative is usually expected to be of better quality. Boulding and Kirmani (1993) highlighted that when consumers are unable to judge quality, brand names are often used as an important assessment criterion, or as a substitute quality indicator. From the marketing point of view, the importance of extrinsic quality cues lies in the fact that they can be manipulated without the need for any physical alterations to the product. Consumers' attitudes and response towards such cues, however, may be modified by certain inherent personal characteristics such as their level of category knowledge. Hence, the assessment and perception of quality can vary from one consumer to another. Past research (Perrouy *et al.*, 2006) has shown that the level of consumers' product

knowledge influences the way they use information to form product quality judgments, and ultimately, on their product choice.

2.5 Factors affecting consumer decisions at purchase point

The link between quality perceptions of consumers and physical product and process attributes requires knowledge on the quality evaluation of the consumers. According to Aklilu (2002) and Muchenje *et al.* (2009b), beef acceptance and purchasing behaviour by consumers is affected by quality variables, such as beef colour, tenderness and flavour, which more often than not get affected by pH. Therefore, a negative perception of beef by consumers regarding such encounters may result in losses to the beef industry (Muchenje *et al.*, 2009a). It is important that factors affecting consumer decision at purchase points are considered. Price, consumer income, age and gender, packaging, taste, safety, health and environmental factors all influence consumption behaviour towards meat.

2.5.1 Packaging

There are many factors that influence the colour, shelf life and sensory attributes of meat and packaging is one of those factors. Packaging plays an important role in the food industry because it helps to protect the product against environmental effects, communicates with the consumer as a marketing tool, provides the consumer with ease of use and time saving convenience. According to Brody (1997), packaging fresh meat is carried out to avoid contamination, delay spoilage, permit some enzymatic activity to improve tenderness, reduce weight loss and where applicable, to ensure an oxymyoglobin or cherry red colour in red meat at retail or customer level. Packaging shows the product that is labeled to show any nutrition information on the food being consumed (Potter, 1995). A growing body of sensory

consumer research confirmed that extrinsic product cues, such as packaging influence how consumers evaluate food products (Deliza and MacFie, 1996). Meat can be supplied onwards to the customers packed in a variety of ways. Understanding the packaging options and the effects on the meat is very important hence they later have an effect on its quality. Fresh meat is highly perishable and a biologically active item. Shelf life is a key factor in meat storage and usage. Factors affecting shelf life of the meat include pH value, oxygen, temperature, light, micro-organisms and the amount of moisture available in the product. Modern meat packaging techniques are intended to maintain microbial and sensory quality of the product. Vacuum and modified atmosphere packaging techniques are used in the food industry to extend the product shelf-life. The basic purpose of packaging is to protect meat and meat products from undesirable impacts on quality including micro-biological and chemical alterations. The purpose to prevent these changes is to make the product available to consumers in the most attractive form. However, initial quality of the meat has to be very good because packaging can only maintain the existing quality of the meat, or delay the onset of spoilage by controlling the factors that contribute to it. The product is only protected for a limited period determined by the system that is used. Packaging protects foodstuffs during processing, storage and distribution from contamination by dirt, contamination by micro-organisms, contamination by parasites, contamination by toxic substances, influences affecting colour, smell and taste, loss or uptake of moisture.

<http://www.eblex.org.uk/documents/content/directselling/packaging300311.pdf>

2.5.1.1 Packaging types

There are many meat packaging systems currently existing, each with different attributes and applications. These systems range from overwrap packaging, for retail display to a diversity of specified modified atmosphere packaging (MAP) systems for long term display to vacuum packing.

MAP and Overwrapping – Before MAP overwrapping was extensively used for the retail display of meat. The film used for overwrapping is purposely permeable to external air. It facilitates the oxygenation of the meat causing the production of oxymyoglobin and the red “fresh meat” that consumers tend to look for. However, its disadvantage is that the meat soon oxidises, changing colour to dark brown. According to Liu *et al.*(1995) consumers discriminate negatively against meat that is discoloured. Consumers prefer a light pink to bright red colour and they will strongly reject dark coloured meat, believing that it is from an old or sick animal or contaminated (Muchenje *et al.*, 2009b). The modified atmospheric concept for packaged goods consist of modifying the atmosphere surrounding a food product by vacuum, gas flushing or controlled permeability of the pack so as to control the biochemical, enzymatic and microbial actions so as to avoid or decrease the main degradations that might occur (Farber, 1991). This allows the preservation of the fresh state of the product without the temperature or chemical treatments used by competitive preservation techniques such as freezing, dehydration and other processes. According to Church and Parsons (1994), MAP is the replacement of air in a pack with a single gas or mixture of gases. The proportion of each component is fixed when the mixture is introduced. No further control is exerted over the initial composition and the gas composition is likely to change with time owing to the diffusion of gases into and out of the product, the permeation of gases into and out of the product, and the effect of product and microbial metabolism. The

normal composition of air is 21% oxygen, 78% nitrogen and less than 0.1% carbon dioxide. One of the most important advantages of MAP is that it increases shelf life allowing less frequent loading of retail display shelves (Davies, 1995).

Vaccum Packing - This type of packing seals cuts of meat in plastic bags from which air has been excluded, and is extremely hygienic. The bags minimise both gas and moisture permeability by acting as a barrier preventing the meat surface coming into contact with external oxygen and the meat's moisture from reaching the outside world. The lack of oxygen is enough to prevent any bacteria that might cause the meat to deteriorate. (<http://www.eblex.org.uk/documents/content/directselling/packaging300311.pdf>)

2.5.2 Price

The cost of food is a major factor in determining food choice, particularly in the lower socio-economic groups (Johansson and Andersen, 1998), on the other end affordable food is a concern throughout the world. The price of meat is another important extrinsic cue that can affect consumer purchase decision (Lange *et al.*, 1999), especially when the product cannot be evaluated prior to purchase, as it happens with the meat. Although price is an important cue it is not the only factor that explains changes in meat consumption. Issanchou 1996; Becker *et al.* (2000) stated that other aspects, such as food safety and status of the meat may also affect consumption. Mannion *et al.* (2000) also stated that the relationship between the price and eating quality is not clear. In some studies the eating quality of beef is very little affected by price (Becker *et al.*, 2000) whilst in some others (Bello and Calvo, 2000) price has a positive influence on expected quality. Schnettler *et al.* (2009) found that in Chile price is not the most important factor that affects most of the consumers meat purchasing

decisions. In some cases the low price of meat was associated by consumers with low quality due to the fact that supermarkets offer discounts on meat closer to the use by date (Schnettler *et al.*, 2008).

2.5.3 Labelling and place of purchase

Product labelling has become an increasingly important means of sending messages about food quality and safety to consumers (Gellynck *et al.*, 2006). Label is considered to be a cue for inferring the quality of meat (Martinez *et al.*, 2007). When meat bears a label it contains a great amount of information (Bredahl, 2004) and is considered as a cue that allows the quality of the meat to be inferred (Bello and Calvo, 1998; Verbeke and Viaene, 1999; Bredal, 2004; Martinez *et al.*, 2007). Consumer interest being greater when clearly identifiable quality signals such as quality labels or certified quality brands are included (Verbeke and Ward, 2006). Quality labels have a positive effect on the quality of the meat perceived by consumers, and play a more important role when credence attributes are sought (Bello and Calvo, 1998). According to Barrena *et al.* (2003), a greater confidence in quality labels as a quality cue is related to a greater concern of consumers for aspects of health, nutrition and food safety. Quality labels are an indication that guarantees that the meat has undergone a certain type of control (Verbeke and Ward, 2006).

Trying to buy good meat can be a frustrating experience. Purchasers of food products attach high levels of importance to place of purchase and availability (Du Toit and CraVord, 2003). In a study in Germany by Becker *et al.* (2000), the place of purchase was ranked as most helpful in assessing beef quality in the shop. Grunert (1997) found that consumers in Germany, France, Spain and the UK, perceived fat and place of purchase as crucial quality

cues. It is therefore important that research in South Africa be conducted to determine the quality cues which consumers perceive the most.

2.5.4 Age and gender

Social influences need to be considered when investigating meat consumption behaviour. Le Roux (2003) found that 55% of the respondents in her study on red meat believed that they can judge the quality of meat simply by looking at it. Social structural factors, gender, socio-economic class, age and family status influence consumer decision when purchasing meat. Women are regarded as having a higher concern when purchasing food products as compared to men. This could be due to the task of women as primary caretakers, since they are more likely to engage in household tasks (Burrell and Vrieze, 2003). In a study done by Jocumsen (2005), females rated colour, leanness, marbling, labels and presentation more significantly more helpful for predicting eating quality than males did. The significant role of females in our society corresponds to their large purchasing power and increase in female business-travelers for the past several decades.

According to NCES (2005) in a college participation the number of females enrolled 27%, the number of males only 18%. In addition, 51% of women had entered and/or completed college education while men constituted up to 41%. Considering this disproportion, the importance of food in general and its consumption trends, gender differences may play an essential role in food service management perceptions and effects. In Han and Ryu's (2006) study, gender differences showed a significant moderating role in the relationship between customer satisfaction and revisit intention in an upscale restaurant; female customers showed a stronger intention to revisit the restaurant when satisfied than did male customers.

According to the selectivity theory, males often do not engage in comprehensive processing of all available information as a basis for judgment but, instead, use selective cues which are highly available and salient in the focal context. On the other hand, females attempt to engage in effortful, comprehensive and itemized analysis of all available and accessible cues (Meyers-Levy and Maheswaran, 1991). In addition, females are often more attuned to their emotional states and assign more value to such feelings to arrive at buying decisions than males do (Dubé and Morgan, 1998).

2.6 Physical meat quality attributes and their effect on the quality of meat at point of purchase

2.6.1 Meat colour

Research has shown that meat colour is a primary factor affecting consumer purchasing decisions, hence Mancini and Hunt (2005) stated that more than any other factor, consumers use discolouration as an indicator of freshness and wholesomeness in meat. According to Vimiso (2010), it is important for meat traders or scientists to determine the colour of meat since meat colour can be used to predict its eating quality. Colour, together with tenderness and flavour, are some of the characteristics that define sensory quality of meat. However, as is generally the case with food products, colour is often the most important of these characteristics at the point of sale, since it is the first quality characteristic which consumers experience. Colour has a critical influence on meat purchasing decisions and thus is of fundamental importance to the red meat industry (Cornforth, 1994). As a result, nearly 15% of retail beef is discounted in price due to surface discoloration, which corresponds to annual revenue losses of \$1 billion (Smith *et al.*, 2000). Differences in meat colour have been associated with variations in intramuscular fat and moisture content, age dependent changes in muscle myoglobin content and the pH_u of the muscle (Muchenje *et al.*, 2008). Myoglobin is the principle protein responsible for meat colour. Myoglobin is purplish in colour, fixed in

the tissues and is responsible for the majority of the red colour in meat. Haemoglobin is a pigment that occurs in circulation accounts for the remaining colour of meat (Priolo *et al.*, 2001). According to Kannan *et al.* (2003), colour of meat is defined in terms of Hunter colometric co-ordinates with L*, a* and b* values. The L* measures the lightness and is a measure of the light reflected (100 = white; 0 = black); a* measures positive red, negative green and b* measures positive yellow, negative blue (Commission International De L' Eclairage, 1976). Many factors have been identified affecting the colour of meat, pH and chilling rate are one of the important factors at point of purchase.

2.6.2 Meat pH

The pH level of meat has got an effect on the shelf life of meat, its colour, tenderness and eating quality. According to Strydom *et al.* (2000), meat tenderness is related to ultimate pH (pH_u) and meat colour. Hoffman (2003) stated that, the normal pH (pH) or pH_u level of muscle should range between 5.3 and 5.7. Meat with pH values greater than that (5.8 and 6) is likely to be rejected by consumers because it is visibly dark and is tough and unpalatable at consumption (Viljoen *et al.*, 2002; Wulf *et al.*, 2002). An ultimate pH promotes a bright red attractive colour in beef and mutton, whereas low pH (below 5.3) causes pale, soft, weepy meat. With a higher pH, meat becomes darker and unacceptable to consumers.

2.6.3 Meat tenderness

According to Muchenje *et al.* (2008), tenderness can be attributed to a person's perception of meat such as softness to tongue, resistance to tooth pressure and adhesion. Through all the meat quality traits, tenderness is the most difficult trait to predict (Xazela *et al.*, 2010) and cannot be judged at point of purchase. Tough meat cannot be recognised by the eye when you are buying at the supermarket. Toohey and Hopkins (2006) highlighted that consumers prefer

meat that is tender with desirable flavour. Consumer research suggests that tenderness is an important element of eating quality and that variations in tenderness affect the decision to repurchase. However, meat tenderness is not guaranteed by price. Tougher meat cuts may be found in every grade. In the United States of America (USA) where cattle are fed grains and other supplements to lay down extra fat within the muscle ('marbling'), consumers often choose the most 'marbled' cuts as an indication of tenderness. Yet marbling accounts for a mere 10% of the variation in tenderness. Tenderness varies mainly due to changes to the myofibrillar protein structure of muscle in the period between animal slaughter and meat consumption (Muir *et al.*, 2000). At point of purchase, tenderness could be affected by factors such as storage temperature and type of packaging used. The age of an animal does have an effect on tenderness of meat but at point of purchase that background information is not available.

2.6.4 Factors affecting tenderness of the meat purchased by consumers

By the time the meat is in the refrigerated display, its tenderness or otherwise is largely set. Obviously, the 'best cuts' are more tender. But even meat that should have been tender can be toughened by stress just prior to slaughter and at the point of purchase. Storage temperatures also play a significant role. In general, breed and sex have relatively little effect on tenderness, but pre slaughter treatments such as Vitamin D injections or medication, quiet handling and good transport conditions on the way to the killing plant, electric stunning to render the animals unconscious immediately prior to slaughter, freezing then thawing and then aging to allow muscle enzymes to break apart muscle fibers, all treatments significantly improved tenderness.

2.7 Summary

Physico-chemical attributes of meat are colour, pH, cooking loss, and tenderness; and among these attributes, consumers use colour to judge the quality of meat. However, consumers' attitude may differ depending on their background, age, and shops. This affects the consumption patterns of meat, with the Eastern Cape being the major province of mutton production in South Africa, as compared to other provinces. A study on consumer perception of meat as an important aspect to the meat industry is therefore recommended, hence the perceptions of consumers have been shown to have an impact on profitability. It is important that quality cues that affect consumer decisions be considered, hence their negative influence on consumer decisions result in loss or affects profitability in the meat industry.

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Chapter 3. Perceptions of rural consumers on the quality of mutton in the Eastern Cape Province, South Africa

(This manuscript is under review at *Scientific Research and Essays*)

By Rani Zikhona Theodora

Abstract

The objective of the study was to determine the perceptions of consumers from the Eastern Cape Province of South Africa on the quality of mutton. A survey was conducted where 215 consumers from five different municipalities in the Eastern Cape province of South Africa were involved. Data was gathered from consumers who were willing to be interviewed at the point of purchase, or as they left the shops. Door to door visits were also carried out where consumers who lived and shopped in the studied areas, were randomly selected. The frequencies for consumer profiles and perceptions was determined using PROC FREQ of SAS (2003). Price was found to be one of the major factors affecting the purchasing decisions of consumers. Thirty-four percent of the consumers preferred mutton as compared to other protein sources, but were not buying it because they claimed it was expensive. Both male and female consumers suggested that there was a need for the growth of the local sheep farming industry so that the levels of imported mutton into South Africa can be diminished. They also suggested the need for the implementation of more efforts in selection programmes that should result in efficient sheep production and reduced mutton prices. Educational status had an effect on the way consumers chose meat colour, their preference on sheep meat parts and on health. The study showed that consumers were more concerned about the price of mutton and relatively more fat in it that might have a negative effect on their health.

Key words: meat quality, rural consumer, gender, price, educational status

3.1 Introduction

Consumer perception of meat and meat products is a critical factor for the meat industry because it directly impacts on its profitability (Troy and Terry, 2010). In order for consumers to willingly purchase and consume a particular food type, their perceptions must be positive towards it. When making food purchasing decisions, consumers consider different attributes (Engel *et al.*, 1995). In the case of meat, the most important attribute in choosing a product is quality. Meat quality describes how attractive meat is to consumers (Dinh, 2006). Meat quality can also refer to some of the following attributes: carcass characteristics and composition; meat characteristics such as colour, marbling, pH and eating quality characteristics including tenderness, juiciness and flavour (Bredahl *et al.*, 1998; Muchenje *et al.*, 2009). Consumers are becoming more demanding about the type of food they buy and the preferred attributes and expected quality of the red meat they buy and consume (Corcoran *et al.*, 2001).

If food, and meat in particular, is to be successfully marketed it has to meet changing consumer expectations (Corcoran *et al.*, 1999). According to Glitsch (2000), quality judged at the point of purchase highlights the role of "quality in the shop". At the point of purchase consumers use cues to evaluate quality. Therefore cues such as price, labelling, freshness and colour are of importance, and colour has been regarded as the most important factor since it is a visual measure of freshness and quality (Faustman and Cassens, 1990).

Consumption patterns of red meat have shown a decline in consumption of mutton over the years due to related consumers' perceptions. Sainsbury (2009) highlighted that mutton is no

longer being consumed as often as other red meat in South Africa. According to Burger *et al.* (2004), the total consumption of sheep meat is dominated by whites, thus a focus on aggregate consumption patterns ignores the important differences in consumption between blacks and whites. However, it is important to note that consumption patterns may differ systematically by race, given income, either because tastes differ between race groups due to culture or because of a different history. South African sheep farmers are faced with the ever increasing input costs and low product price increases, resulting in the dwindling profit margins (Hoffman, 2003). Local farmers feel that they need to run their enterprises in the most effective manner in order to survive economically. Given the increasing economic pressures on sheep farmers, it is evident that red meat industry should be given due attention to find ways of addressing the issue. Research on consumer perceptions on mutton can be a relevant way in addressing this issue.

Several studies on consumer perception of meat have been conducted in different countries (Grunert *et al.*, 2004; Brunso *et al.*, 2005; Banovic *et al.*, 2009; Troy & Terry, 2010), but research on perceptions of black consumers from rural areas of South Africa is lacking. There is not much information available on the quality perceptions of this group. Similar work was done before 1994 on mostly white consumers from suburban South Africa. Findings from this research may result in a significant mind shift for decision makers in the South African meat industry. Therefore, the objective of this study was to determine the perceptions of consumers from the Eastern Cape Province of South Africa on mutton quality. The null hypothesis tested was that consumer perception of meat quality at purchase point is similar.

3.2 Materials and methods

3.2.1 Study site

The study was conducted from five different municipalities situated in the Eastern Cape province of South Africa. The chosen municipalities were Buffalo City municipality (East London and King Williams Town), Nkonkobe municipality (Alice, Middledrift and Fort Beaufort), Nxuba municipality (Adelaide), Lukhanje municipality (Queenstown), and Amahlathi municipality (Sutterheim, Cathcart) and Ngqushwa (Peddie). Areas that were selected from these municipalities were categorised into urban and rural towns. East London, King Williams Town, Queenstown, Sutterheim, Cathcart, Adelaide, and Fort Beaufort were categorised as urban while Alice, Middledrift and Peddie were classified as rural towns.

3.2.2 Selection of consumers

A survey was conducted where 215 consumers were involved. The selection of consumers was limited mostly to those consumers who were directly purchasing mutton from shops and butcheries in the chosen areas, although some homesteads from the villages were also visited. Selection of these consumers was done randomly.

3.2.3 Demographics of respondents

Data collected included demographic information such as gender and age, employment status, source of income, number of household members, education and race of the respondents. The consumers also answered questions pertaining to meat purchasing decisions, preference to source of protein, preferred meat parts, and their ability to assess the quality of mutton by visual observation. Questions focussing on meat quality traits of sheep and on consumer health were also included.

3.2.4 Data collection

Questionnaires were administered to 215 randomly selected consumers buying meat from all the selected points of sale. The respondents were interviewed with permission from the butchery and shop owners at point of purchase or as they left the shop. Trained enumerators administered the questionnaires. Each consumer had to sign a consent form before the interviews were conducted. The enumerators also paid some door to door visits where consumers were interviewed at their homes. The amount of time taken to interview each consumer was 10 minutes.

3.2.5 Statistical analyses

Frequencies for consumer profiles and perceptions were determined using the PROC FREQ procedures of the Statistical Analyses Systems (SAS) (2003). The chi-square test of SAS (2003) was computed to determine associations between age, gender, educational qualifications, employment status, source of income, total monthly income, meat quality traits of sheep meat and factors influencing meat purchasing decisions.

3.3 Results

3.3.1 Consumer demography and characteristics

The distribution of participants according to municipality is shown in Figure 3.1. Nkonkobe municipality had the highest number of participants (43%) followed by the Buffalo City municipality. The socio-economic profiles of the respondents who participated in this survey are shown in Table 3.1. Of the 215 consumers who were interviewed in this study, 53% were male and 47% were females. Of all the consumers 71.6% were black and 58.1% of them were single. It was observed that the age range of 31 to 40 years had many participants. The majority of the consumers had basic formal education and more than 39.1% of them had

gone through matriculation. Among these consumers 54% were employed (Figure 3.2) and most of them were earning amounts between R500 –R2500 per month (Figure 3.3).

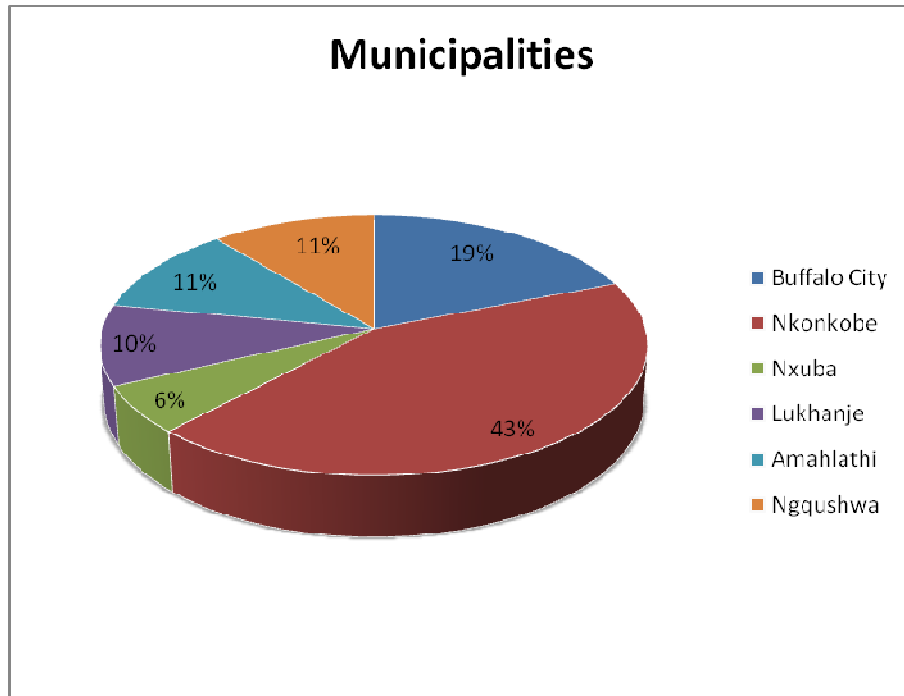


Figure 3.1 Percentage numbers of consumers who participated in the survey from different municipalities

Table 3.1 Demographic characteristics of consumers interviewed in Eastern Cape

	Frequency	Percentage
Gender		
Male	114	53
Female	101	47
Age –group (years)		
<20	12	5.6
21-30	60	27.9
31-40	62	28.8
40-50	51	23.7
>50	30	14
Race		
Black	154	71.6
White	23	10.7
Coloured	34	15.8
Indians	4	1.9
Marital Status		
Single	125	58.1
Married	73	34
Widowed	8	3.7
Divorced	9	4.2
Educational Status		
No formal education	22	10.2
Grade 1-7	26	12.1
Grade 8-12	84	39.1
Tertiary	83	38.6
Family size		
<3	51	23.7
3-5	98	45.6

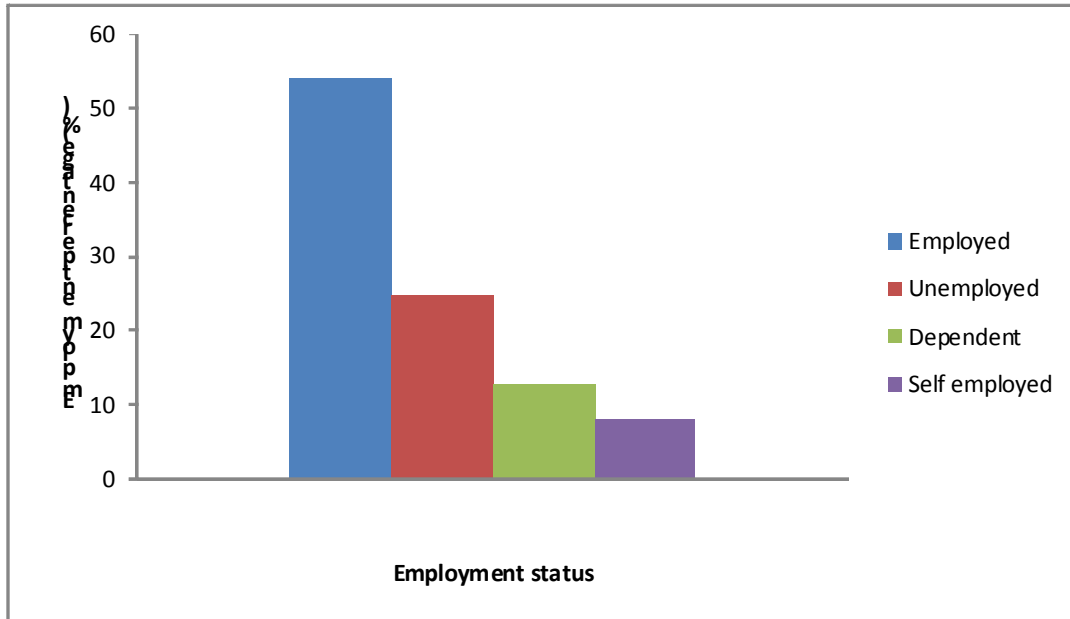


Figure 3.2 Employment status of consumers who participated in the survey

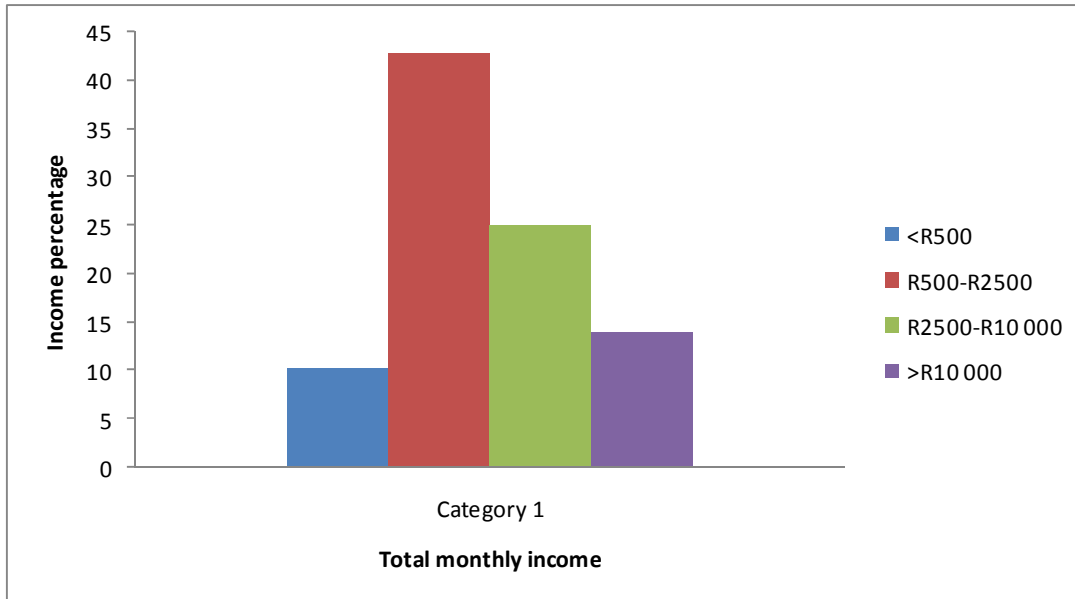


Figure 3.3 Total monthly income for consumers interviewed in the survey.

Salaries and wages at 53.5%, were the highest source of income for the consumers as shown in Figure 3.4. The highest source of income 53.5% were from their salaries and wages as shown in Figure 3.4.

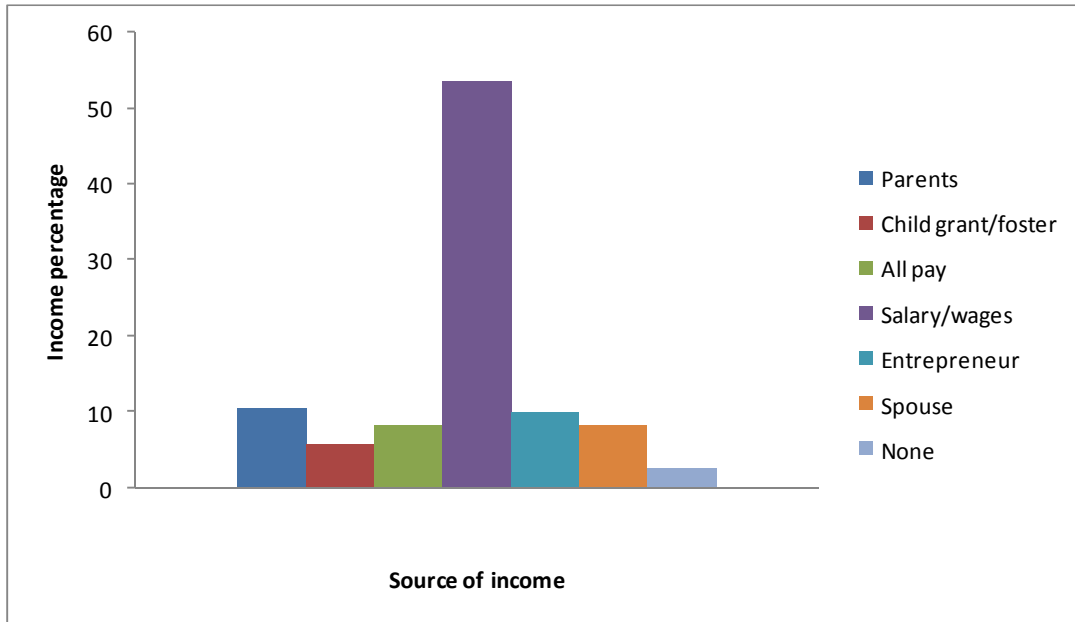


Figure 3.4 Source of income of consumers interviewed in the survey

3.2.2 Consumer perceptions on the factors influencing their mutton purchasing decisions and their perception on mutton quality

The primary factors that consumers consider when purchasing meat are shown in Figure 3.5.

Most consumers considered price as the most important primary factor they use when purchasing meat in a retail store. They consider quality of the product after price, and the health aspect was the least factor. Figure 3.6 represents different meat types preferred by consumers and high preference was on mutton followed by beef, with the least preference being on fish. The perception of consumers on what colour stimulates them the most when purchasing mutton is shown in Figure 3.7. Most consumers, 35% reported that red colour in mutton stimulates them the most when purchased in shops. About 25% preferred bright red meat, with 10% reported to have no knowledge on colour preference in mutton. Reasons were that some of them do not even purchase mutton because of its price, or some purchase what they can afford. Figure 3.8 represents perceptions of consumers on what makes mutton quality superior. Most consumers interviewed in this study agreed that the special quality of mutton lies in its taste, followed by its juiciness while colour was the least important factor.

The results on the association between demographic information, factors influencing purchasing decision and perception on meat quality traits of sheep are shown in Table 3.2. Source of income had an effect on the way consumers choose their source of protein when purchasing meat. Source of income also had an association with reasons given by consumers on why they did not choose mutton. Most consumers, about 34% preferred mutton but were not buying it, reasons being that the price of mutton is too high as compared to other protein sources. Consumers also raised that in most shops mutton is unavailable, hence most of the time it would not be fresh, and freshness of the meat is the good indication of its quality. Some consumers complained that where they purchase mutton especially in rural towns, mutton would be having a darker colour.

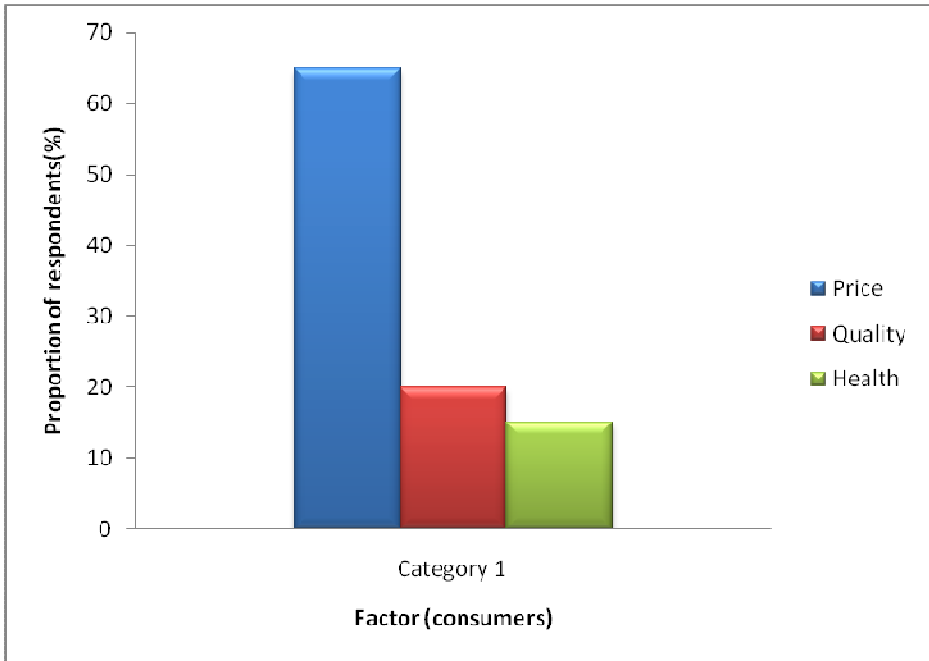


Figure 3.5 Primary factor in meat purchasing decision making.

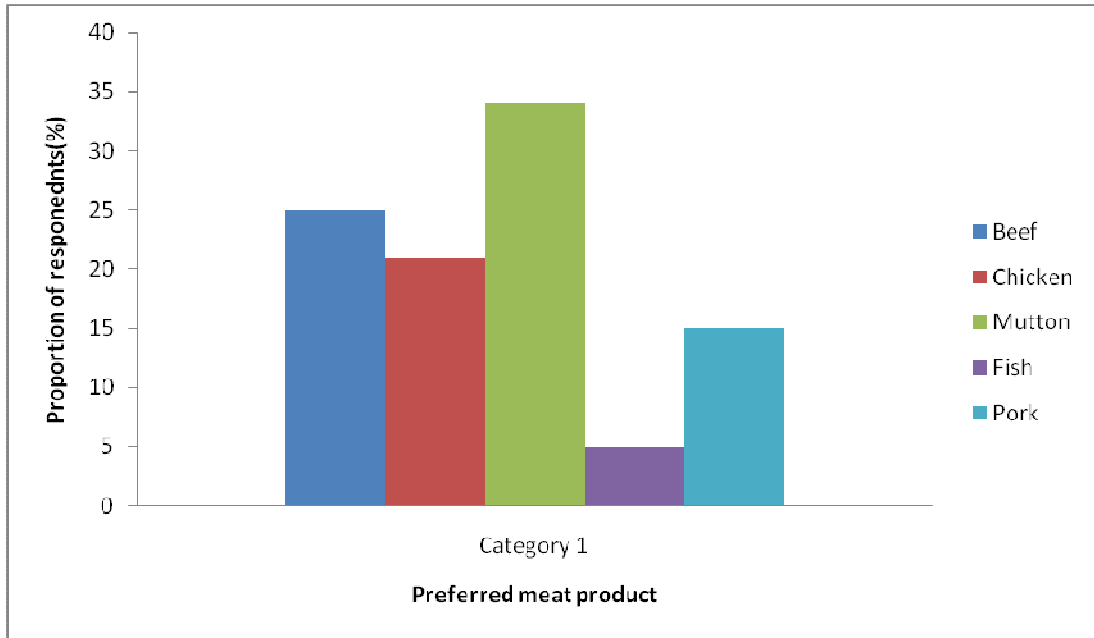


Figure 3.6 Meat types preferred by consumers interviewed in this study.

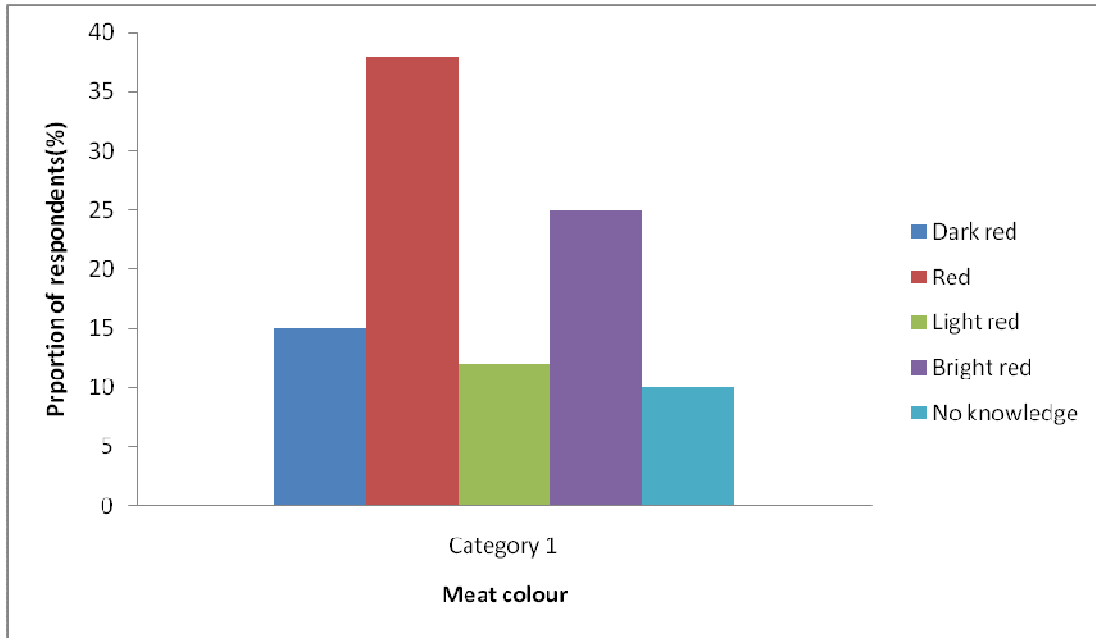


Figure 3.7 Meat colour preference of consumers when purchasing mutton.

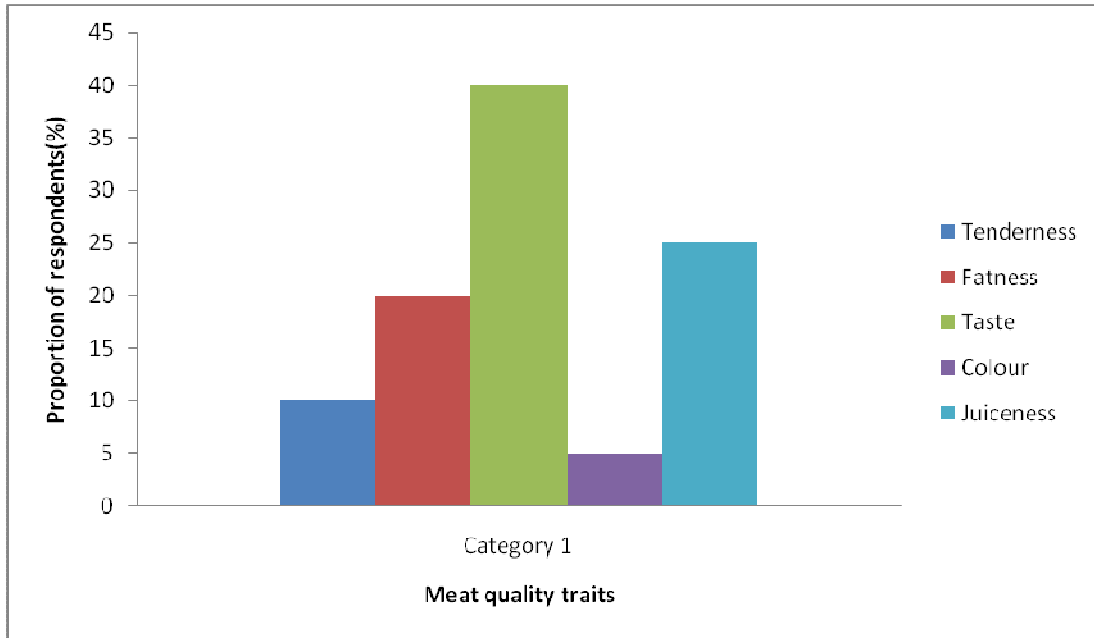


Figure 3.8 Perceptions of consumers on what makes mutton quality superior.

Table 3.2 Representing association between demographic information, factors influencing purchasing decision and perception on mutton quality

Demographic Factor	Primary factor	Source of protein	Reasons for not buying	Improve choice of mutton	Colour	Quality	Part most	Like it	Superior	Consider
Gender	NS	NS	NS	***	***	***	NS	NS	NS	NS
Age	NS	NS	NS	NS	NS	NS	***	***	NS	NS
Educational Status	***	NS	NS	NS	*	NS	*	*	NS	***
Employment	NS	NS	NS	NS	NS	NS	**	NS	NS	NS
Source income	NS	**	**	NS	NS	NS	***	NS	NS	*
Total monthly income	***	NS	NS	NS	NS	**	***	NS	**	NS

*** p < 0.001; **p < 0.01; *p < 0.05

Primary factor = price, quality, health

Source of protein = beef, chicken, mutton, fish, pork

Colour = that stimulates the most when purchasing mutton

Quality = can you tell quality of mutton by looking at it

Part most = loin, leg, shoulder, rib chops, liver, lungs, offal

Like it = fat, lean, moderate

Superior = tender, fatness, taste, colour, juiciness, don't know

Gender was associated ($P < 0.05$) with the following aspects: suggestions raised by consumers on what would improve their choice on mutton, and on whether the quality of mutton can be judged just by looking at it in a retail store. Both male and female suggested that the price of mutton should be reduced because it is expensive compared to other protein sources at point of purchase. What is significant is that the reasons for it being expensive were not known.

Consumers also raised that growth is imperative for the local sheep farming sector and that if it is genetically possible, sheep can be raised in such a manner that the amount of fat in mutton be reduced. The suggestions subsequently entail that the growth of the local sheep farming sector will result in reduced import levels, since imported mutton comes with a higher price tag. Some consumers complained about the unavailability of mutton at different purchasing points. Consumers would prefer sheep to be slaughtered whilst still young and be sold immediately after slaughter. There was an association between gender and the way consumers judge mutton quality at purchasing points. Age, educational status, employment, source of income, and total monthly income significantly affected consumer preference on sheep meat parts. In the case of consumers asked whether they preferred their meat lean, fat or moderate age, educational background significantly had an effect on their choice. Total monthly income affects the way consumers judge meat quality on what makes mutton meat superior. Since some consumers seem to be complaining about mutton meat containing too much fat, a question on when at point of purchase they are health conscious or do they purchase what they can afford, was later included. Educational and employment status were found to have an effect on their decision.

3.3.3 Consumer perception on important quality cues used at point of purchase

In this study consumers found that the place of purchase was one of the most important quality cues that can be used as a good indicator of mutton quality. Consumers agreed that where they go to purchase meat, indicates the quality of meat that they buy. Consumers also found information on the labelling or packaging as a good indicator of mutton quality. Consumers, whether educated or not, young or old all agreed that the texture of the meat at purchasing point is an indicator of mutton quality. Freshness was also one of the most important quality cues identified by consumers as a good indicator of mutton quality.

Consumer perception on the price of mutton as an important quality cue that consumers use when buying meat is presented in Figures 3.9 and 3.10 respectively. Consumers did not agree with the fact that the price of mutton can be used as an indicator of mutton quality, especially those rated under no formal education. Unemployed, dependent and self employed consumers felt that price of mutton is not a good indicator of mutton quality. They highlighted that mutton is always sold at a higher price even when it is not of good quality. About 57% of consumers who are employed indicated that where they purchase meat, higher price indicates good quality of a product. Therefore employed consumers agreed that the price of mutton is a good indicator of its quality.

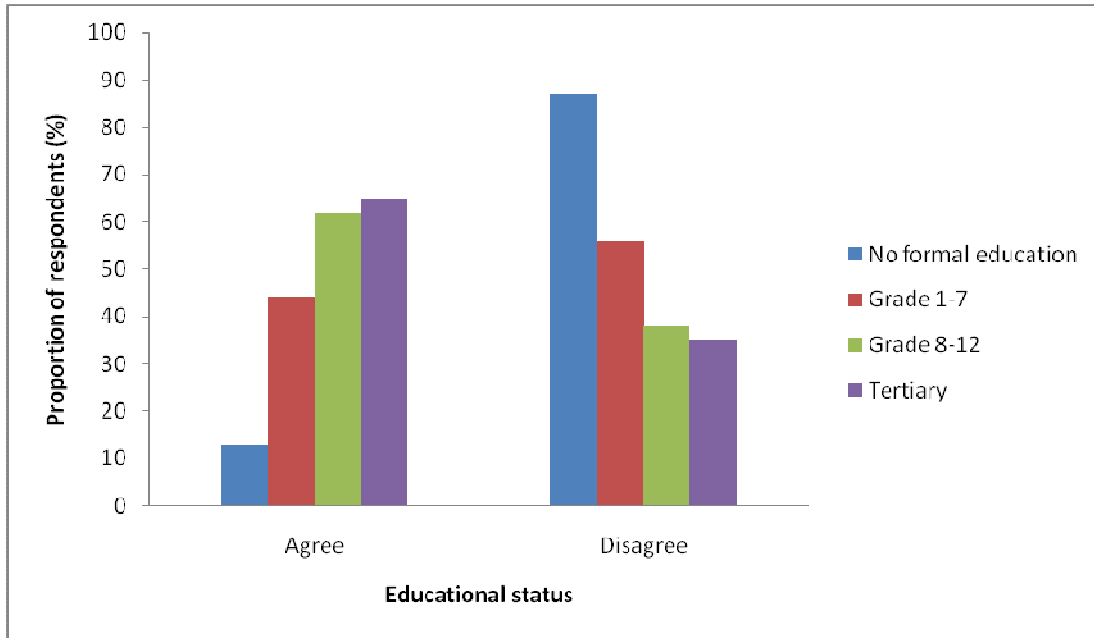


Figure 3.9 Effect of educational status of consumers on whether price of mutton is a good indicator of mutton quality.

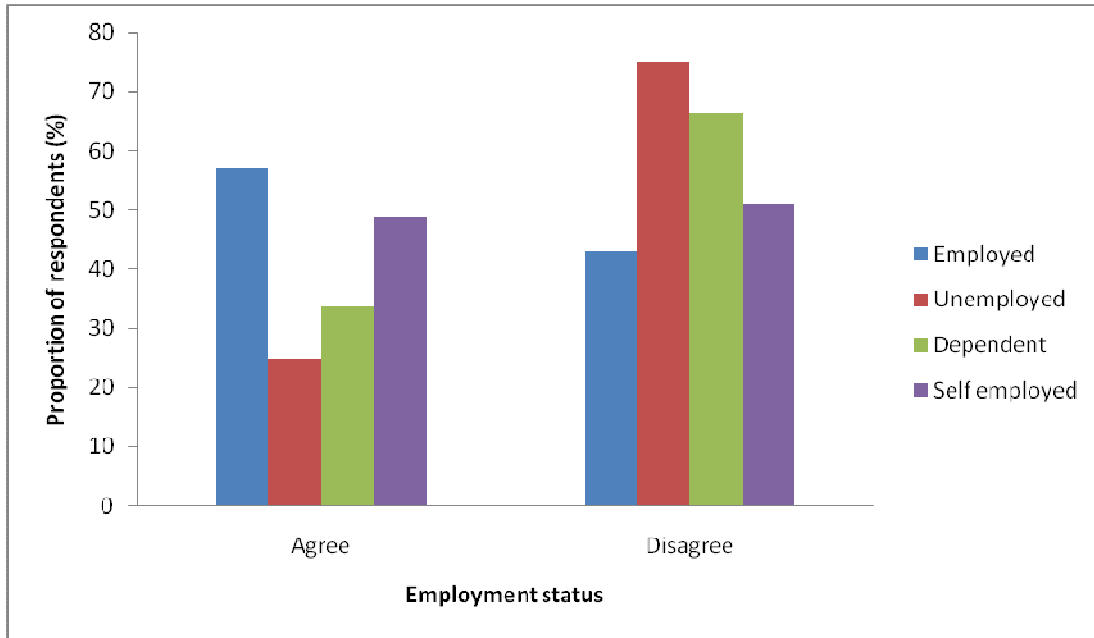


Figure 3.10 Effect of employment status of consumers on whether the price of mutton is a good indicator of mutton quality

3.4 Discussion

The present study showed that price was regarded as the primary factor affecting purchasing decisions of consumers, largely due to the fact that most of the respondents were from rural/communal areas. Vimiso (2012) and Ballantine *et al.* (2008) highlighted that with consumers from rural and poor background, most purchases are determined by the amount of disposable cash available. Quality of a product was rated as the second factor in the current study. Case (1998) conducted a study focussing on black consumption patterns where she found that most black consumers buy lower quality foods, thus they faced far lower average prices. Although consumers rated health as the least primary factor affecting their purchasing decision, it is contradictory to observations made from developed countries where consumers considered health as the most critical factor judged by consumers at purchase point (Grunert *et al.*, 2004; Brunso *et al.*, 2005). This may be due to the fact that high priced products may indicate products with high quality and more health benefits. Issanchou (1996) highlighted that price can be a cost factor, as well as a quality indicator. As an indicator of quality, a buyer can have two price limits in mind, an upper limit, beyond which she/he would find the meat too expensive and indicating a high quality, and a lower price limit below which the quality would be suspected. Grunert (1995) states that consumers who perceive quality as a primary factor when purchasing meat are willing to pay the price demanded by the shop when meat quality is perceived as high. Zeithaml (1998) refers to the relationship between perceived quality and price as value for money.

Some demographic factors like educational status and monthly income of consumers had an association with primary factors judged by the consumer at points of purchase. This may be due to the fact that educated consumers are more concerned about their health, since they might be having an advantage of being more knowledgeable on the factors that might have a negative impact on their health; hence their income allows them to purchase what they want.

Source of income, age, and educational background had a significant effect on the consumers' choice between lean and fat meat. Lean meat is usually more expensive than fat meat, therefore consumers earning low amounts or those living under the poverty datum line usually afford meat that is not of a high quality. Hence Johansson and Andersen (1998) define the cost of food as a major factor in determining food choice, particularly in the lower socio-economic groups. Consumers older than the age group of fifty are often associated with being in the danger of being exposed to chronic diseases such as heart disease, and therefore encouraged to consume lean meat most of the time. Since consumers complained about mutton containing too much fat, it is therefore of importance that research on breeding and feeding practices is conducted to improve mutton quality.

The current study showed that consumers had a high preference for mutton, but consumption was low. Ahmed (2007) highlighted that consumers had least preference for mutton and high preference for beef and chicken. In a study by Vimiso *et al.* (2012), consumers preferred beef than any other meat product. Viljoen and Gericke (2001) also found that half of the studied group consumers consumed beef four to ten times out of thirty days whilst also having a high preference for mutton. According to Ahmed (2007), the price of mutton was found as the major factor preventing consumers from buying mutton, and also its unavailability. This is in line with the perception of consumers from the current study where consumers complained about the price of mutton, strongly suggesting that it should be reduced. Consumers when interviewed, believed that prices are controlled by butchery and shop owners, and we should find a way of influencing them to decrease the price of mutton. Therefore, it was crucial that some butchery and shop owners were interviewed on this matter. When asked on how they determine price per kg, almost all the shop and butchery owners priced their mutton according to the purchase price to ensure profitability. This implies that the price of mutton is

not entirely determined by the butcheries and shop owners. According to Laas (1995), consumer prices start with production costs. Therefore, further studies or research on how the price of mutton at the abattoir are determined is of importance so as to help consumers understand why mutton is so expensive.

Dodds and Monroe (1985) underscored that when comparing two similar products, the higher-priced alternative is usually expected to be of better quality. But consumers in current study agreed that the price of mutton cannot be used as a good indicator of mutton quality hence even when not in good quality, it is always expensive. Current study indicated that there is an association between gender and the way consumers judge mutton quality at purchasing point. This can be due to the fact that women spend more time when purchasing a product comparing in a shop as compared to men (Devasahayam, 2005). Le Roux (2003) found that 55% of the respondents in a study on red meat believed that they can judge the quality of meat simply by looking at it, which is in line with the results from the current study. The fact that there was a relationship between employment, source of income, total monthly income and consumer preference for sheep meat parts in this study, is economically sensible. Consumers earning low amounts of income and those earning high amounts cannot afford to purchase certain sheep parts. For an example loin is usually more expensive than other parts like rib, shoulder or leg chop.

Consumers rated the place of purchase as one of the most important quality cues that can be used as good indicator of mutton quality. These results are in line with the study by Becker *et al.* (2000) where the place of purchase was ranked as most helpful in assessing meat quality in the shop. Meat labelling has been reported as a promising strategy to regain consumer confidence (Wagner and Beimdick, 1997; Wit *et al.*, 1998). Most consumers in this study

agreed that labelling /packaging is a good indicator of mutton quality. They agreed that when meat bears a label it contains a great amount of information (Bredahl, 2004) and is considered as a cue that allows the quality of the meat to be inferred (Bello and Calvo, 2000). Tenderness, texture and freshness of the meat are also more important in the appreciation of meat quality. Freshness of meat is known as a search attribute, due to the fact that it is known before purchase. In the mind of the average consumer about to purchase meat, colour and freshness are determining factors.

3.5 Conclusion and recommendations

Consumers from the Eastern Cape Province had a high preference for mutton, but could not afford it because of its high prices. The study showed that consumers are more concerned about the price of mutton and relatively more fat in it that could have a negative impact on their health. Further studies demonstrating the flow market channels based on mutton prices are recommended. Consumers from this study perceive the quality of mutton as the best, with its taste and tenderness rated as the most important traits that make mutton meat superior. Further research on how genetic traits of sheep can be manipulated to reduce the amount of fat in sheep meat is imperative, since consumers seem to have a negative perception on mutton fat. The study showed that demographic factors do have an influence on the way consumers make their purchasing decisions; hence educational status and income were shown to have an effect on the way consumers judge meat quality in a shop. In order to find if the perceptions of consumers are true, it is important that the physico –chemical attributes of meat purchased from different shops is determined, and determines if they link with the perceptions of these consumers.

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Chapter 4: Physico-chemical quality of mutton purchased from different shops in the Eastern Cape Province, South Africa

By

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Abstract

The objective of the current study was to determine the physico-chemical quality of mutton purchased from different shops in the Eastern Cape Province, South Africa. Forty different shops selling meat and butcheries from five different municipalities were visited. Shops were chosen on the basis of whether they sell mutton and were classified into top class, middle class, and ordinary butcheries. Mutton samples were collected from these shops in four different seasons. Colour (L^*, a^*, b^*), pH, and tenderness were measured. Season had an effect on lightness (L^*) values of meat at points of purchase, with the L^* value (24.7 ± 0.49) in winter being the lowest and (32.2 ± 0.49) in spring being the highest. The class of shop did not have an effect on meat quality attributes. The number of days from when the meat was put on the shelves, to the time when it was purchased for consumption (days to purchase) had a significant ($P < 0.05$) negative correlation with the tenderness and lightness of the meat, hence the longer the storage period, the softer and darker it becomes. A significant negative ($P < 0.05$) correlation between pHu and colour of the meat (L^*, a^*, b^*) was observed. The point of purchase temperature had a negative correlation with redness and lightness of the meat. It was therefore concluded that the physico-chemical quality of meat purchased from different shops was different, largely based on the part of meat, meat storage conditions and not necessarily on the class of the shop.

Keywords: Meat quality, different shops, pH, days to purchase, colour, tenderness

4.1 Introduction

In Chapter 3, perceptions of consumers on mutton quality attributes were observed and according to Boleman *et al.* (1997), consumer evaluation of eating quality is the major determinant of meat quality. However, it is important to determine the physico - chemical quality of mutton to see if it matches with consumer perceptions. According to Tejeda *et al.* (2008) and Muchenje *et al.* (2008), physico-chemical characteristics are some of the determinants of meat quality and its acceptability by consumers. Muchenje *et al.* (2009) stated that meat is composed of physical and chemical components. Chemical attributes include the pH. Physical attributes include tenderness, colour, cooking loss, flavour and juiciness of the meat. The major parameters considered in the assessment of meat quality are appearance, juiciness, tenderness, and flavour (Lawrie, 1998). Tenderness is known as the most difficult trait to predict, yet it is very important to meat quality and consumer acceptance (Xazela *et al.*, 2010). Tenderness inconsistency is a priority issue for the meat industry (Destefanis *et al.*, 2008).

At the point of purchase, sales of meat is influenced by the appeal of meat to consumers (Chapter 3; Dinh, 2006). How marketable or how much meat sales are at points of sale depend on its quality. The critical point of appraisal of meat quality occurs when the consumer eats the product, and it is this outcome, together with views of colour, healthiness and price, that determine the decision to repurchase (Chapter 3; Boleman *et al.* 1997). Colour is an important visual cue denoting freshness and quality to consumers who prefer to purchase meat that is red rather than brown in colour (Chapter 3; Jacob, 2011). It is one of the most important factors in consumer selection and decisions to purchase meat and meat products (Muchenje *et al.*, 2009). Meat should have a desirable colour that is uniform throughout the entire cut. The surface of meat changes in hue of colour from red to brown

during retail display, due to the formation of metmyoglobin (Faustman, 1990). Xazela *et al.* (2010) highlighted that differences in meat colour depend upon several individual factors and their interactions.

There are many studies which have been conducted prior to purchase looking at these individual factors (Muchenje *et al.*, 2008; Miranda *et al.*, 2010; Vimiso, 2010; Chulayo, 2011; Gajana, 2011). However, there is paucity of information on the factors that might have an effect on the quality of meat at points of purchase. According to Muchenje *et al.* (2008), there are several factors that interact and affect meat quality and the consumer perception of meat eating quality. These factors range from the way the animals are raised, transportation to the abattoir, post slaughter handling and the keeping of meat in butcheries, shops and home. Chulayo (2011) put an emphasis that the physico - chemical characteristics are affected by conditions that occur prior to slaughter. However, different factors at every stage should be considered to improve meat quality.

It is therefore important to determine if days to purchase time may have an effect on meat quality traits such as meat colour, cooking loss and tenderness of the meat. It has been established by many authors, that muscle colour is highly correlated with muscle pH (Wulf & Page, 2000; Page *et al.*, 2001). According to Muchenje *et al.* (2008), pH_u was highlighted as one of the most important factors that caused differences in the colour of meat. It is therefore important that research is conducted to see if the pH of the meat at the point of purchase should be considered as one of the factors affecting the colour of meat. In a study by Becker *et al.* (2000), the place of purchase was ranked as most helpful in assessing beef quality in the shop. Grunert (1997) also found that consumers perceived the place of purchase as most crucial quality cue, indicating the quality of the meat they buy. In Chapter 3 most consumers

ranked the place of purchase as one of the important factors affecting their purchasing decisions. Therefore it is important to determine if the place where consumers purchase meat, including the class of the shop have got an effect on meat quality attributes such as colour, cooking loss and tenderness of the meat. Interactions between the place of purchase and days to purchase time are also important to be determined and see if they have an effect on meat quality attributes hence, in different shops days to purchase time may differ according to the demand of a product.

Different consumers may have variable preferences for different meat parts. For an example one would prefer to buy a loin, chump or different chops depending on their reasons for their choice. According to Meat and Healthy (2003), some consumers are health conscious and demand high quality food products. It is important to see if there is an interaction between meat parts and meat quality at points of purchase. The relationship between meat quality attributes have been studied in various researches conducted, yet there is still a considerable knowledge gap on the relationship at the point of purchase. At points of purchase, the background information of the meat displayed in shelves is not known. The objective of the current study was to determine the physico - chemical quality of mutton at purchase points. The null hypothesis tested was that the physico-chemical quality of mutton purchased from different shops is similar

4.2 Materials and Methods

4.2.1 Study site and data collection

In this study 40 different shops and butcheries selling meat were visited. These shops and butcheries were chosen from five different municipalities in the Eastern Cape Province of South Africa. The chosen municipalities were Buffalo City Municipality (East London and

King Williams Town), Nkonkobe Municipality covering Alice, Keiskamahoek and Fort Beaufort, Nxuba Municipality (Adelaide), Lukhanje Municipality (Queenstown), Amahlathi Municipality (Sutterheim, Cathcart) and Ngqushwa (Peddie). Shops and butcheries were chosen on the basis that they sell mutton. Shops were ranked as either top class, middle class, or ordinary butcheries. From each purchasing point, different samples of mutton were purchased. No specific meat parts were targeted, as different consumers would purchase different parts when buying meat. Meat samples were collected in four different seasons. In each season, 120 meat samples with three replicates in each shop were collected. Three meat quality attributes were measured, colour (L^* , a^* , b^*), pH, meat tenderness and cooking loss. Colour (L^* , a^* , b^*) and pH measurements were taken at point of purchase. Samples then delivered to the Meat Science Laboratory at UFH where they were kept in a fridge to await cooking loss and tenderness evaluations.

4.2.2 Colour determination

The colour of the meat (L^* = Lightness, a^* = Redness and b^* = Yellowness) (Commission International De l'Eclairage, 1976) was determined using a Minolta colour-guide 45/0 BYK-Gardener GmbH machine, with a 20 mm diameter measurement area and illuminant D65-day light, 10° observation angle. Three readings were taken from each sample by rotating the instrument at 90° between each measurement, in order to obtain a representative average value of the colour. The guide was calibrated before each measurement using the green standard. Colour was taken from different parts of mutton samples, (chump, leg chop, loin chop, rib chop, shoulder chop, Brisket chop, cutlets, loin and leg chop, rib and loin chop).

4.2.3 pH measurement

The pH from the samples was taken using a Crison pH 25, pH meter (Crison instruments, S.A., Alella, Spain). The pH meter was calibrated with pH 4 and pH 7 standard solutions. Meat samples with pH 5.5 and 5.8 were classified into normal mutton quality. Those lower than 5.5 were classified into abnormal mutton quality. The pH and colour measurements were recorded on standard sheets.

4.2.4 Warner-Bratzler shear force and cooking losses determination

For determination of cooking loss and Warner-Bratzler shear force (WBSF) values, samples were taken out of the fridge a day before to thaw them at room temperature. Before cooking using a water bath, samples were weighed. Labelled samples were cooked for 45 minutes in plastics bags at 85°C then weighed again to measure cooking loss then cooled. Cooking loss (CL) was calculated using the following formula: $\text{Cooking loss \%} = [(\text{weight before cooked} - \text{weight after cooked}) \div \text{weight before cooked}] \times 100$.

After measurement of cooking loss, the cooked samples were used to determine WBSF values. Three sub samples measuring 10 mm core diameter were cored parallel to the grain of the meat. The samples were sheared perpendicular to the fibre direction using a Warner Bratzler (WB) shear device mounted on an Instron (Model 3344) Universal testing apparatus (cross head speed at 400mm/min, one shear in the centre of each core). The mean maximum load (N) was recorded for the batch.

4.2.5 Statistical Analysis

The physico-chemical meat quality parameters (pH, colour measurement, temperature, cooking loss) were analysed using GenStat 2008. The GLM model was used

$$Y_{ijklmn} = \mu + M_i + P_j + Q_k + S_l + L_m + (M \times P)_{ij} + (M \times S)_{il} + (P \times S)_{jl} + (M \times P \times S)_{ijl} + E_{ijklmn}$$

Where:

Y_{ijklmn} = response variable (colour, pH, cooking loss, tenderness, days to purchase time)

μ = Overall mean common to all observations

M_i = Meat part (chump, leg chop, loin chop, rib chop, shoulder chop, brisket chop, cutlets, loin & leg chop, rib & loin chop, trotter)

P_j = Place where meat was purchased (Adelaide, Fort Beaufort, Alice, Dimbaza, King Williams Town, Stutterheim, Cartcarth, Queenstown, East London, Peddie, Middledrift) and

Q_k = Type of shop (top class, middle class, and butcheries)

S_l = effect of season (summer, winter, autumn, spring)

L_m = Days to purchase time

$(M \times P)_{ij}$ = Interaction between meat part and place of purchase

$(M \times S)_{il}$ = Interaction between meat part and season

$(P \times S)_{jl}$ = Interaction between place of purchase and season

$(M \times P \times S)_{ijl}$ = Interaction between meat part , place of purchase and season

E = Random error

4.3 Results and discussion

The effect of season on some of the meat quality attributes are shown in Table 4.1. There were significant seasonal effects ($P < 0.05$) on the lightness, tenderness, pH, and cooking loss of the meat. However, yellowness and redness of the meat were not affected by the change in season. The pH was highest in winter and in autumn as compared to summer and in spring. The L^* values for meat purchased in winter were the lowest. This can be due to pre-slaughter conditions whereby the animals during winter season were subjected to low temperatures and because of the cold it resulted in animals being stressed. Stress in animals resulted in meat

with a high pH which is the reason for the low L^* values or dark colour in mutton samples purchased in winter.

Table 4.1 Mean values (\pm SE) for colour (L^* , a^* , b^*), pH, tenderness and cooking loss% of mutton as affected by season

Parameter	Season			
	Spring	Summer	Autumn	Winter
Lightness (L^*)	32.2 \pm 0.49 ^a	26.9 \pm 0.49 ^b	26.8 \pm 0.47 ^b	24.7 \pm 0.49 ^c
Redness (a^*)	17.8 \pm 0.85	14.8 \pm 0.86	15.3 \pm 0.81	15.9 \pm 0.86
Yellowness (b^*)	10.8 \pm 0.19	10.9 \pm 0.19	11.1 \pm 0.19	10.7 \pm 0.19
pH	5.9 \pm 0.02 ^c	5.9 \pm 0.02 ^c	6.2 \pm 0.02 ^b	6.4 \pm 0.02 ^a
WBSF (N)	17.7 \pm 0.65 ^c	20.7 \pm 0.66 ^{ab}	19.7 \pm 0.63 ^b	21.2 \pm 0.66 ^a
Cooking Loss (CL %)	28.8 \pm 0.88 ^d	35 .2 \pm 0.89 ^b	37.5 \pm 0.85 ^a	30.7 \pm 0.89 ^c

Means in the same row without the same superscripts are significantly different ($P < 0.05$)

This is in line with results by Chulayo (2011) where mutton samples taken in the cold, wet season were dark as compared to other meat samples from hot, wet season. According to Muchenje *et al.* (2008), high ultimate pH values are usually associated with dark cuttings. Mutton samples purchased in winter also had the highest values of WBSF values, but it is important to note that the difference compared to other seasons is not that much. Meat samples bought in Summer and in Autumn had the highest percentages of cooking loss.

The pH of mutton samples purchased in winter and autumn in this study was between 6.2 and 6.4. Devant *et al.* (2008) stated that meat with pH_u above 6.0 is undesirable hence it leads to dark firm meat. Hoffman *et al.* (2003) stated that higher pH (> 5.8) leads to undesirable meat colour which is unattractive to consumers. Though the pH_u of meat at point of purchase might be high, it does not necessarily mean that the meat is not desirable, but it might mean it does not have the same desirable colour it had immediately after slaughter, maybe due to storage conditions. The colour of meat is determined by the relative amount of three myoglobin derivatives; (i) reduced myoglobin, deoxymyoglobin (Mb), which is the purple pigment of deep muscle and known from meat under vacuum, (ii) oxygenated myoglobin, oxymyoglobin (MbO₂), which is bright cherry red and considered to signify fresh meat by the consumer, and (iii) oxidised myoglobin, metmyoglobin (MetMb), which is grey-brown (Rosenvold and Anderson, 2003). The type of packaging used in a shop affects the amount of oxygen exposure to the meat and will therefore influence the colour of meat and appeal to the customer. Different shops used different types of packaging namely; Vacuum packing, Overwrapping, Modified Atmosphere Packaging (MAP) and Frozen meat. In each packaging the temperature that the meat is stored under affects the quality of meat and this affects determines its shelf life.

In many studies, season has proven to have an effect on meat quality. This may be due to variability in composition of feeds consumed by the animal. Kadim *et al.* (2008) stated that seasonal temperatures are said to be the main reason for differences in meat quality. However, winter or cold wet seasons have shown to dominate the most, compared to other seasons. Miranda –de Lam *et al.* (2009) reported that shortage of feed during winter season causes dark cutting. Though the background information of the feed that was consumed by the animal at points of purchase is not known but the fact that yellowness was not affected by change in season is a good result, because most often consumers perceive meat with yellow fat as having come from an old or diseased animal. Yellowness values fell into the stipulated range which is 6.1-11.3 and this agrees with findings by (Muchenje *et al.*, 2008).

According to Vimiso (2010), it is imperative for the meat industry to have knowledge on what quality cues consumers use when purchasing meat and how they can use this information to remain competitive. At points of purchase consumers use intrinsic cues such as colour, extrinsic cues such as quality assurance, place of purchase and price (Glitsch, 2000). In a study by Becker *et al.* (2000), place of purchase was ranked as most helpful in assessing meat quality in the shop. Grunert (1997) found that consumers perceived place of purchase as the crucial quality cue followed by colour. Table 4.2 shows effect of place of purchase on meat quality attributes. Place of purchase had a significant effect on the lightness, yellowness, and tenderness of the meat. However, redness, pH, and cooking loss were not affected. The pH of all the samples ranged from 5.9 to 6.1. This shows that the pH prior to purchase is not the same as that one at point of purchase, hence the meat at this point is refrigerated. In a study by Hopkins and Toohey (2006), a large percentage (82%) of samples had a pH greater than 5.8 at the time of freezing, hence the more the storage days

increased pH_u to 6.2. Therefore the holding temperatures play a significant role in meat quality at the point of purchase. Though results from this study were not significant for keeping temperature, they are in contrast to Lawrie (1998) who found chilling processes to have an effect on meat quality. The way meat is treated after slaughter affects its tenderness since hasty refrigeration immediately after slaughter results in severe muscle contraction, leading to cold shortening (Muchenje *et al.*, 2009a). Again this depends on how butchery and shop owners treat their meat soon after they receive it. The options of either chilling the meat or freezing it have their respective impact. If mutton is frozen soon after slaughter the ultimate pH will not go down and the meat will also be tough.

Table 4.2 Mean values (\pm SE) for colour, pH, tenderness, and cooking loss% of mutton as affected by place of purchase.

	Lightness (L*)	Redness (a*)	Yellowness (b*)	pH	WBSF (N)	Cooking Loss
Adelaide	28.1 \pm 1.02 ^c	15.1 \pm 1.76	10.4 \pm 0.39 ^d	6.1 \pm 0.05	18.1 \pm 1.36 ^{de}	29.8 \pm 1.83
Alice	27.9 \pm 0.69 ^d	15.9 \pm 1.21	11.7 \pm 0.26 ^a	6.1 \pm 0.03	19.1 \pm 0.93 ^{cd}	31.3 \pm 1.25
Fort Beaufort	29.2 \pm 0.96 ^{bc}	14.3 \pm 1.66	9.7 \pm 0.36 ^e	6.1 \pm 0.04	17.6 \pm 1.28 ^e	33.3 \pm 1.73
Dimbaza	31.8 \pm 1.67 ^a	14.9 \pm 2.88	11.5 \pm 0.63 ^b	5.9 \pm 0.08	20.6 \pm 2.22 ^b	29.5 \pm 3.00
K.W.T	26.9 \pm 0.55 ^e	17.7 \pm 0.94	10.4 \pm 0.21 ^{de}	6.0 \pm 0.03	19.7 \pm 0.73 ^c	32.9 \pm 0.98
Stutterheim	25.7 \pm 0.96 ^f	15.5 \pm 1.65	11.3 \pm 0.36 ^c	6.0 \pm 0.04	21.7 \pm 1.27 ^b	33.9 \pm 1.72
Cathcart	29.7 \pm 2.05 ^b	15.3 \pm 3.53	10.9 \pm 0.77 ^c	6.1 \pm 0.09	17.8 \pm .72 ^e	35.6 \pm 3.68
Queenstown	28.4 \pm 0.56 ^c	15.6 \pm 0.97	11.5 \pm 0.21 ^{bc}	6.1 \pm 0.03	21.2 \pm 0.75 ^b	34.1 \pm 1.01
East London	27.7 \pm 0.49 ^d	15.9 \pm 0.85	10.5 \pm 0.19 ^d	6.1 \pm 0.02	18.5 \pm 0.65 ^d	33.9 \pm 0.88
Peddie	26.9 \pm 1.09 ^e	15.6 \pm 1.88	10.3 \pm 0.41 ^e	6.1 \pm 0.05	24.2 \pm 1.45 ^a	33.9 \pm 1.96
Middledrift	31.1 \pm 1.68 ^{ab}	17.3 \pm 2.90	12.5 \pm 0.64 ^a	6.1 \pm 0.08	20.5 \pm 2.22 ^{bc}	30.7 \pm 3.02

Means in the same column without the same superscripts are significantly different ($P < 0.05$)
WBSF (N) -Warner Braztler Force; K.W.T- King Williams Town

Meat that was bought from Peddie had the highest ($P < 0.05$) WBSF compared to meat from any other place. Similarly, meat purchased from Stutterheim, Quenstown and Dimbaza had higher ($P < 0.05$) values of WBSF, compared to the other outlets. The least WBSF values were for meat purchased from Fort Beaufort, Cathcart and Adelaide. The high WBSF values indicate that the meat was tougher compared to meat obtained from other sources. This can be due to the fact that during the cold season, high environmental temperatures from these different areas are usually experienced. Hence the high cold environmental temperatures before refrigeration could have an effect on muscle contraction. At the same time, these meat samples were observed with higher values of cooking loss which is in contradiction with most studies where samples with higher values of WBSF (N) are expected to have lower values of cooking loss and those which are tender are expected to have high values of cooking loss.

Differences in meat quality attributes across the different cuts were observed (Table 4.3). There were significant differences between the different meat parts on the colour of meat, pH, and tenderness and on cooking loss. Muscles taken from various locations on the animal may vary on colour due to the level of activity of the muscle because muscles that are more active tend to be darker in colour due to the higher levels of myoglobin that they contain (Klont *et al.*, 1998). Higher values of cooking loss were observed in the cutlets, TR (trotter), leg chop, chump and loin+ leg chop with low values of WBSF. Trotter dominated the most whereby it was observed with having high values of lightness, redness, yellowness and pH $_{\mu}$ as compared to other meat parts followed by the chump. The loin and loin + leg chops were observed with low values in lightness of the meat. Loin and rib + loin were also observed with low values in the redness of the meat. These results were not expected as the loin is known as the most highly active muscle with more myoglobin, therefore higher values of redness were expected.

Rib + loin chop had the highest internal temperature. The rib and sirloin chops were observed with low values of tenderness, indicating that they were softer as compared to other meat parts with rib+loin being tougher. Rib, rib + loin chops had the lowest percentage values of cooking loss and this can be due to the fact that rib is made up of less muscle fibre compared to other meat parts, most of it is part is concentrated of bone. According to Spanier and Miller (1996) there are differences in the way that different cuts of meat react when exposed to heat. This happens because different cuts of meat are taken from different muscles which may have distinct muscle fibre types, different pH levels, varying fat content and intercellular components (Spanier and Miller, 1996; Schönfeldt and Strydom, 2011). Since these factors have an influence on cooking loss, different cuts of meat with varying levels of these factors would have varying values of cooking loss, which is evident from the results of this study.

Meat quality is greatly influenced by muscle pH and its measurement is important. It is measured for a number of reasons and among them are taste, freshness, food preservation, and possible bacteriological activity.

According to Gregory (2008), in sheep pH_u is expected to range between 5.75 and 6.00. Therefore, the observed ultimate pH ranging from 5.9-6.3 could be considered to be on the higher side. Cloete *et al.* (2008) reported that high pH_u has an effect on the colour and tenderness of the meat. Meat tenderness has been reported to be related to ultimate (pH_u) value and meat colour (Muchenje *et al.*, 2008). These are the most important quality attributes. Though one cannot predict tenderness of the meat at point of purchase but yet very important hence a consumer would be willing to pay a higher price in the market place for meat as long as it is of guaranteed tenderness (Destefanis *et al.*, 2008; Yancey *et al.*, 2010). This is where tenderness and colour relate the most because consumers at this point use the colour of the meat to predict its freshness.

Table 4.3 Mean values (\pm SE) for colour, pH, tenderness and cooking loss% of mutton as affected by different meat parts

Meat parts	Lightness (L*)	Redness (a*)	Yellowness(b*)	pH	WBSF (N)	Cooking Loss
Br chop	25.2 \pm 1.26 ^c	15.6 \pm 0.62 ^c	10.8 \pm 0.49 ^{cd}	6.1 \pm 0.05 ^b	22.8 \pm 1.68 ^{bc}	31.9 \pm 1.98 ^d
Chump	28.9 \pm 1.35 ^a	15.0 \pm 0.67 ^c	11.4 \pm 0.53 ^c	6.2 \pm 0.06 ^a	19.9 \pm 1.79 ^d	35.1 \pm 2.13 ^c
Cutlets	28.6 \pm 1.45 ^a	14.6 \pm 0.72 ^e	10.6 \pm 0.57 ^{de}	6.1 \pm 0.06 ^b	17.6 \pm 1.93 ^e	41.4 \pm 2.29 ^a
Leg	26.1 \pm 0.54 ^b	15.8 \pm 0.35 ^{bc}	10.9 \pm 0.21 ^c	6.1 \pm 0.02 ^b	19.2 \pm 0.72 ^{de}	36.6 \pm 0.85 ^{bc}
Loin	24.9 \pm 1.08 ^d	14.7 \pm 0.53 ^{de}	11.8 \pm 0.42 ^{bc}	6.1 \pm 0.05 ^b	21.5 \pm 1.43 ^c	34.1 \pm 1.69 ^c
Loin & leg	24.5 \pm 1.23 ^d	16.0 \pm 0.61 ^a	10.3 \pm 0.48 ^e	6.2 \pm 0.05 ^a	21.5 \pm 1.64 ^c	36.4 \pm 1.95 ^b
Rib	25.1 \pm 0.71 ^c	15.9 \pm 0.35 ^b	10.4 \pm 0.28 ^e	6.2 \pm 0.03 ^a	18.9 \pm 0.94 ^e	30.9 \pm 1.12 ^d
Rib & loin	26.0 \pm 1.54 ^{bc}	14.5 \pm 0.76 ^e	11.6 \pm 0.60 ^c	6.0 \pm 0.07 ^{bc}	29.2 \pm 2.05 ^a	30.9 \pm 1.12 ^d
Shoulder	26.9 \pm 0.59 ^b	15.1 \pm 0.29 ^c	10.9 \pm 0.23 ^c	6.2 \pm 0.03 ^{ab}	21.2 \pm 0.79 ^c	34.0 \pm 0.93 ^{cd}
Sirloin	25.3 \pm 1.60 ^c	17.4 \pm 0.79 ^a	10.5 \pm 0.63 ^e	5.9 \pm 0.07 ^c	18.9 \pm 2.13 ^e	34.8 \pm 2.53 ^c
TR	30.4 \pm 2.78 ^a	30.4 \pm 2.78 ^a	13.1 \pm 1.08 ^a	6.3 \pm 0.12 ^a	24.9 \pm 3.69 ^b	39.5 \pm 4.38 ^{ab}

Means in the same column without the same superscripts are significantly different ($P < 0.05$)
WBSF (N) - Warner Braztler Shear Force; Br Chop – Brisket; TR- Trotter

Many retailers acknowledge the importance of store environment as a tool for market differentiation (Levy and Weitz 1995). Store environment also influences various stages of shoppers' cognitive process inside a store, including attention, perception, categorization and information processing. Consumers' impression of store environment can influence their retail patronage decision (store choice or choice of a shopping area for visit) over a period of time. Store environment can provide shoppers with various kinds of shopping value (such as convenience in locating products and recreation), and hence shoppers' impression of a store's environment in terms of shopping value that the environment delivers may affect their likelihood of choosing the store for shopping (Babin *et al.*, 1994).

The effect of the type / class of shop where meat was purchased is shown in Table 4.4. The type of shop was found to have a significant effect on yellowness, pH, and cooking loss of the meat. The effect on cooking loss could be due to the storage temperatures and type of packaging used in different shops. There were no significant effects observed on lightness, redness, and tenderness of the meat. These results were not expected as meat quality attributes of mutton that was bought from shops regarded as top class were expected to be different from others. Consumers' comments in Chapter 3 assume that the treatment is not the same, hence the standard of the shops is assumed not to be the same. There might be no differences observed on tenderness, maybe due to the fact that samples were stored at the same temperature after purchase.

Table 4.4 Mean values (\pm SE) for colour, pH, tenderness and cooking loss% of mutton as affected by the class of shop where meat was bought.

Parameter	Type of shop		
	Top Class	Middle Class	Butcheries
Lightness(L*)	28.1 \pm 0.49	27.3 \pm 0.84	27.8 \pm 0.28
Redness (a*)	15.3 \pm 0.86	15.1 \pm 1.46	16.3 \pm 0.49
Yellowness(b*)	11.5 \pm 0.19 ^a	11.1 \pm 0.33 ^b	10.6 \pm 0.11 ^c
pH	6.09 \pm 0.02 ^b	6.16 \pm 0.04 ^a	6.04 \pm 0.01 ^b
WBSF(N)	20.5 \pm 0.67	20.3 \pm 1.15	19.4 \pm 0.38
Cooking Loss (CL%)	26.5 \pm 0.56 ^a	24.6 \pm 0.45 ^b	24.9 \pm 0.63 ^b

Means in the same row without the same superscripts are significantly different ($P < 0.05$)
WBSF (N) - Warner Braztler Shear Force

Table 4.5 shows correlations between days to purchase and meat quality characteristics. Days to purchase had a significant ($P < 0.05$) negative correlation with tenderness and lightness of the meat. Therefore it means the longer the storage period, the softer and darker it became. Significant negative correlations between days to purchase and temperature and pH_u were observed. There were significant ($P < 0.05$) positive correlations between lightness and days to purchase. In reality this is true because the longer the meat is kept, the darker it becomes. Significant negative correlations between lightness and tenderness of the meat were also observed. There were negative ($P < 0.05$) correlations between pH and colour of the meat (L^* , a^* , b^*). These results are in line with findings from other studies. Zhang *et al.* (2005) found that high pH meat had lower L^* (lightness), a^* (redness), b^* (yellowness). Muchenje *et al.* (2008) also reported weak correlations between pH_u and L^* . Vestergaard *et al.* (2000) reported a negative correlation between pH and b^* values. Significant ($P < 0.05$) positive correlations between tenderness and pH_u were observed. Santos *et al.* (2007) found that redness of meat is normally related to the pH_u of the meat. Increases in storage temperature resulted in reductions in storage-life (Bailey *et al.*, 1997). Chilling temperature has a significant effect on meat preservation.

Interactions between factors that might have an effect on meat quality parameters are shown in Table 4.6. Meat parts and place of purchase had a significant effect ($P < 0.05$) on colour, pH_u , tenderness and cooking loss of the meat. This can be associated with grading and storage facilities of the shops, whereby meat sold in shops is at different grades. For an example, grade A class means the meat is guaranteed with high quality than meat from other grades hence top class shops usually sell Grade A meat. Again in areas where there's high demand or where most purchases are made everyday, the colour of the meat will differ with those where there less demand due to differences in the number of days that the meat has

been kept in shelves. There were no significant effects between meat parts and season on meat quality attributes. The place of purchase and season had an effect on lightness, yellowness, pH μ , cooking loss and tenderness of the meat. However, redness values were not affected. Interaction between meat part, place of purchase and season had a significant effect on lightness and redness. Yellowness, pH, and tenderness were not affected.

Table 4.5 Correlations between days to purchase and meat quality characteristics

	pH	Yellowness (b*)	Redness (a*)	Lightness (L*)	Days to purchase
Tenderness	0.05*	0.16	0.01	-0.15*	-0.09*
pH		-0.06	-0.09	-0.16	-0.12***
Yellowness (b*)			0.05	-0.06	-0.08
Redness (a*)				-0.09	-0.01
Lightness (L*)					0.19***

Significantly correlated at *p<0.05; **p<0.01, ***p<0.001

Table 4.6 Interactions between factors that might have an effect on meat quality parameters

Parameter	MxP	MxS	PxS	MxPxS
Lightness(L*)	***	NS	***	*
Redness (a*)	**	NS	NS	**
Yellowness (b*)	***	NS	***	NS
pH	*	NS	**	NS
WBSF(N)	**	NS	***	NS
Cooking Loss (CL%)	**	NS	*	*

P < 0.05 = *, P < 0.01 = **, P < 0.001 = ***, NS = Not significant (P > 0.05)

Mx P = Meat part x Place of purchase ; MxS = Meat part x Season ; P x S = Place of purchase x Season; Mx P x S = Meat part x Place of purchase x Season

4.4 Conclusion

Results from this study showed that pH at point of purchase ranges above the usually normal range prior to purchase. This study also shows that there is a strong relationship between meat quality attributes particularly the pH_u and colour of meat, of which this relationship as stated in the introduction is there even prior to slaughter. Season has shown to have an impact on some of the meat quality attributes but b* is not affected by seasonal changes at point of purchase. The keeping temperatures should be considered the most at points of purchase, hence they have shown to play a big role in quality of meat about to be sold. This study was concluded that the physico-chemical quality of mutton purchased from different shops is different, depending on the part of meat and storage conditions, not by class of shop.

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Chapter 5. General Discussion, Conclusions and Recommendations

5.1 General discussion

Consumer perceptions of any meat product are an important factor to the meat industry hence they have an influence on its profitability. If consumers have a negative perception towards any meat product, their purchasing behaviour will be affected negatively. Grunert *et al.* (1996) and Verbeke (2000) highlighted that consumer and market orientation are the key factors to be considered for successful future development of today's meat industries. According to Henson and Northen (2000), Issanchou (1996) and Northen (2000) a lack of consumer -oriented communication from the industry has often been given as one of the main problems of the meat sector. Since Eastern Cape was identified as the highly productive province of mutton in South Africa but with low consumption rates, the conducting of this study was imperative in an attempt to discover and explore the possible reasons for these low consumption patterns, and to determine on which quality cues consumers perceive the most when making their purchasing decisions.

In Chapter 3, perceptions of rural consumers on mutton quality at the point of purchase were determined. Consumers had shown to have a high preference for mutton but were not buying it due to its high price. According to Grunert *et al.* (2004) usually high priced products may indicate products with high quality and more health benefits. Consumers from this study disagreed with that, stating that with mutton whether, it is of high quality or not, it is always expensive. Consumers from this study perceived price as the the first quality cue considered when making their purchasing decisions, with health being the least factor though complaints on mutton's relatively high fat content were also raised. In a study by Vimiso (2010) price influenced 70% of the consumers' purchasing decision, while quality influenced the remaining 30% and all of them were not concerned with health. This can be due to the fact

that with consumers from rural and poor backgrounds, most purchases are determined by the amount of disposable cash available (Vimiso *et al.*, 2012; Ballantine *et al.*, 2008). The fact that consumers strongly suggested the price of mutton be reduced by butchery and shop owners whereas they are not the ones who determine the price of mutton. This shows that there is some misunderstanding between consumers and meat marketers on how prices are set. Although consumers from this study had many complaints concerning mutton and its unavailability at purchasing point, yet they still perceived the quality of mutton as the best with its taste and tenderness rated as the most important traits that make mutton meat superior to other types of meat.

Various studies have looked at the quality of meat prior to purchase, but there is a lack of research at the point of purchase where profit is made. In Chapter 4, the physico-chemical quality of mutton at the point of purchase were determined. In Chapter 3 consumers rated colour and place of purchase as important quality cues they use when making purchasing decisions, with tenderness being the most difficult trait to predict when purchasing meat. (Muchenje *et al.*, 2009b) stated that meat colour is the most important factor affecting consumer acceptance, purchasing decisions, and satisfaction of meat products. Results in Chapter 4 show that there is no relationship between class of shop and the quality of meat, that meat quality is affected by storage temperatures at points of purchase. Season has shown to have an impact on some of the meat quality attributes but b^* values are not affected by seasonal changes at point of purchase. According to Gregory (2008), in sheep pH_{μ} is expected to range between 5.75 and 6.00, in this study it has been proven that pH_{μ} at point of purchase ranges above the usual normal mark. Though the pH_{μ} of meat at point of purchase might be high, it does not necessarily mean that meat is not desirable but it might mean it does not have the same desirable colour it had immediately after slaughter, possibly due to

storage conditions. There were negative ($P < 0.05$) correlations between days to purchase, pHu and colour of the meat (L^* , a^* , b^*).

5.2 Conclusion

It was concluded that consumers from the Eastern Cape Province have got a high preference for mutton, but have a problem with its price. The perception of consumers on mutton quality at point of purchase is not the same and demographic factors have been shown to have an influence on the way consumers make their purchasing decisions, hence educational status and income had an effect on the way consumers judge meat quality in a shop. Days to purchase together with pHu have got an influence on the colour and tenderness of meat at point of purchase. The physico- chemical quality of mutton at point of purchase differs depending on the part of meat, storage temperatures and the type of packaging used.

5.3 Recommendations

More research should be conducted with the following factors in mind

- A study demonstrating flow market channels on how prices on mutton are set would be important as to help consumers understand the basis of mutton prices.
- The meat industry or more studies should focus on selection programmes that may result in efficient sheep production and reduced mutton prices .
- Research focusing on factors affecting tenderness of meat at point of purchase is highly recommended

5.4 References

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Appendix 1: Perception of consumers on meat quality traits of sheep meat.



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Important information

This survey is designed to gather information about the perception of consumers on the meat quality of sheep meat at purchase point. It is not meant to implicate anyone but rather, to gather data for academic purpose only. Your response and co-operation will be immensely appreciated.

Enumerator name :	
Name of respondent :	Municipality:.....
District:	Date:
Place of meat purchase	

Part 1: Demographic information of sheep meat consumers

1. Please indicate your age group: >20yrs 21-30yrs
 31-40yrs 41-50yrs 41-50yrs >50 yrs

2. Educational status of the respondent:

No formal education Grade1-7 Grade8-12 Tertiary

3. Race: Black White Coloured Indians Other

4. Marital Status: Single Married Widowed Divorced Other

5. Employment : Employed Unemployed Dependent

6. Sources of income:
- Other :
7. Total Monthly income (R) : < 500 500-2500 2500-10 000 above
9. Family size : < 3 3-5 6-8 >8
10. How many children in school: Primary Secondary Tertiary None

Part 2: Factors Influencing consumer purchasing decisions

1. Expenditure Pattern

How do you share your monthly income (in percentage?)

Education.....

Rent.....

Food.....

Relatives & others.....

2. Do you know anything about a balance diet?

Yes No don't bother myself about it

3. Primary factor in meat purchasing decision:

Price Quality Health Other.....

4. Which source of protein do you prefer among these?

Beef Chicken Mutton Chevon Fish
Pork

Give reasons for your decisions:

Available income Taste Close purchase point Other reason

.....

5. Why didn't you choose mutton

Not common Traditionally forbidden expensive packaging taste
Smell/Aroma Chosen it

6. What do you think needs to be done to improve your choice of mutton even if you have chosen it?

1.....
.....

2.....
.....

3.....
.....

4.....
.....

Part 3: Meat quality traits of sheep meat

1. What colour stimulates you the most when purchasing mutton?

Dark red Red Light red Pale Do not even buy it Bright red

No knowledge Why

2. Can you tell the quality of mutton just by looking at it? Yes No Not sure

3. Which part of sheep meat do you prefer most?

Loin Leg Offal Lungs Liver Other

4. When purchasing meat do you like it Lean Fat Moderate

Why?

5. What makes the meat quality of the sheep breed superior?

Tender Fatness Taste Colour Juiciness Do not know

6. Fill in Agree/disagree

6.1 Colour of mutton is an important indicator of quality.

Agree Disagree

6.2. Leanness of mutton is an important mutton quality indicator.

Agree Disagree

6.3. Presence of fat/ marbling is indicative of mutton. Agree Disagree

6.4. Smell of the raw meat is an indicator of mutton quality.

Agree Disagree

6.5. Juiciness is an indicator of eating quality . Agree Disagree

6.6. Carcass class indicates meat quality & influences my purchasing decision .

Agree Disagree

6.7 Do you have any background information on fatty acids? Yes No

6.8 Are you health conscious or you purchase what you can afford?

.....

6.9 Do you always purchase meat here? Yes No

Why?

6.10 If meat is discoloured and is sold at a cheaper price, would you buy it?

Why?

.....

6.11 Do you have any background information on how pH can affect meat quality?

.....

6.12 When buying meat , do you consider the sex of the animal?

Yes No Information not available

Appendix 2: Record sheet for parameters taken at point of purchase



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DATE.....

Shop/B utchery	Date of arrival	Meat part	(T°C)	pHu	Wt 1	Wt 2	COLOUR		
							L*	a*	b*
