
**APPLYING EYE-TRACKING TECHNOLOGY TO INVESTIGATE RED
MEAT CONSUMER'S PURCHASING PREFERENCES: A CASE STUDY
OF THE MANGAUNG MUNICIPALITY**

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DECLARATION

I, Willem Abraham Lombard, hereby declare that this dissertation, submitted for the degree of Doctor of Philosophy in the Faculty of Natural and Agricultural Sciences, Department of Agricultural Economics at the University of the Free State, is my own independent work, and has not previously been submitted by me to any other university. I furthermore cede copyright of the dissertation in favour of the University of the Free State.

Willem Abraham Lombard
Bloemfontein

Date

DEDICATION

This thesis is dedicated to

My wife and daughter,

Marese & Marike Lombard,

whom I especially want to thank for their love and support.

&

My parents,

Willem & Erna Lombard,

for the opportunities they gave me in life.

I will always be grateful for that.

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*The views expressed in this dissertation do not necessarily reflect those of the RMRD.

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LIST OF ABBREVIATIONS

AMPS	All Media and Products Survey
AOI	Area of interest
BFAP	Bureau for Food and Agricultural Policy
BLE	Bluetooth Low Energy
DAFF	Department of Agriculture, Forestry and Fisheries
FDA	Food and Drug Administration [USA]
GDP	Gross domestic product
KDF	Karoo Development Foundation
kg	Kilogram
LED	Light-emitting diode
LSM	Living Standards Measure
MTL	Multiple traffic light
NFC	Near-field communication
NIT	Nutritional information table
POPAl	Point of Purchase Advertising International
QR	Quick Response
R	Rand [South African currency]
RMRDT	Red Meat Research and Development Trust
RPO	Red Meat Producers Organisation
SAARF	South African Audience Research Foundation
SAMIC	South African Meat Industry Company
Stats SA	Statistics South Africa
USA	United States of America

ABSTRACT

South African consumers are very fond of meat products, as seen from the large share this industry contributes to the total retail value of the country. A shift of power has been seen in the red meat industry whereby the market has become more consumer driven. Consumption statistics for beef and mutton/lamb have shown an increasing trend in recent years, with the trend being stronger for beef. Consumer preferences with regard to red meat products in South Africa have been investigated by researchers in the past, but without the use of eye-tracking. To become more consumer orientated, red meat producers/retailers must adapt by knowing their customers better. By using eye-tracking technology, the researcher is able to improve consumer research. The primary objective of this study is to use eye-tracking technology to analyse and determine red meat consumers' preferences in the Mangaung Metropolitan Municipality area of South Africa.

Red meat consumers in the Mangaung Metropolitan Municipality were tested at nine different locations throughout the municipality. This was done to ensure representativeness in the data and 350 consumers were tested in total. During the test, the participants were first asked to complete the eye-tracking test where they were shown different images of red meat products for a period of five seconds each. The product aspects on the images were manipulated in order to test the attention that consumers pay to different aspects. Product aspects that were altered included red meat aspects (e.g. colour and fat), price label information (e.g. price of the pack and packaging date), and quality indicators (e.g. brand and origin certified). After completion of the eye-tracking test, the participants were asked to complete a questionnaire that contained questions regarding aspects such as monthly red meat budgets, meat consumption trends, and their red meat preferences. By making use of these two sources of data, it was possible to determine what consumers thought was important when selecting their red meat products and comparing it to what consumers actually paid attention to when presented with red meat products. The preferences identified from the post-test questionnaire were ranked against eye-tracking data by making use of Kendall's coefficient of concordance tests.

The results showed that red meat consumers in the Mangaung Metropolitan Municipality place a high value on the brand of meat that is presented to them. They not only indicated this importance in the questionnaire but also showed it when presented with the test images. Labelling that indicated the nutritional information of the products and certified the breed and different production practices proved to enjoy higher levels of attention than the self-reported data's ranking would suggest. The opposite was found, however, for labels indicating traceability and after-slaughter practices. A label guaranteeing quality was identified as the most important after-slaughter practice labelling. Production practice labelling that proved to be more important and thus more preferred among consumers were the labels that certified that the meat was produced "greener". "No antibiotics" labelling was the most preferred form of production practice labelling among the participants.

The price of the pack was identified as the price label aspect that enjoyed the highest amount of attention from the participants; this was found while the participants indicated that price per kilogram was the more important aspect of the two. The meaty area of red meat products enjoyed the highest level of attention from the participants and was also ranked as the most important. Fat on the meat was also important to the participants and it influenced the attention they paid to packs of meat.

Conclusions drawn from the study were that the participants paid more attention to some red meat aspects that were identified with the assistance of eye-tracking than indicated by the self-reported data. The questionnaire and eye-tracking data confirmed that the brand of meat sold at retailers is important to consumers. If no brand label is provided, consumers will make use of the butchery's name to determine the value of the presented red meat product. It was determined that consumers were aware of their health and wanted to know how their red meat was produced, where it came from, and what the nutritional value of the meat was. The price of the pack was also identified as the most important aspect on the price label that the participants consulted when presented with a red meat product. While it was confirmed that the meat-only area of both high- and low-fat packs of meat enjoyed the same level of attention from the participants, the total package area (including fat and bone) of lower-fat packs of meat enjoyed higher levels of attention. The findings confirm the improvement that eye-tracking provides in traditional research methods when investigating red meat preferences. An important advantage of the technology is that it shows exactly what consumers pay attention to and for how long when selecting red meat products, and the results are not only based on what consumers say they look at when buying red meat products. Eye-tracking results can therefore be used in various ways to give the producer or retailer a competitive advantage in terms of customers and prospects.

Keywords: Red meat preferences, eye-tracking, heat maps, gaze plots, price per pack, brand, origin certification, colour of meat.

1.1 INTRODUCTION AND BACKGROUND

The South African agricultural sector's contribution to the gross domestic product (GDP) was estimated at 2.4% in 2016. Agriculture fulfils an indirect role in the economy due to forward and backward linkages with other sectors, which skew the importance of the sector. Almost 70% of the sector's output is used as intermediate goods, and agriculture should therefore be seen as a critical source of growth for the rest of the South African economy (Department of Agriculture, Forestry and Fisheries [DAFF], 2016). The agricultural, hunting, forestry, and fishing sector also provides employment for roughly 953 000 people (DAFF, 2017).

The red meat sector is a large contributor towards agriculture's GDP and contributed an estimated R37.2 billion in 2016 (DAFF, 2017). Approximately 3.2% of annual household consumption expenditure is spent on meat and it is the commodity that contributes the largest share of total retail value in South Africa (Statistics South Africa [Stats SA], 2012; Stats SA, 2018). Estimated contributions of sub-segments to total expenditure on main meat types between 2005 and 2010 show that the middle-income group (Living Standards Measure [LSM], 5-7) dominates the beef and poultry industry in terms of expenditure, followed by the wealthy groups (LSM 8-10). Expenditure on sheep meat (lamb/mutton) is dominated by the wealthy segment.

Globally, protein is enjoying the attention of consumers (New Nutrition Business, 2017) as people across the world are following diets that are richer in protein. They prefer more natural protein that comes in a convenient product form (Issanchou, 1996; Bureau for Food and Agricultural Policy [BFAP], 2014). Protein that was seen as a micro trend in food products in 2010 grew to a full-fledged food trend in 2017 (New Nutrition Business, 2017). Meat and meat products are among the main sources of protein in human diets (Font I Furnols & Guerrero, 2014).

South African consumption trends between 2005 and 2010 show that the poor segment had a 17% and 3% increase in the expenditure on beef and beef sausage respectively. The middle-income groups showed a 13% increase in beef, while the wealthy segments showed a 9% and 5% increase in expenditure on beef sausage and beef respectively (BFAP, 2014). The total beef consumption in South Africa has shown a steady increase since the early 2000s. The per capita consumption of beef has risen from 16.71 kilograms (kg) in 2012 to 20.93 kg in 2017 (DAFF, 2017). Predictions show that local beef and mutton/lamb consumption will increase by 6% and 10% respectively between 2015 and 2025 (BFAP, 2016). The meat industry is changing from being a production-led to a consumer-driven industry (Issanchou, 1996).

On the local front, consumers are also changing in favour of meat consumption because of the Banting diet that became popular during the past five years. The Banting diet has led to consumers substituting low-fat and high-carbohydrate foods in favour of high-fat and low-carbohydrate meals. This has caused an increase in the demand for meat, not only among wealthy consumers but also in lower-income areas (Euromonitor, 2016).

With the increase in local meat consumption in mind, retailers and marketers should always look for new ways of satisfying consumers and outperforming the competition. Consumers' attention is a key element for all involved in marketing (Milosavljevic & Cerf, 2008). Marketing research relates to the collection of information that provides decision makers with the power to find solutions for their business problems (Smith & Albaum, 2012). It is also known that getting consumers' attention is crucial. A common method used to measure attention to advertising, among others, is by using self-reported techniques such as questionnaires (Milosavljevic & Cerf, 2008). These self-reporting techniques have been used for red meat studies in South Africa, where aspects such as consumer preferences with regard to traceability, animal welfare aspects, and fat and fat colour preferences have been investigated (Du Plessis & Du Rand, 2012; Vimiso, Muchenje, Marume & Chiruka, 2012; Maré, Taljaard & Jordaan, 2013). The different preferences of red meat consumers from different income groups have also been studied (Vermeulen, Schönfeldt & Pretorius, 2015).

Memory-based measures, however, can be poor indicators of what caught consumers' attention (Rosbergen, Pieters & Wedel, 1997). Limited studies have been conducted on meat, and specifically red meat, where the visual attention and choice of meat have been investigated. The foundation of marketing research is not a new concept; however, advancements in technology have made a wider range of studies possible (Smith & Albaum, 2012). According to Milosavljevic and Cerf (2008), studies that integrate findings from cognitive psychology, cognitive neuroscience, and marketing are in their infancy. These study measures should be used to improve and not replace traditional research measures. One such technology is eye-tracking. Eye-tracking has been recommended as a more scientific manner of gathering data on preference determination and the recalling of brands (Durr *et al.*, 2015).

Eye-tracking can be used to quantify an observer's overt visual attention and can be used to evaluate and compare the visual search patterns of individuals in an array of situations (Tonkin, Ouzts & Duchowski, 2011). Eye-tracking research should always be combined with a verbal questionnaire since the technique on its own will not be able to study the cognitive processes underlying the eye movement. It will allow researchers to not only determine what consumers are looking at (eye-tracking) but also to know why they are looking at these aspects (questionnaire) (Graham, Orquin & Visschers, 2012; Mitterer-Daltoé, Queiroz, Fiszman & Varela, 2014).

With the mentioned background in mind, it is important to conduct some more scientific research on the effects of eye-tracking that can enhance and make the marketing of red meat more attractive to the final customer to buy more or more effectively to satisfy their needs.

1.2 PROBLEM STATEMENT

To comply with and satisfy consumer needs, red meat producers and retailers need to understand their consumers' needs and wants better and in more detail. Various techniques, such as customer satisfaction indices, self-reporting techniques, and a more recent technique called eye-tracking, can be used to understand the consumer better. Since previous research found that self-reporting preferences often differ from visual preferences, using only self-reporting preferences may no longer be sufficient for market research. Eye-tracking is not a well-known technique and has thus so far not been commonly used in red meat studies, especially not among South African consumers. Red meat consumer research in South Africa can prove in more detail what red meat consumers are actually paying attention to when purchasing red meat. Knowing these details can ensure better marketing actions to enhance red meat sales and increase customer satisfaction.

1.3 OBJECTIVES

The primary objective of this study is to use eye-tracking technology to analyse and determine red meat consumers' preferences in the Mangaung Metropolitan Municipality of South Africa.

In order to achieve the primary objective, the following sub-objectives must be reached:

- **To provide a qualitative review of the beef and mutton/lamb trends in the market in South Africa**
Available literature and sources will be investigated to determine the current standings of these meat markets. This will also provide a picture of the direction in which the markets are trending.
- **To determine red meat consumers' preferences in the buying process via eye-tracking, combined with self-reporting data-collection processes**
For this sub-objective, red meat consumers' preferences will be identified. Self-reported preferences will be identified by means of data collected by the post-test questionnaire. Preferences from the eye-tracker test will be identified from the test data generated during the eye-tracker test.
- **To analyse any differences in consumers' preferences identified from the self-reported data to preferences identified from the eye-tracking data**
To reach this sub-objective, the preferred red meat aspects identified in the self-reporting questionnaire and eye-tracking test will be analysed, ranked, and compared between the

two sources of preferences. This will be done to compare whether the aspects that consumers indicated were important to them (questionnaire) also enjoyed higher levels of attention (eye-tracking) than aspects of lower importance.

- **To identify the advantages of eye-tracking technology on red meat consumer preferences**

In fulfilling this sub-objective, the benefits of using eye-tracking when conducting red meat research will be identified. Guidelines will also be provided for future red meat studies that wish to make use of eye-tracking to enhance the quality of their research.

- **To recommend some main strategy adaptations to red meat marketing according to the eye tracker data findings**

After identifying the red meat aspects that truly capture the attention of red meat consumers, this sub-objective will provide guidelines for red meat suppliers regarding their consumers' preferences. This will ensure that they are able to provide their markets with the ideal red meat products that it requires.

1.4 THEORETICAL FRAMEWORK

Consumers these days are exposed to an overwhelming number of advertising messages by means of different media channels on a daily basis (Milosavljevic & Cerf, 2008; Marshall, 2013). Due to the limited capacity of the human brain, not all of this information can be processed. The screening process, developed by individuals to help maintain their sanity, ignores most of the advertisement messages and allows less than 100 of these advertisements to be paid attention to (Milosavljevic & Cerf, 2008; Marshall, 2013). This challenge to advertising creates the need for a product to stand out from the products of close competitors and to be differentiated. Significant ways in which products can be differentiated include product features, packaging, and branding (Milosavljevic & Cerf, 2008; Fahy & Jobber, 2012). Consumers are the last link in the value chain; their satisfaction and shopping behaviour depend on their expectations and it is critical that these be met (Font I Furnols & Guerrero, 2014). Before an organisation can make marketing decisions, a frame of reference is needed.

Consumers' food product preferences change constantly (Font I Furnols & Guerrero, 2014). Food trends worldwide include sustainability, which is not only becoming necessary for companies to survive but is also becoming part of new product development for the common good. More consumers are seeking products with verified claims, such as place-of-origin ingredients or an inspirational story. Many consumers want to "get back to the basics" and consume more unprocessed food sources. The negative stereotype that any and all fat is bad for one's health has started to fade. While flavour has been part of the innovation process for a long time, consumers also eat with their eyes, and much attention has been paid to innovations that are boldly coloured

and artfully constructed. This includes experimentation with vibrant colours and novel shapes to make packaged products worthy of consumers' praise (Mintel, 2016b).

Consumer behaviour trends that have been noticed worldwide include faster shopping. Consumers have become impatient, impulsive, and in pursuit of immediate gratification due to the digital evolution. Consumers want immediate services and real-time virtual dialogue with their brands, ordering in advance is not acceptable anymore. Brands are evolving to meet consumers' increased needs for healthier, better-quality delivered or on-the-go food (Smith, 2017a). Personalised products are also preferred by consumers. Personalisation is causing the slow death of one-size-fits-all/universal dietary recommendations and promoting the ongoing rise in fragmentation. Consumers want to feel more empowered and confident to follow their own personalised eating patterns. This trend has been identified and giant food companies are investing in personalised nutrition (New Nutrition Business, 2017). Product brands are exploring opportunities to strengthen the client-brand relationship by personalising products. Consumers will pay more attention to the post-purchase experience, which is an increasingly important part of the value offered to customers (Smith, 2017a). A fragmentation and premiumisation trend has been noticed. This trend follows the movement of personalisation and will see some parts of the food markets being fragmented. Hand in hand with fragmented markets, niche markets will be formed that can serve as the foundation of premiumisation (New Nutrition Business, 2017).

Healthy living and wellness are becoming a status symbols on the front of food product trends. Consumers are moving the consumption of food, that was once an indicator of wealth to the back seat. Aspiration is now defined by the lack of things, of excess fat, of wayward thoughts. Consumers are aware that eating habits directly influence their lives. This is leading to an increase in demand for healthier eating options with fitness-promoting attributes sought in supplements, beauty products, and even pet goods by consumers who have the means to pay for them (New Nutrition Business, 2017; Smith, 2017a). A strong trend for protein is noticed where protein is seen as both an ingredient and benefit and products containing protein do not have to make health claims (New Nutrition Business, 2017). Fat, which was seen as the demon nutrient, has also experienced a sharp turnaround and sugar is now seen as a bigger concern for consumers. This trend is strengthened by research that has linked sugar to obesity, diabetes, and other health problems (New Nutrition Business, 2017).

Locally, the red meat industry contributed R33.4 billion in 2015 to the GDP of South African. The largest share of this value, roughly R26.8 billion was contributed by slaughtered cattle and calves. Slaughtered sheep and goats generated R6.6 billion (DAFF, 2016). Of the total retail sales in 2014/2015 meat sales in South Africa accounted for 8.1%, which was the largest share of all the commodities (Stats SA, 2018).

The share of South African adults within LSM segments 1-4 declined (-56%) between 2004 and 2013, accompanied by an increase in the share of the adult population classified within wealthier segments such as LSM 6 (+69%), LSM 7 (+99%), LSM 8 (+82%), and LSM 9 (+68%). In recent years, the class mobility rate has varied, but has generally increased in most socio-economic sub-groups after slowing down from 2007/2008 up to 2009/2010 due to recession impacts (BFAP, 2014).

Meat consumption trends show that the poor segment had a 17% and 3% increase in the expenditure on beef and beef sausage respectively between 2005 and 2010. While the wealthy segments showed a 9% and 5% increase in expenditure on beef sausage and beef respectively, the middle-income groups showed a 13% increase in beef (BFAP, 2014).

South African diet and health trends are partially responsible for the predicted increase in the demand for red meat (Euromonitor, 2016). This increased demand is also supported by the BFAP's report, which predicted a 6% increase in beef consumption and a 10% increase in mutton/lamb (BFAP, 2016). The Banting diet that focuses on real foods and switches low-fat, high-carbohydrate food in favour of high-fat low-carbohydrate meals has become a big trend. This diet is not only causing wealthier consumers to cut their consumption of bread, pasta, and rice and replacing it with meat, butter, and cream, but it is also gaining popularity in townships, resulting in an increase in demand for some of these products (Euromonitor, 2016).

In South Africa, the power has shifted from the supply side into the hands of the consumers in the beef value chain and the demands and needs of beef consumers have changed (Labuschagne, Louw & Ndanga, 2011). South African studies have investigated consumer preferences and purchasing behaviour for red meat (Maré *et al.*, 2013; Vermeulen *et al.*, 2015; Liebenberg, 2016; Uys & Bisschoff, 2016). South African studies mostly make use of self-reporting techniques for data collection. Self-reported techniques are memory-based techniques commonly used to measure attention towards advertising, among others (Milosavljevic & Cerf, 2008). Memory measures, however, can be poor indicators of what caught consumers' attention (Rosbergen *et al.*, 1997). The issue of self-reported studies is that consumers are likely to give the "right" or "desirable" answers instead of stating how they truly feel (Samant & Seo, 2016).

Studies that integrate findings from cognitive psychology, cognitive neuroscience, and marketing are in their infancy. These study measures should be used to improve and not replace traditional research measures (Milosavljevic & Cerf, 2008). It is suggested that eye-tracking is a more scientific manner of gathering data of preference determination and the recall of brands (Durr, Van Zyl, Strydom, Beelders & Wium, 2015).

1.5 RESEARCH METHODOLOGY

This study focused on the Mangaung Metropolitan Municipality's red meat consumers. The larger towns in the municipality are Thaba Nchu, Botshabelo, and the main city of Bloemfontein. To determine red meat consumers' preferences, 350 consumers were surveyed by means of a convenience sampling technique. These consumers were tested at eight different locations near different red meat retailers such as butcheries and supermarkets that sell red meat. During the testing procedure, consumers were first asked to complete an eye-tracking test where different red meat products were shown to them for a period of five seconds. Once a consumer completed the eye-tracking test, they were asked to complete a post-test questionnaire. This was done to capture the self-reported preferences of consumer while data collected from the eye-tracking test were used to determine consumers' red meat preferences that they actually paid attention to. To determine whether consumers' self-reported preferences matched their eye-tracking data (actions) the aspects were statistically ranked with Kendall's coefficient of concordance (W) test. This analysis ranked the aspects from both sets of data. The rankings were then compared to determine whether the participants paid the most attention to the aspects that they reported as the most important.

1.6 CONTRIBUTION OF THE STUDY

To the knowledge of the author, no study to date has made use of eye-tracking technology to investigate consumer preferences under South African conditions. This study is the first of its kind to determine red meat consumers' preferences by making use of an eye-tracker in South Africa. These preferences were analysed and compared to preferences identified from the self-reporting data-collection process, which in this study was a post-eye-tracking-test questionnaire. This identified aspects which the participants paid attention to but did not necessarily report as important in their questionnaires. Besides highlighting the advantages of using eye-tracking in red meat research, accurate preferences were identified that could be used by red meat retailers to improve their products and marketing strategies.

1.7 LIMITATIONS OF THE STUDY

A number of limitations were encountered during the study and are mentioned to provide insight into the steps that were followed. Time was one of the biggest constraints in the study. The data-collection process was very time consuming, and the availability of only one eye-tracking device resulted in a smaller number of participants who could be tested per day in the field. Permission from the test locations was another limitation. All test locations were visited in the months prior to data collection. Besides identifying the correct location, the correct authorities of each venue were contacted to ask for the required permission to collect data at the venue. Not all identified locations granted permission for this study and other venues had to be used. Finances was another constraint, where provision had to be made for the transportation for the interviewing team and eye-

tracking equipment. The members of the data-collection team also had to be remunerated for their time that they sacrificed.

1.8 OUTLINE OF THE STUDY

This study consists of five chapters. Chapter 1 provides the background and motivation for the study. Chapter 2 consists of a literature review of studies and other sources relevant to eye-tracking and the South African red meat market. Chapter 3 presents the methods used for data collection and the area of data collection. Chapter 3 also discusses the different forms of eye-tracking results and Kendall's *W* test, which was used to rank consumers' preferences in the study, is explained. The results of the study are presented in Chapter 4. These results consist of the questionnaire-based consumer preferences and the eye-tracking-based preferences. These preferences are firstly presented separately, after which they are ranked and compared. This is done to compare what the participants indicated that they deemed as important to what they actually paid attention to when choosing red meat products. Chapter 5 consists of the study's conclusions and recommendations, which are based on the findings of the study.

2.1 INTRODUCTION

This chapter focuses on available literature that is relevant to the study and upon which the argument for the need for the study is based. This chapter firstly provides an overview of the South African red meat sector, followed by consumer and food trends. The focus then shifts to the quality attributes of products, product differentiation, and branding and labelling. Lastly, the chapter presents relevant red meat studies and other studies that have made use of eye-tracking.

Modern-day consumers are exposed to hundreds (even thousands) of advertising messages by means of different media channels, including television commercials, in retail shops, newspapers, magazines, and websites and blogs on a daily basis (Milosavljevic & Cerf, 2008; Marshall, 2013). Due to the limited capacity of the human brain, also known as the attentional bottleneck, not all information can be processed. The screening process, developed by individuals to help maintain their sanity, ignores most of the advertisement messages and allows less than 100 of these advertisements to make it past the “attention wall” (Milosavljevic & Cerf, 2008; Marshall, 2013). This challenge to advertising creates the need for a product to be differentiated from the products of close competitors. Significant ways in which products can be differentiated include product features, packaging, and branding (Milosavljevic & Cerf, 2008; Fahy & Jobber, 2012). Basic human requirements, such as air, food, water, clothing, and shelter are all “needs”. These needs become “wants” if they are directed to specific objects that could satisfy these needs (Kotler, 2000). “Demands” are the wants for a specific product backed by the consumer’s ability to pay (Kotler, 2000). Marketers who want to ensure success will attempt to understand their target market’s needs, wants, and demands because people use products to satisfy their needs, wants, and demands (Kotler & Keller, 2012). A good marketer is also always looking for new ways of satisfying consumers and outperforming the competition. Consumers’ attention is a key element for all involved in marketing (Milosavljevic & Cerf, 2008). Consumers are the last link in the value chain, and their satisfaction and shopping behaviour depend on their expectations and it is critical that these must be met (Font I Furnols & Guerrero, 2014). Before an organisation can make marketing decisions, a frame of reference is needed. One of the important aspects of a frame of reference is to create a strategic marketing plan (Jooste, Strydom, Berndt & Du Plessis, 2012). Such a marketing plan will assist in reaching and servicing target markets, ensuring that the organisation remains competitive. Brand strategies, including optimal brand positioning and updating the brand positioning over time, are part of a strategic marketing plan (Jooste *et al.*, 2012). A branded product verifies that the product is from a known source, and consumers make all kinds of associations to brands. Product associations can be formed by past experiences with the product and marketing

programmes that allow customers to determine which brands satisfy their needs and which do not. These associations create the product's brand image and lead to identical products being evaluated differently due to branding differences (Kotler & Keller, 2012). The responsibility of the performance of the product can also be assigned to the manufacturer. With consumers living more complicated, rushed, and time-starved lives, brands that can reduce risk and assist in simplifying decision making become invaluable (Kotler & Keller, 2012). Studies that integrate findings from cognitive psychology, cognitive neuroscience, and marketing are in their infancy. These study measures should be used to improve and not replace traditional research measures (Milosavljevic & Cerf, 2008). One such type of study is where eye-tracking technology is used for marketing research.

2.2 THE SOUTH AFRICAN RED MEAT SECTOR

The gross value that the South African red meat industry contributed to the GDP in 2015 was estimated at R33.4 billion. Of this value, slaughtered cattle and calves contributed roughly R26.8 billion, while slaughtered sheep and goats generated R6.6 billion (DAFF, 2016). In 2014/2015, South African meat sales accounted for 8.1% of total retail sales in the financial year 2014/2015, which was the largest share of all the commodities (Stats SA, 2018). Estimated contributions of sub-segments to total expenditure on main meat types between 2005 and 2010 showed that the middle-income group dominated the beef and poultry industry in terms of expenditure, followed by the wealthy groups (BFAP, 2014). Expenditure on mutton and lamb is dominated by the wealthy segment. Consumption trends between 2005 and 2010 showed that the poor segment had a 17% and 3% increase in the expenditure on beef and beef sausage respectively. For the same period of time, the middle-income groups showed a 13% increase in beef consumption, while the wealthy segments showed a 9% and 5% increase in expenditure on beef sausage and beef respectively (BFAP, 2014).

The total cattle herd in South Africa consists of approximately 13.7 million cattle. Approximately 8.1 million of these animals are owned by commercial farmers, while 5.6 million belong to communal farmers. In terms of numbers, the Eastern Cape province houses the largest cattle herd, comprising 24% (see Figure 2.1) of the national herd. In second and third place respectively are KwaZulu-Natal (20%) and the Free State province (17%) (DAFF, 2015).

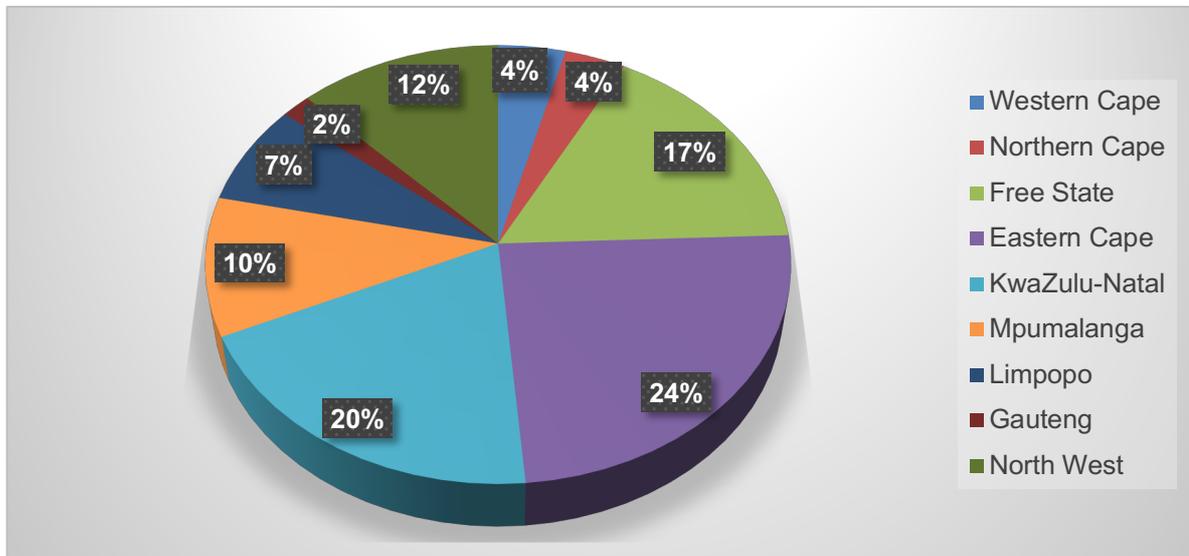


Figure 2.1: Composition of the national cattle herd

Source: DAFF (2015)

The national sheep flock is estimated at 23.9 million sheep (see Figure 2.2), with just more than 21 million belonging to commercial farmers and 2.9 million to communal farmers. Similar to cattle, the largest percentage of sheep in the country is found in the Eastern Cape province (29%). The Northern Cape province has the second largest flock (25%) and the Free State province the third largest (20%) (DAFF, 2015).

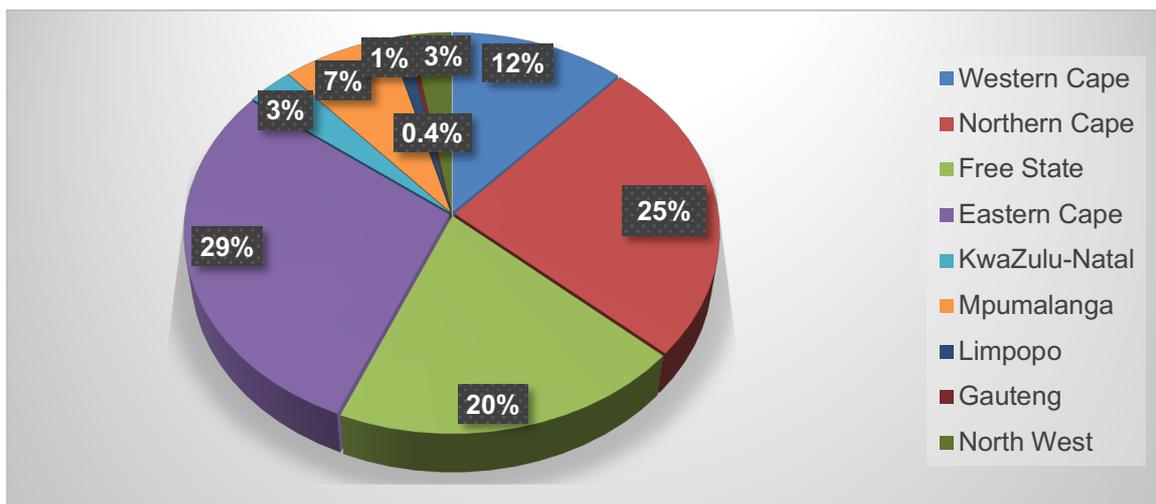


Figure 2.2: Composition of the national sheep flock

Source: DAFF (2015)

South Africa has a goat herd of roughly 5.9 million animals. The largest portion of these animals are found in the Eastern Cape (38%), with the Limpopo province (18%) in second place and KwaZulu-Natal (14%) in third place, as shown in Figure 2.3. Approximately two million goats in the national herd are owned by commercial farmers, while 3.9 million goats are owned by communal farmers (DAFF, 2015).

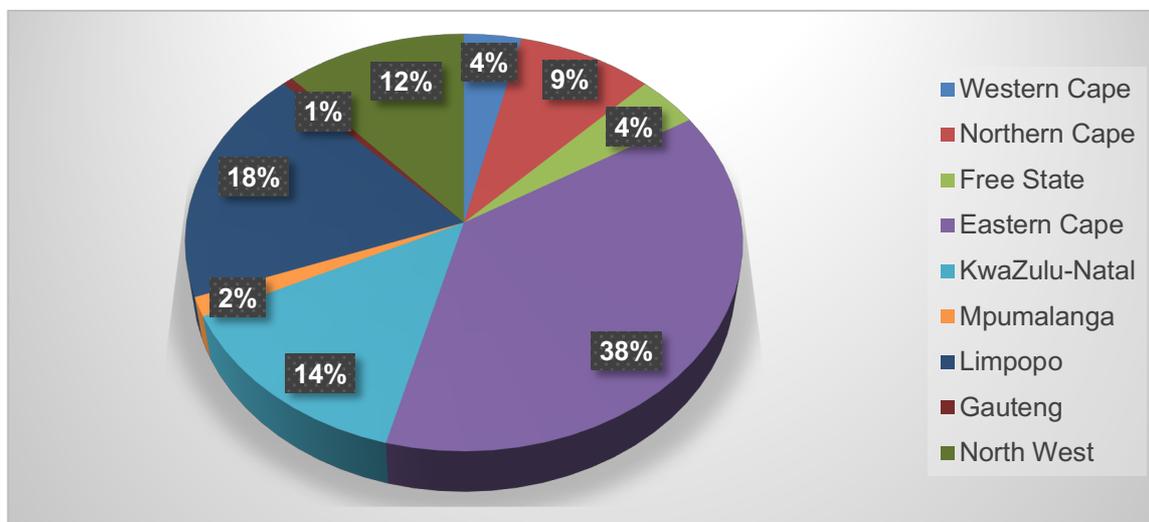


Figure 2.3: Composition of the national goat flock

Source: DAFF (2015)

This section provides an overview of the value and size of the red meat sector in South Africa. These statistics show what a large contribution the red meat livestock sector contributes to South Africa's GDP.

2.3 CONSUMER AND FOOD TRENDS

It is important to see the bigger picture in terms of trends before focusing on South African trends. This section firstly examines global food trends in the food market, followed by consumer behaviour and food product trends. This section also sheds light on the buying behaviour of consumers, before shifting the focus to food product trends and red meat production and consumption in South Africa.

2.3.1 Global food trends

A fad quickly gains popularity and may disappear just as fast as it appeared in a market. Clothing, exercise, food, and hairstyles are all subject to fads, which usually last only one season but could spill over to a next. Trends are slower in pace and represent something that occurs on a much larger scale. Because trends take longer to develop on a broader basis, they have the power to stay in the market, indicating that trends constitute a permanent alteration to the landscape (Haberman, 2014). Examples of trends could be where people live, their modes of transport. Glaciers of the market, or megatrends, which are long-lasting, take years to develop, and can change the world we live in. Megatrends can be defined as the probable future based on what we know with great confidence about the future. This refers to aspects such as an ageing population and urbanisation (Haberman, 2014). A framework for megatrends in the food industry that can be used for future planning was developed by the Fresh Agenda (2015).

The five megatrends captured in this framework are as follows (Fresh Agenda, 2015):

- **Volatile world** relates to the uncertainty linked to food markets and aspects such as climate change, trade policies, and economic uncertainty that could all affect the food market.
- **Discerning consumers** refers to factors in the food market such as wealthier customers caused by a developing world, ageing demographics, and more complex segments and preferences in the market.
- **More from less** focuses on how limited resources will be used to feed the growing number of mouths and the community's concern for sustainable production practices.
- **Disruptive technologies** refers to how technologies are reshaping consumer behaviour, lifestyles, and engagement, as well as the advancement in automation for production and processing practices.
- **Evolving value chain models** signifies new forms of value chain integration, the shift in capital power, and emerging retail models.

Consumers are constantly changing their food product preferences (Font I Furnols & Guerrero, 2014). Food trends worldwide include sustainability, which is not only becoming necessary for companies to survive but also becoming part of new product development for the common good. More consumers are seeking products with verified claims, such as place-of-origin ingredients or an inspirational story (Mintel, 2016b). Many consumers want to “get back to the basics” and consume more unprocessed food sources. The negative stereotype that any and all fat is bad for one's health has started to fade. While flavour has been part of the innovation process for a long time, consumers also eat with their eyes, and much attention has been paid to innovations that are boldly coloured and artfully constructed. This includes experimentation with vibrant colours and novel shapes to make packaged products worthy of consumers' praise (Mintel, 2016b).

Changing diets in the past 50 years are characterised by people eating more food than their grandparents did. Increases have been seen in food weight as well as in calorie content, protein content, and fat consumption (Kammlade & Khoury, 2017). World average diets became more diverse between countries on the same continent but also led to diets becoming more similar between other countries because the global supply of food has become similar. The world's most diverse food supply at country level is found in countries of Africa and Asia, and small island countries. Other countries from these continents also showed the least diverse food supply (Kammlade & Khoury, 2017). Globally, people's diets are becoming richer in protein, and they tend to seek more natural protein in convenient product forms (Issanchou, 1996; BFAP, 2014). One of the main sources of protein in the human diet is meat and meat products. The consumption of these products is influenced by socio-economic factors, ethics (religious beliefs), and tradition (Font I Furnols & Guerrero, 2014).

The general focus is on health maintenance and disease prevention through better nutrition with less “bad” ingredients like antibiotics, sugar, fat, and gluten. The convenience factor is also rising quickly and the “snackification” of everything is evolving at a fast-growing pace. The ease of cooking and the product offering the consumer a feel-good experience are constantly changing the packaging and processing of value-added products. These products also need to be tasty while consumers intend to seek more pleasure from ordinary foods and other cultures’ foods that are healthy, and a new experience can be seen as an affordable luxury product. Examples include a kiwi fruit grower who has created an ultra-convenient kiwi berry, and beetroot growers who are transforming this traditionally boring vegetable into convenient snacking options (New Nutrition Business, 2017). People also move to the benefits of natural foods and these foods are moving from the health shops to the retailers. These natural foods are made from fewer and simpler ingredients, have “clean” labels, and are moving away from technology to get back to the “real world”. An increased focus on sustainability is seen as requiring a reduction in food wastage – from food loss during processing and waste at the retailer straight through to the consumer – in order to make it a sustainable product/process (Issanchou, 1996; BFAP, 2014; New Nutrition Business, 2017).

From the literature some positive trends were identified for the global red meat industry. With people’s diets becoming richer in protein, it could allow for future growth in the consumption and sales of red meat. With the negative connotation of all fats being bad fading, it could also strengthen the position of red meat products in the market. The red meat industry should take note of consumers diverse trends that move towards more unprocessed food (Mintel, 2016b), while consumers also require convenience in the food that they purchase (New Nutrition Business, 2017).

2.3.1.1 Global consumer behaviour

Besides “snackification”, other global trends that are expected to affect the food industry are now discussed. Changing trends in consumer behaviour (how and where they shop) are presented first, followed by changing trends in food products (new types of products).

Consumer behaviour trends include an ageing population; almost 25% of the world’s population will be older than 50 by 2017. These consumers are transforming what it means to be older and are more demanding in terms of lifestyle. These older consumers are enthusiastic users of health, beauty, and fashion-forward products and they are also open to technological development. Terms such as “midorexia” have been created, which highlight the shifting status and expectations of a demographic whose members are living and working for longer and prioritising wellness while challenging the typical age-appropriate behaviour of older people (Smith, 2017a). Besides an ageing population, more children stay at home for longer; some into their 20s and beyond. This is caused by parents struggling to balance work and private life and, for instance, seeking paid-for convenience. This not only gives children a greater say in what the family consumes but it also places them in a position of being “consumers in training” due to this larger say in consumption

trends. Business strategists view teens and young people as key components in their marketing (Smith, 2017a). Personalisation seems like the slow death of one-size-fits-all dietary recommendations and the ongoing rise in fragmentation. Consumers want to feel more empowered and confident to follow their own personalised eating patterns. This trend has been identified and giant food companies are investing in personalised nutrition (New Nutrition Business, 2017). Product brands are exploring opportunities to strengthen the client-brand relationship by personalising products. Consumers will pay more attention to the post-purchase experience, which will become an increasingly more important part of the value offered to customers (Smith, 2017a). The trend of fragmentation and premiumisation follows the movement of personalisation and will see some parts of the food markets being fragmented. Hand in hand with fragmented markets, niche markets will be formed that can serve as the foundation of premiumisation. As mentioned earlier, some companies have already embraced this trend (New Nutrition Business, 2017). Modern consumers are outspoken regarding their needs in their respective under-served markets. This seems to have led to mass production losing some of its appeal among extraordinary consumers (Smith, 2017a). Digital evolution has made consumers impatient, impulsive, and in pursuit of immediate gratification through faster shopping. Ordering in advance is not good enough anymore; they want immediate services and real-time virtual dialogue with their brands. Brands are evolving to meet consumers' increased needs for healthier, better-quality food on the go or delivered (Smith, 2017a).

Red meat retailers could, on their terms, attempt to use the need of consumers for personalised products to their advantage. If the trends identified in the literature are applied to the red meat sector, it will mean that beef, for instance, is not just beef where one size fits all and that segments of the market will be willing to pay a premium for more personalised products and experiences.

2.3.1.2 Global food product trends

In this part the changes witnessed in food products are presented. This provides an idea of the trends identified globally amongst what consumers are demanding for their food products that they purchase.

The digestive wellness trend is enjoying much attention and many food brands have launched products specifically to assist in this regard. The availability of lactose- and gluten-free products have seen an increase, and some probiotic juices have been launched successfully (New Nutrition Business, 2017). The healthy living and wellness trend is becoming a status symbol. Consumers are moving the consumption of food that once was an indicator of wealth to the back seat. Aspiration is now defined by the lack of excess fat, and of wayward thoughts. Consumers are aware that eating habits directly influence their life. This is leading to an increasing demand for healthier eating

options with fitness-promoting attributes sought in supplements, beauty products, and even pet goods by consumers who have the means to pay for them (New Nutrition Business, 2017; Smith, 2017a). A shift is taking place in how consumers look at their plates. They want to increase protein intake while searching for other protein options beyond meat and dairy; substitutes such as beans and peas are now valid options. At the same time, they want to reduce their “bad” carbohydrate intake and replace it with “better for you” options that are easy to prepare. Consumers do not want to reduce their meat intake but rather boost their diets with proteins from plant origins. This trend has seen the creation of butternut spaghetti and the use of cauliflower as a substitute for rice, pizza bases and dips (New Nutrition Business, 2017).

The trend of sportification is not only noticed in the fashion industry but also in food. Fitness restaurants have emerged that focus on protein, calories, and “fuel food”. They offer nutritionally dense meals, meal plans, and food that can be delivered and collected. Some of the commonly offered dishes include protein smoothies, egg whites pancakes, and avocado dishes (New Nutrition Business, 2017). Inflammation has been covered broadly and globally by the media; especially the causes and symptoms thereof. The danger of inflammation that is associated with diseases such as cancer is discussed along with preventative measures in the form of anti-inflammatory foods and diets (New Nutrition Business, 2017). Protein is seen as both an ingredient and benefit and products containing protein do not have to make health claims. The beliefs consumers have about protein are broad and not very specific. These beliefs range from “it helps with a firmer body”, “weight loss”, to “healthier hair”. This protein trend, along with the plant-based movement, has led to entrepreneurs reinventing snacks such as Brami beans and chick peas (New Nutrition Business, 2017). Fat, which was always considered the demon nutrient, has experienced a sharp turnaround and sugar is now seen as a bigger concern for consumers. This trend is strengthened by research that has linked sugar to obesity, diabetes, and other health problems. An increase in consumption of fat-containing products, such as butter and full-cream milk, is also seen. While consumers are more aware of sugars, they do not often act on it and are willing to oversee it if it delivers a desired benefit such as increased energy (New Nutrition Business, 2017). Consumers are still consuming carbohydrates but they are taking a more balanced approach to carbohydrate consumption. This is indicated by the increased consumption of different vegetables such as zucchini and the ricing (breaking up into the form of rice) of cauliflower. These reshaped vegetables are used instead of pastas and rice (New Nutrition Business, 2017).

Comparing the abovementioned to trends from 2010, one notices that some trends have lasted until present, namely digestive health, healthy food that is convenient, healthy snacks, premiumisation through packaging for niche markets, and to a certain extent fruit and super-fruit as the future of food and health. Conversely, trends such as bone health, weight management, antioxidants, and energy drinks have slowed down in recent times. A micro-trend was the increased interest in protein in 2010, and compared to 2017 trends it seems as if this micro-trend transformed and is now worthy to be called a trend (New Nutrition Business, 2010).

The food industry has also seen extensive fragmentation in recent years (see Figure 2.4), which is fed by health brands providing for consumers' interest in new brands, tastes, textures, and new types of foods that in turn are giving birth to even more niches. This increase of healthier products ranges from plant waters to seaweed snacks (New Nutrition Business, 2016). It seems as if the food market has been fragmenting due to focuses on minor aspects of the product; for example soy-free.

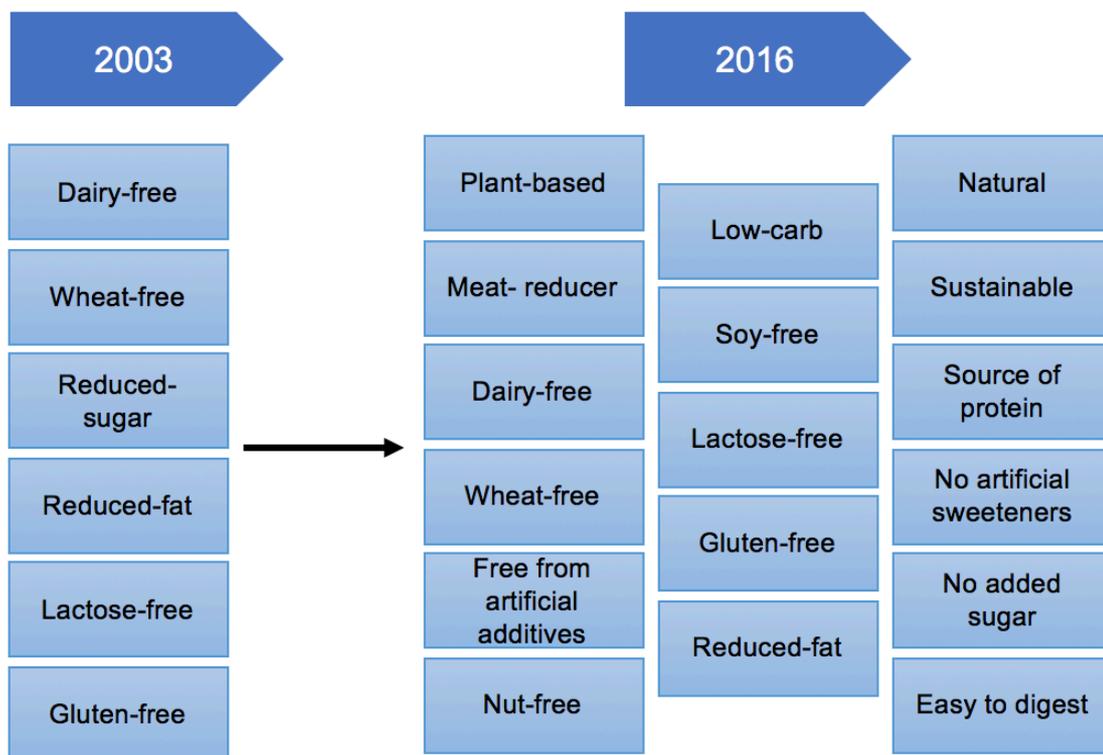


Figure 2.4: Fragmentation of the food market

Source: Adjusted from New Nutrition Business (2016)

2.3.2 Global buying behaviour

The next part focuses on consumers' buying behaviour trends as identified by various studies. This allows for insight into how and where consumers make their final purchase decisions.

Recent trends in in-store marketing focus on the consumer's expenditure in the store in order to "grab consumers" at the point of purchase, thus moving from out-store to in-store marketing. The increase in total shelf space and end-of-aisle displays have effects on product brand sales (Bemmaor & Dominique, 1991).

According to a study by Chandon, Hutchinson, Bradlow and Young (2009) on shelf space, the management thereof, and the influence it has on point-of-purchase decisions, most brands would not benefit from additional facings. Findings further suggest that more shelf space and larger

displays are reliable drivers of increased attention. This was also concluded by an eye-tracking study conducted by Wedel and Pieters (2008). The shelf position on top is prioritised and gets more attention. Also, vertical displays are preferred over horizontal displays; however, placing a brand near to the horizontal centre of a shelf increased noting of the brand by 22% and choice by 17%.

Selling commodities alone is not the way of the future. As goods and services become commoditised, the customer experiences that companies create will become more important (Pine & Gilmore, 1998). Understanding where customers are making their purchasing decisions can provide a better idea to retailers, brands producers, etc. of what shoppers are seeing and interacting with in a shopping scenario (Abratt & Goodey, 1990). Impulsive purchasing can be defined as “unplanned” and is the buying plan of the consumer, which he/she makes without evaluating the product displayed. The independent variables are aspects such as promotions, store environment, window display, income level, ownership of a credit card, and visual merchandising. The higher the income level, the less sensitive one is to making a decision, and since what one wants to buy depends on one’s income level, people in the higher-income groups are mostly involved in impulsive buying. Impulsive purchases will also increase the use of credit cards. Consumers are more likely to buy impulsively when they see free products promotions and price discounts. A pleasant and calm store environment with colourful surroundings motivates the consumer and builds excitement in the consumer’s mind. A well-designed window display can attract a consumer to a store, and in store the proper placement of products, packaging, and displays of products can also attract the consumer to make an impulsive decision (Ahmed & Parmar, 2013).

General purchasing behaviour is categorised into four categories (Abratt & Goodey, 1990):

- **Specifically planned purchase** is where the consumer has a specific brand and product in mind and purchases it.
- **Generally planned purchase** is where the consumer has a product category in mind but not a specific brand.
- **Substitute purchase** is where the consumer changes from a specific product to another.
- **Unplanned purchase** is where the consumer purchases an item that was not planned.

From the Point of Purchase Advertising International [POPAI]/Du Pont study of 1977, it appears that 65% of all supermarket decisions are made in store and of these over 50% are unplanned (Abratt & Goodey, 1990).

Today, more purchasing decisions than ever are made in stores, with 76% of the decisions under grocery shopping circumstances, and 82% in the case of mass merchant outlets. Fewer shoppers specifically plan their shopping outings and are more open to substitute products when making their purchasing decisions (POPAI, 2014). This allows substitute products to pinch customers from one another and serves as a warning of how important it is to ensure that the customer is provided with

products they require. This also emphasises the importance of consumer-orientated market research. Marketing study measures that integrate results from cognitive psychology and cognitive neuroscience, such as eye-tracking, should be used to improve existing research measures (Milosavljevic & Cerf, 2008).

Red meat retailers and outlets should also take note of the changes seen in consumers' purchasing behaviour. The increasing trend seen among purchasing decisions made in stores allows not only different types of meat to compete for the same purchasing power of consumers but could also create the possibility of different cuts of beef, for instance, to compete against one another.

2.3.3 Socio-economic aspects of South African consumers

The constant pressure on the rand and financial pressure caused prices to rise in a wide range of commodities (BFAP, 2014). Negative aspects such as crime, strikes, and load shedding also affected these trends. An increasing awareness of consumer protection and the new food labelling legislation affects consumers' purchasing decisions (BFAP, 2014).

To better understand the movement in the "richness" of consumers, the South African Audience Research Foundation (SAARF) uses the LSM. This is not directly based on income levels of the consumer, but also takes into consideration the consumer's access to various amenities, such as durables, household location, and dwelling type (SAARF, 2014). SAARF's LSM has become a widely used research tool in South Africa. It divides the population into 10 LSM groups that cut across race and is a unique manner of segmenting the South African market (SAARF, 2017).

Class mobility is a reality in South Africa, where consumers move toward higher LMS groups driven by economic growth and socio-economic empowerment. From 2004 to 2013, the share of South African adults within LSM segments 1-4 declined (-56%), accompanied by an increase in the share of the adult population classified within wealthier segments such as LSM 6 (+69%), LSM 7 (+99%), LSM 8 (+82%), and LSM 9 (+68%) (BFAP, 2014). In recent years, the class mobility rate has varied, but generally increased in most socio-economic sub-groups after slowing down from 2007/2008 up to 2009/2010 due to recession impacts (SAARF All Media and Products Survey [AMPS], 2013; BFAP, 2014).

The education levels in South Africa have also improved in recent years, with the number of adults with no education declining with 51% between 2009 and 2013. At the same time an increase of 17%, 32%, and 37% was found for adults with some high school education, a National Senior Certificate, and a tertiary education respectively (BFAP, 2014).

To summarise, South African consumers are characterised by the growth in real household income across the income groups and class mobility, particularly the growing middle-class and upper-income segments, an increase in urbanisation, a relatively young but gradually ageing population,

and an increase in the education levels, although the quality of it is declining. Another contributor to characterising the consumer can be the decrease in unemployment and an increase in debt over time, as well as over- and undernutrition (BFAP, 2014).

2.3.4 Food product trends in South Africa

Previous sections discussed global food product trends and consumers' purchasing behaviour, followed by socio-economic trends seen among South African consumers. Apart from these aspects, it is important to investigate food product trends identified in South Africa to ensure that this study applies the identified aspects where possible.

South Africans are seen, in international terms, as the third fattest country, due to unhealthy food generally being more affordable and accessible than healthier food options (Euromonitor, 2016). A family of four should spend at least R3 200 a month to be able to eat healthy. This is 84% more than what the majority of South African households are spending on food. It is estimated that 40% of South Africans cannot afford to eat healthy (Smith, 2017b).

The country also has a culture of glorifying “belly building” and roughly 90% of respondents in a survey indicated that they preferred a fat body type, with many associating skinny people with health problems (Euromonitor, 2016). Consumers are, however, becoming more health conscious, and especially South Africans with health complications are discovering the correlations between healthy food and their wellbeing and switching to healthier alternatives. Annual per capita consumer expenditure on vegetables has shown an increase from R531.40 in 2002 to R846.70 in 2014 (Euromonitor, 2016). Consumers are craving healthier and cleaner options across the board and chefs are determining how to make it delicious. Healthier options range from high-protein fibre matcha flapjacks to mashed and spiraliser vegetables (Jacobs, 2016). In the broadest definition, more South African menus are adding health foods. Gourmet fast foods are expected to stay with us in the future and restaurants are expected to make adjustments to their products during tough economic conditions. Restaurants have started to use local flavour in their food and nostalgic flavours are making a comeback (Jacobs, 2016).

South African consumers want to know more about the food they are eating. Increasing awareness of chemical substances used during the production process leads more consumers to ask questions about the origin, production practice, the use of antibiotics, pesticides, fertilisers, and food safety. All these factors are causing natural, free-range, and organic products to gain popularity (Euromonitor, 2016). Online shopping in South Africa is still low compared to other countries and accounts for only 3% of total sales, but it is gaining popularity. Two leading retailers, namely Woolworths and Pick n Pay, have started to offer online shopping and delivery services (Euromonitor, 2016).

Different new diets are causing consumption changes (Euromonitor, 2016). The Banting diet has become a big trend and focuses on real foods and switches low-fat and high-carbohydrate foods in favour of high-fat and low-carbohydrate meals. This diet not only causes wealthier consumers to replace bread, pasta, and rice with meat, butter, and cream, but it is also gaining popularity in townships, resulting in an increasing demand for some of these products (Euromonitor, 2016). Prominent food trend combinations among new products in 2013 included: indulgence + health + convenience: 44% of products; indulgence + health: 25%; and indulgence + convenience: 25% (BFAP, 2014). South African diet and health trends are partially responsible for the predicted increase in the demand for red meat (Euromonitor, 2016). This increased demand is also supported by the BFAP's report, which predicted a 6% increase in beef consumption and a 10% increase in mutton (BFAP, 2016).

These food product trends show that consumers are becoming more concerned regarding where their food was produced, how their food was produced, and the safety of their food. This can be an indication of the forms of labelling that could be used on the packets of red meat in the eye-tracking test. These packets should contain labelling aspects that can be used to investigate consumers' attention towards labels that indicate claims such as the origin of the product, that no additional antibiotics were added, produced under free-range conditions, and organically produced.

2.3.5 South African meat production and consumption

South African beef production was calculated at a total of 1 038 000 tonnes in 2014/2015, while beef imports were 19 000 tonnes for the corresponding year (see Figure 2.5). It can also be noted that while local production has kept increasing, imported beef has shown a steady decrease (DAFF, 2016). Predictions show that local beef consumption will increase by 6% between 2015 and 2025 (BFAP, 2016).

Total beef and veal consumption in the country moved almost horizontally between the early 1970s and early 2000s, and fluctuated between 549 000 tonnes and 741 000 tonnes. Only after the mid-2000s, an increasing trend could be seen, with total consumption amounting to 1 023 000 tonnes in 2014/2015 (DAFF, 2016).

A review of available data on South Africa's beef consumption trends shows that per capita consumption in the country reached a maximum of 25.91 kg/year in 1979/1980; thereafter it steadily decreased to a minimum of 12.69 kg/year in 2000/2001. Ever since 2000/2001, beef consumption has increased with per capita consumption at 20.95 kg/year in 2016/17 (DAFF, 2017).

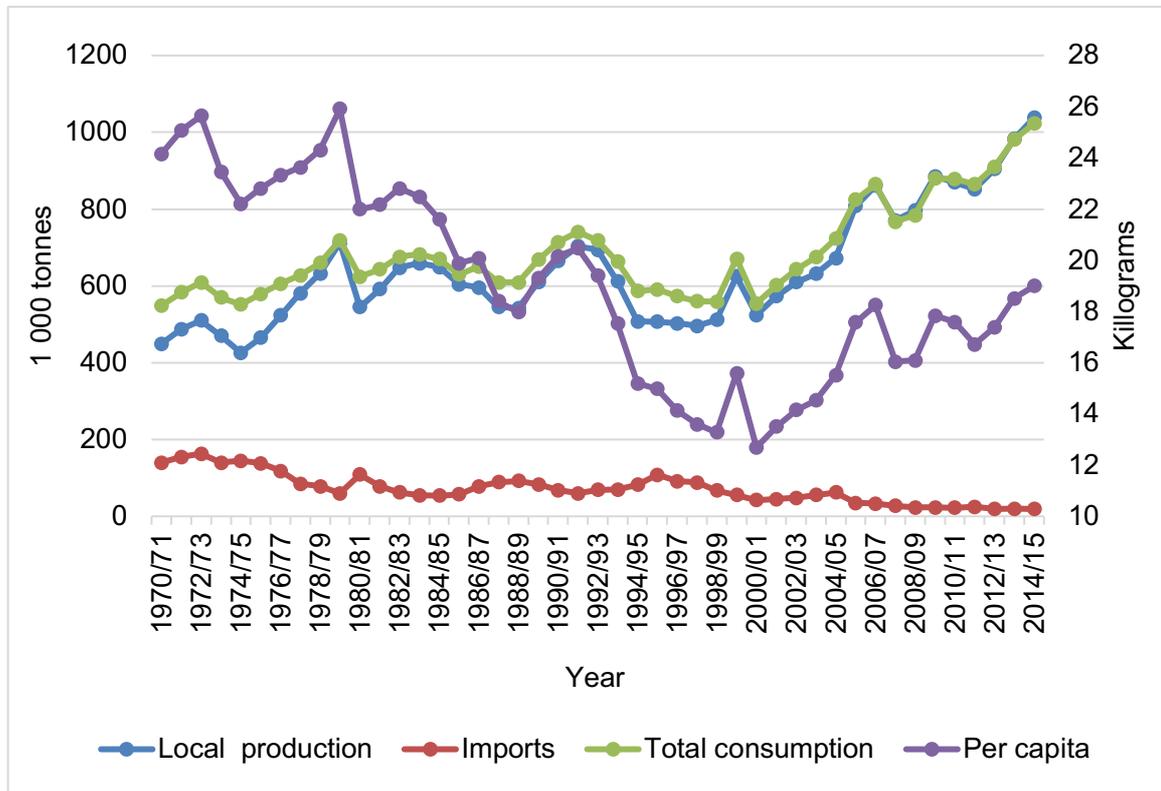


Figure 2.5: South African beef and veal production, import, and consumption

Source: DAFF (2016)

Figure 2.6 illustrates the consumption, production, and import trends for mutton, lamb, and goat meat in South Africa. Total production statistics showed a negative trend between the 1980s and 1994/1995, after which production has steadily been increasing. In 2014/2015 the total local production was calculated at 184 600 tonnes (DAFF, 2016).

Total local consumption showed a decrease between 1984/1985 (225 000 tons) and 1994/1995 (118 000 tonnes) and has since steadily increased to (193 thousand tonnes in 2014/2015) (DAFF, 2016). Imported meats seem to be negatively correlated to local production, implying that these meats are only imported during periods when local supply cannot meet demand.

Per capita consumption has shown a decrease since the mid-1980s, when consumption spiked at 7.3 kg in 1984/1985 to 3.1 kg in 1994/1995. Since 1994/1995, the per capita consumption per year of these meats has kept on fluctuating between the 3 kg and 4 kg level (DAFF, 2016). Consumption of mutton based on 2013 to 2015 levels of consumption is projected to increase by 10% leading up to 2025 (BFAP, 2016).

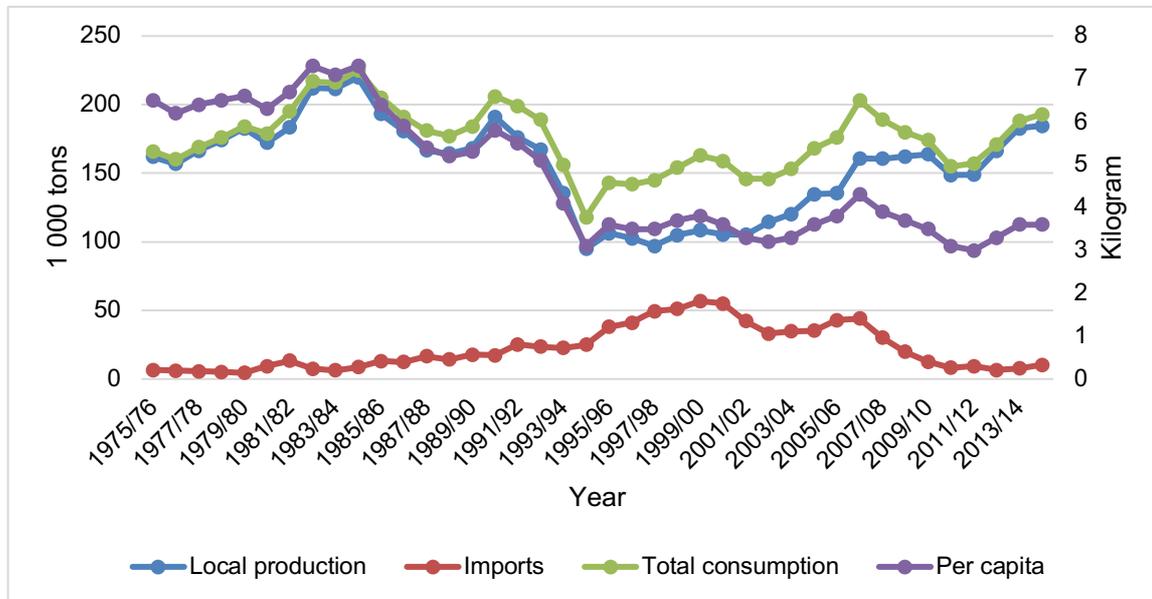


Figure 2.6: South African mutton, lamb, and goat meat production, import, and consumption
Source: DAFF (2016)

The presented statistics show that the consumption of both beef and mutton/lamb meat has been increasing and is predicted to continue to increase in the near future. This serves as a signal to red meat producers and retailers of the increasing demand that will have to be met either by increases in local production or by imported meats. Considering that consumers are becoming more concerned regarding the production processes and safety of their food, red meat producers will also have to ensure that this increase in production meets the requirements of South African consumers.

2.4 QUALITY ATTRIBUTES OF PRODUCTS

Product attributes serve as the sources of information that consumers use to extract the needed information about a product. It is therefore important that these attributes are used correctly to ensure that the needed information is conveyed to potential consumers.

Customers strive to maximise their expected utility with regard to the products they purchase. To do this, they gather, interpret, and base decisions on available product information while taking into account their preferences (Cunningham, 2003). Product information is conveyed to consumers in the form of attributes. Product attributes fall into three information categories, namely search, experience, and credence. Search attributes include product colour, and packaging, which can be identified immediately by consumers. Experience attributes are identified when the product is consumed and include the taste, tenderness, and convenience. Lastly, credence attributes cannot be identified at any point during the purchasing or consumption process and must be verified by a third party. Credence attributes include nutritional and hormone-free claims (Cunningham, 2003). Search and credence attributes can be tested by eye-tracking research. In the case of this study,

search attributes represent the colour and packaging of the meat, while claims such as “No added hormones” will represent credence attributes.

Caswell, Noelke and Mojduzka (2002) assumed that each product has an array of intrinsic quality attributes namely search, experience, and credence, which exist in a customer’s informational environment. Note that information might be categorised under different intrinsic quality attributes between different customers based on the cost and benefits that the consumer faces when gathering the information during shopping (Cunningham, 2003). Besides the intrinsic quality attributes, products also have extrinsic indicators or cues to assist during the process of purchasing. The expectations regarding the quality of a product can be influenced by both the intrinsic attributes and the extrinsic indicators. Cunningham (2003) identified possible intrinsic and extrinsic quality indicators/cues for processed bison products. These indicators are shown in Figure 2.7.

Intrinsic Quality Attributes	Extrinsic Quality Indicators/Cues
<p>1. Food Safety Attributes Food borne pathogens Hormone residues Antibiotic residues Food additives Spoilage Physical hazards</p> <p>2. Nutrition Attributes Calories/Fat/Cholesterol Sodium Carbohydrates Protein Vitamins and Minerals</p> <p>3. Sensory Attributes Taste Colour Appearance Freshness Smell/Aroma</p> <p>4. Value/Function Attributes Size and Style Composition Convenience of preparation Package materials Shelf-life</p> <p>5. Process Attributes Animal welfare Traceability Environmental impact Place of Origin Native/Heritage product</p>	<p>1. Test/Measurement Indicators Quality management systems Certification Records Labelling Minimum quality standards Licensing</p> <p>2. Cues Price Brand name Manufacturer name Store name Packaging Advertising Country of Origin Warranty Reputation Past experience 3rd Party Endorsements Other information provided</p>

Figure 2.7: Intrinsic attributes and extrinsic indicators

Source: Adapted from Caswell *et al.* (2002:57, cited by Cunningham, 2003:15)

As previously mentioned, Font I Furnols and Guerrero (2014) stated that the consumption of meat products depends on consumers’ ethics, traditions, and socio-economic factors. A multidisciplinary

model of factors affecting consumer behaviour in the food domain is shown in Figure 2.8, with some of the categories discussed thereafter.

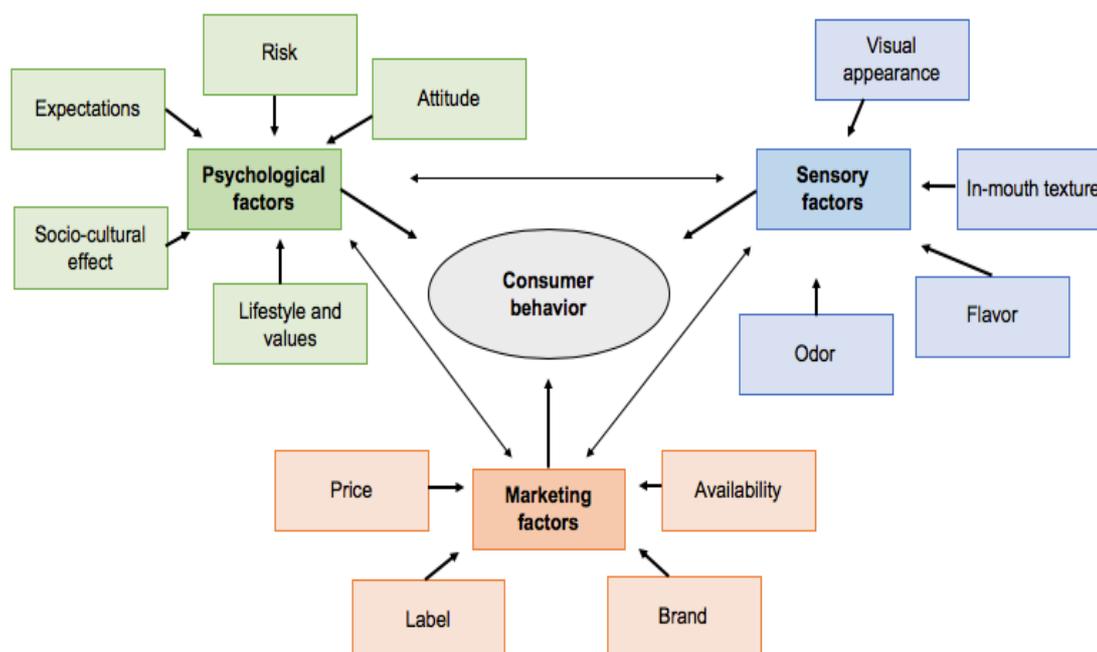


Figure 2.8: Multidisciplinary model of the main factors affecting behaviour in a food domain

Source: Font I Furnols and Guerrero (2014)

In this model, the factors that affect consumer behaviour can be divided into three main types: psychological, sensory, and marketing (Font I Furnols & Guerrero, 2014).

Psychological factors focus on the basis that consumers are rational beings and several external inputs can influence their cognitive, emotional, volitional, and even automatic actions. The individual conduct of consumers is made predictable from a social, economic, cultural, or psychological perspective due to the motivational, perceptive, attitudinal, and expectation factors that drive their lives. The following categories are allocated under psychological factors: attitude (beliefs and moral and affective component), risk, expectations, socio-cultural effects, lifestyle, and values.

Sensory factors comprise visual appearance, in-mouth texture, flavour, and odour. These traits depend on intrinsic and extrinsic factors such as age, nutrition, ante-mortem and post-mortem treatment, slaughter procedure, storage, species, genotype, and ageing time. Preferences with regard to sensory factors differ between consumers and it is a difficult task to improve on meat characteristics because of all the stakeholders in the whole meat value chain (Duckett & Kuber, 2001; Channon, Kerr & Walker, 2004; Pethick *et al.*, 2005; Font I Furnols & Guerrero, 2014). Changing the chain of production to improve one aspect of the meat could have negative consequences for other aspects of the meat. Visual appearance characteristics are intrinsic quality cues consisting of colour, fat content, drip loss, and marbling, which have been found to be highly related to consumers' expectations of meat quality (Bredahl, Grunert & Fertin, 1998; Cunningham,

2003; Banović, Grunert, Barreira & Aguiar Fontes, 2009). In-mouth texture, according to Szczesniak (2002), is a multi-parameter sensory attribute. Tenderness and juiciness are quality attributes that positively influence consumer preferences (Bello Acebrón & Calvo Dopico, 2000; Thompson *et al.*, 2005; Font I Furnols *et al.*, 2009; Polkinghorne & Thompson, 2010). Aged beef received higher tenderness scores and intramuscular fat (marbling) correlated positively to tenderness and juiciness (Brewer & Novakofski, 2007; O'Quinn *et al.*, 2012; Pannier *et al.*, 2014).

Marketing factors include availability, brand, labels, and price. Labels and brands provide consumers with much of their meat and meat quality information. Consumers make use of this information together with other factors to create quality expectations. These expectations influence the consumer's product choice, purchasing decisions, and willingness to pay (Verbeke & Ward, 2006; Font I Furnols & Guerrero, 2014).

Consumers' behaviour to meat and meat products is affected by multiple determinants. This leads to heterogeneous consumer behaviour and perceptions of meat and meat products. The aforementioned are affected not only by the appearance and sensory properties of the meat but also the psychological and marketing aspects. The competitiveness of the meat industry could be improved if these issues are understood. This could be done by providing information such as label information that can increase consumer acceptance of more convenient, healthy, and environmentally friendly food. Information regarding the meat and meat culture could also create more accurate expectations and will assist in reducing uncertainty, creating accurate expectations, and linking expectations to product characteristics (Font I Furnols & Guerrero, 2014).

2.5 PRODUCT DIFFERENTIATION

A product comprises everything that a company produces, including any services that may be attached to the physical product (Lamb, Hair & McDaniel, 2008). A product may thus be tangible, such as red meat, a service, such as the free delivery of the product to a general dealer, an idea or concept emphasised on the packaging, such as "do not litter", or any combination of these three elements. Packaging, style, colour options, and size are some typical product features and can be changed to lead to differentiation (Lamb *et al.*, 2008).

Product differentiation allows a product to stand out in the market because of the characteristics that only that product has. These unique characteristics must assist consumers to immediately identify the product (Grimm & Malschinger, 2010). To fully understand both the nature of the product offering and the way in which it can best be distinguished from those of competitors, it is necessary to consider the different levels of a product. The core benefit that can be derived from the product is found at the most basic level, such as transport provided by cars and basic nutrition provided by red meat. In essence, the core benefit is the same for all motor vehicles or all red meat products (Fahy & Jobber, 2012). The next product level focuses on the actual product that is purchased by the consumer, with all its features and styling; for example, red meat consists of the specific

packaging, the size of the packaging/meat, and the class of the meat. The final product level is concerned with the augmented product. These are the additional benefits that a meat-packaging company adds to the product and typically include a guarantee of freshness (determined by the packaging material) or a guarantee of origin. Product differentiation can take place on any or all of the three mentioned product levels (Fahy & Jobber, 2012).

Whether it is a tangible product, a service, or an idea, the aspects related to marketing are still dependent on the way in which the product is differentiated from those of competitors (Lamb *et al.*, 2008). Successful product differentiation is one of the most important and essential aspects when marketing a product. Strategies to differentiate a product include using unique characteristics such as added vitamin C or organically produced. Price differentiation serves as another strategy where, for example, two-for-the-price-of-one promotions could be applied (Grimm & Malschinger, 2010). Niche offers can also be used to differentiate the product where a product is produced for and marketed to a specific target market. The service that accompanies the product (e.g. home deliveries) can form the basis of differentiation while the original product has not been changed (Grimm & Malschinger, 2010).

Products can further be differentiated through direct communication with the consumer. This can be done to compensate the lack of genuinely distinctive product qualities. Communications should be done either through the packaging of the product or by added labels (or stickers) on the product. The communication with the consumers should focus their attention on the value for money the product offers, as well as the different uses of the product. An example is Fairtrade milk that is sold at a premium of 5% to 10% to the benefit of the milk producers (Grimm & Malschinger, 2010).

Lastly, packaging itself can be used as a method of differentiating products. This is more important when the qualities of the product in the market are more or less the same. In such cases it is essential that the consumer immediately judges the product by the information on the packaging, as well as the consumer's general impression of the packaging. Packaging aspects that combine to communicate the important differences to consumers include colour, print, and form (Grimm & Malschinger, 2010).

Packaging is a form of differentiation but is different from product differentiation. Product differentiation in terms of red meat refers to how the product was produced (for example, organically), the classification of the meat presented (e.g. A2), and could also be a special cut that differentiates the product (for example, rib-eye steak).

2.6 PRODUCT PACKAGING

Packaging decisions involve all the aspects regarding the type of packaging, the material to be used, as well as the size of the container. While in the past packaging only fulfilled the primary role of protecting the product, it is used in modern marketing as an instrument for attracting attention,

providing information, and conveying elements of product positioning. Organisations change their packaging on a regular basis as part of their marketing strategy. Changing the branding, colours, and other distinctive features on the packaging is often considered to be a risk as consumers tend to grow accustomed to the packaging and when new packaging is introduced, they may consider the product itself to be new or different (Cant & Van Heerden, 2013).

It is not good enough for organisations to only deliver services or products; the experience accompanying the service or product plays a big role for consumers (Pine & Gilmore, 1999). According to POPAI (1996), 70% of consumer purchasing decisions are made at the shelf in the retail shop, with 85% of the choices being made without picking up a competitive item, and 90% of the decisions being made after consumers only looked at the front of the product's packaging without having the product in hand (Urbany, Dickson & Kalapurakal, 1996). This suggests that packaging design clearly plays a significant role in determining the success of products. and the consumer ultimately influences the packaging of products. A study that investigated perceived healthfulness found that packaging colour dominated packaging shape. Green packaging was seen as a healthy colour, while red and black were perceived as relatively less healthy. Black on packaging was seen as luxury colour (Ruumpol, 2014). Packaging aspects such as colour and a picture of the product on the packaging had the highest relative importance in terms of consumers' perception and purchase intention of functional food (Ares, Besio, Giménez & Deliza, 2010).

From the presented literature, the importance of product packaging and the effect it might have on consumers' perception of the product could clearly be seen. In the two sections to follow, an overview of trends seen in packaging is provided (Section 2.6.1), followed by the meat marking and packaging regulations applicable to South African red meat (Section 2.6.2).

2.6.1 Packaging trends

The digital evolution has made it possible for retailers, brand owners, and packaging converters to customise or personalise products (Intel, 2016a). This trend was placed in the global limelight by the success of Coca-Cola's "Share a Coke" campaign. Flexible product packaging is seen by consumers as modern and allows more marketing and decorative opportunities than traditional packaging (Intel, 2016a). It is predicted that brands will focus on the next generations of flexible/rigid hybrids that provide functional as well as environmental benefits along with great shelf presence. Consumers want more information on the packaging of the product that they are buying but less on-pack clutter that confuses them. Aspects such as ingredients and the use of artificial preservatives are important to consumers. Brands are going green in their search for packaging that is good for the earth. In situations where products have equal prices and are seen by consumers as products of equal quality, more and more consumers will base their purchasing decisions on the eco- and alternative-use attributes. It is also expected that an increase will be seen in the use of mobile engagement while shopping. The use of near-field communication (NFC) and

Bluetooth Low Energy (BLE) is accepted to replace the use of Quick Response (QR) and text codes (Intel, 2016a).

In terms of meat packaging, a few trends are being researched and form large parts of packaging companies' research budgets. Trends in terms of meat packaging that have received attention year after year include the extension of stores' business hours to a 24/7 situation, along with a reduction in the number of people working at the back of the stores, which in some cases have led to out-of-stock situations. Secondly, consumers' time crunch and desire for fresh, high-quality, convenient meat items and ready meals drive packaging solutions. The trend that remains the highest priority is how meat items can safely be delivered to consumers every time (Belcher, 2006).

As the world is getting smaller due to globalisation, it is critical that meat-packaging companies understand and solve the problems that consumers and retailers encounter with meat products. Case-ready packaging will continue to evolve all over the world as labour issues become a problem (Belcher, 2006). Consumers will always demand convenience and be willing to pay for convenience to solve their problems. The meat-packaging industry must continue to work on their systems to make the provision of safe and palatable products possible (Belcher, 2006). The ability of materials to offer flexibility in the processing and reheating of food products at home will be critical. The increasing cost of petroleum will drive the demand for product packaging that is bio-based (Eilert, 2005).

Understanding the factors that will have the largest influence on the evolution of the packaging of meat is critical. The ageing of the population, a reduction in the cooking skills of average consumers, and less time available for food preparation at home will all be contributing factors that fuel the demand for products with greater consumer convenience (BFAP, 2014; Eilert, 2005). This includes fully cooked products and marinated meats (Mize & Kelly, 2004, cited in Eilert, 2005; Eilert, 2005). The demand for pre-packed and case-ready meats has increased, and it is expected that packaging formats that allow wider distribution of these products will evolve. It is expected that low-oxygen packaging technologies will be developed and improved as long as they allow wider distribution of centrally packaged meat while still economically making sense (Eilert, 2005).

Packaging has evolved over the years. In the United States of America (USA), the trend moved to fresh meat in a case-ready format. The majority of products continue to be offered in a high-oxygen environment ($\pm 80\%$) to maintain bloom with a minimum of 20% carbon dioxide to prevent microbial growth. In many cases, vacuum packaging continues to be the most cost-effective packaging strategy. Merriman, Deluca, Luthra and Goulette (2003) developed another low-oxygen packaging alternative to high oxygen. In this system, a small amount of carbon monoxide was used in a secondary package surrounding the primary package. This was a critical element that allowed this type of package to gain approval by the Food and Drug Administration (FDA) for use in 2002. Low-oxygen packaging benefits are a major advantage that will improve consumers' eating experience.

This evolution will enable any meat industry to meet the needs of a larger group of retailers, in a packaging format that uses less packaging materials and is less labour intense than vacuum packaging (Eilert, 2005).

As seen in most South African retailers, there is a section in the store where meat and meat products are displayed, which is mostly prepared in store to make the product visually attractive. They offer the consumer a large variety of options and the consumer needs to make a purchasing decision. Although some of the higher-LSM consumers tend to visit a local butcher or deli, the retail sector will always play a big role because of convenience. South African consumers still desire the opportunity to interact with butchery staff (Mack, 2013).

2.6.2 Meat marking and packaging regulations

According to the Meat Safety Act of 2000, no animal may be slaughtered at any place other than an abattoir. Animals that are slaughtered for cultural or religious purposes are excluded from this regulation but may not be sold to a third party. Abattoirs must be registered according to the regulations as stipulated in the Act (Meat Safety Act, No. 40 of 2000).

Classification of bovine, sheep, and goat carcasses must be done according to the age of the animal (A, AB, B, or C), fatness of the carcass (0-6), confirmation of the carcass (1-5), and damage of the carcass (1-3) (Agricultural Product Standards Act, No. 119 of 1990). A calf is defined as a bovine with a maximum carcass weight of 100 kg, of which only the first real molar has emerged in the upper jaw or no real molars have emerged from the upper jaw. Calf carcasses are classified according to age, mass, and the class of calf. Confirmation of the calf carcasses must be classed 1-5, according to the provisions of Regulation 8 of the Agricultural Product Standards Act (No. 119 of 1990). Calf carcasses must also be classified according to damage classes (1-3). The use of the terms “lamb” and “kid” may only be used respectively in the sale of mutton and goat meat that has been classified according to the regulations in the Act as Age Class A (Agricultural Product Standards Act, No. 119 of 1990).

According to the Agricultural Product Standards Act (No. 119 of 1990), the age of bovine, sheep, or goat carcasses must be determined according to the number of permanent incisors, as shown in Table 2.1. For example, the meat from a sheep that does not have any permanent incisors will be classified as Class A. If the animals receive a Class 3 for fat, the animal’s carcass will be marked with a purple roller mark indicating AAA 333 on the carcass.

Table 2.1: South African carcass classification system

Trait	Beef/Lamb/Mutton							
Age	A		AB		B		C	
Permanent incisors (#)	0		1-2		3-6		>6	
Roller mark	AAA		ABAB		BBB		CCC	
Colour	Purple		Green		Brown		Red	
Tenderness	Most tender		Tender		Less tender		Least tender	
Fat grade	0	1	2	3	4	5	6	
Beef (fat thickness mm)	0	<1	>1<3	>3<5	>5<7	>7<10	>10	
Sheep (fat thickness mm)	0	<1	>1<4	>4<7	>7<9	>9<11	>11	

Source: South African Meat Industry Company (SAMIC, 2006) and Spies (2011).

The Agricultural Product Standards Act (1990) also regulates the sale of processed meat. Part of the processed meats' product description must indicate the chemical solution used on the meat, for example "with brine". Weight gain caused by the processing of meat is limited to 10% and is only allowed for quality-enhancement purposes. The use of water on its own is prohibited, as well as the treatment of meat with the sole purpose of increasing the mass of the product (Agricultural Product Standards Act, No. 119 of 1990).

According to the Agricultural Product Standards Act (No. 119 of 1990), in terms of quality indicators, no mark is to be applied to the carcass, container, or outer container of the meat that directly or indirectly leads to the misinterpretation of the mark. Quality indicators such as the terms "super", "prime", "top", "choice", "quality", "extra", or "ultra" or any other term that directly or indirectly creates the impression that the marked meat is of special or particular quality other than set out in the regulations of the Act may not be placed on the meat products. The only quality indicators that may be used to mark carcasses or meat products are those that were approved by the executive officer upon written request (Agricultural Product Standards Act, No. 119 of 1990). Table 2.2 shows a list of the approved quality indicators as provided on the SAMIC website.

Table 2.2: Approved South African Meat Industry Company (SAMIC) quality indicators

Afrikaner Beef	Hope's Free Range
Beefcor Select	Karoo Naturally Free
Braeside's Free Range Grass Fed Meat	Karoo Free Range Veld Raised
Chalmar Beef	Oak Valley Free-range Acorn-fed Pork
Certified Natural	Oak Valley Wagyu Beef
Certified Karoo Meat of Origin	Oak Valley Free Range Beef
Certified Woodview Beef	Pick n Pay Free Range
Checkers Angus Beef	Pick n Pay Veal
Food Lover's Free Range	Pick n Pay Sow Crate Friendly
Fruit & Veg City Grassfed	Pork 360
Famous Laingsburg Karoo Lamb	Quality Veld Beef
GFASA	Spier Pasture Reared Beef
Grassland Meat	Sernick
Greenfields Free Range Beef	Triple A Beef
Guaranteed Natural	Woolworths Free Range
HHB Free Range	Woolworths Sow Friendlier Pork

Source: SAMIC (2017)

This concludes the sections that focused on packaging and regulations that are applicable to meat classification, packaging, and the adding of quality indicators. In the next section, the focus shifts to branding.

2.7 PRODUCT BRANDING

While labelling is used to identify a specific product and characteristics relating only to the product itself, a brand is a broader concept that entails the product's characteristics, its reputation, and the accumulated customer experience with the brand name and symbol viewed at the consumer's point of purchase. A brand is thus not merely the creation of an image in the minds of the consumer (Innes, Kerr & Hobbs, 2007).

Branding's simplest form can involve both product differentiation and firm reputation. It can also signal information to the consumer and, based on previous experience, the consumer knows he/she is served with a consistent product that complies with company and consumer standards. This signalling of differences can be accomplished in a variety of ways; through advertising, reputation-building strategies, warranties, or simply brand building through capital investment. It is then important that the consumer experiences what is promised, or at least trusts the firm that the product contains the advertised attributes (Goldsmith, Turan & Gow, 2003).

Branding is not the easiest aspect of marketing to handle. A strong brand name can have a positive influence on consumer perceptions and preferences. This in turn leads to brand loyalty because the consumer gets used to the quality, service delivery, and other related aspects. The impact of the strong, positive perceptions held by consumers about leading brands in the red meat market makes it difficult for new brands to compete effectively. Even if the new brand performs well on blind taste tests, it may not be sufficient to push the opposition out of a specific market segment (Elliot & Percy, 2007).

A brand makes it easy for a consumer to engage in a purchase action. A compelling brand identity provides any company with an immediately recognisable, distinct, professional image that positions it for success. The future success of any brand is dependent on building public awareness, preserving their reputations, and upholding their value. A strong brand identity will support the establishment of brand equity through increased recognition, awareness, and customer loyalty, which in turn have a positive influence on the success of a company (Elliot & Percy, 2007).

A strong brand provides a foundation for leveraging positive perceptions and goodwill from the core brand to brand extensions. Brands also provide a consumer with a variety of benefits, such as communicating significant features and benefits, reducing the risks involved in purchasing, simplifying the purchasing decision, and showing symbolic value. Once brands have been established, several important decisions must be made (Elliot & Percy, 2007).

Some feel that branding has a stronger value for the products than labels. Labels, for instance, can indicate the origin of the product (e.g. “Produced in South Africa”), while a brand (e.g. a South African-produced brand) can by its design represent all previous brand marketing and create heightened awareness of what the consumer associates with South Africa (Innes *et al.*, 2007).

In South Africa, the past years showed an increase in the trend to brand meat and especially beef and lamb/mutton. Outlets such as Woolworths have been selling free-range beef, lamb, and chicken, which are claimed not to have been given routine antibiotics and growth hormones (Woolworths, 2016). Other certified brands such as Karoo Lamb started delivery of their certified meat in 2011 (Karoo Development Foundation [KDF], 2017), while a more recent brand launched was the Afri Beef trademark that was registered late in 2016 (De Kock, 2016).

The brand decision maker must be informed in order to make any strategic marketing decisions. The eye-tracker is an innovative way in which additional information from the branding and packaging process can be obtained as it establishes which areas the consumer focuses on when looking at the product. With the eye-tracker, never-before-noticed contributors can be identified as to what it is the consumer bases the decision on when making a point-of-purchase or store decision.

2.8 LABELLING

Contrary to branding, which creates a broader perception of the product, labelling is used to identify specific product characteristics that only relate to the product itself (Innes *et al.*, 2007). At the point of purchase, food labels are supposed to provide the consumer with sufficient information relating to the contents of the product and thereby assisting the consumer in identifying nutritionally appropriate food products (Grunert & Wills, 2007). Consumers' own needs and motivations relate to the information that they search for on food labels (Jukes, 2000).

All businesses, according to Haering and Franco (2010), depend on marketing to promote their products and build consumer relationships. Food marketing takes many forms, from advertising, raising brand awareness, to paying stores for shelf space. Food companies focus on added value, like free of hormones, for example, all natural nutrients, etc. Food labelling, when not misleading, can lead to educating consumers about the origins of their food, the practices used to produce it, or the nutritional content, as mentioned above. It can also help consumers to assess the health, environmental, and social outcomes of their purchases, empowering them to “vote with their forks”. The consumer can also use the label to make informed purchasing choices (Haering & Franco, 2010).

A South African study by Jacobs (2009) showed that 24.7% of the respondents always read food labels, 42% sometimes read the labels, and 33.3% of the consumers never read the labels. The study also found that 92.8% of the consumers who always read the labels, read them to identify the nutrient content of the product, as well as when they purchased the product for the first time.

The consumers who sometimes read the labels indicated that the most prominent reason was when they were purchasing a product for the first time (76.7%) (Jacobs, 2009).

In the past, South African food manufactures have used marketing strategies that misled the consumer with half-truths printed on the labels (De Villiers, 2009). New laws and regulations relating to the labelling and advertising of foodstuffs (Regulation 146, Department of Health, 2010) pay specific attention to the wording of labels and how products are advertised. The objective is to create an equal platform stating only facts, with no confusing language, and using the label as a platform to educate the consumer (De Villiers, 2009).

Requirements for food labels in this legislation include the following aspects:

- An accurate name of the product, and information telling consumers exactly what is inside the packaging. If the name is not a proper description of the product, an appropriate description must be added on the main panel.
- Product ingredients must be listed in descending order of mass. The names of ingredients used must be the same name as when such an ingredient is sold as a foodstuff.
- All allergens must be identified in the prescribed format.
- The country of origin must be shown on the label.
- A batch identification number on the container, as well as date markings such as “best before”, must appear on the container or label.
- The name and address in South Africa of the manufacturer or importer or distributor.
- Net contents in metric units.
- Agricultural products must also comply with the relevant standards act for the specific food (Foodstuffs, Cosmetics and Disinfectants Act, No. 54 of 1972; Steenkamp, 2010).

2.9 RELATED RED MEAT STUDIES

Related red meat studies presented in this study are divided into two sections and discussed accordingly. Related red meat studies conducted in other countries (Section 2.9.1) are summarised and discussed first, followed by related South African studies (Section 2.9.2).

2.9.1 Related red meat studies from other countries

Presented in this section are studies from other countries conducted on red meat and red meat consumers. This creates a picture of different types of red meat studies that can be used when investigating red meat consumers.

Issanchou (1996) reviewed available red meat studies and came to the following conclusions. Western countries have experienced no growth in their red meat consumption, with declines being experienced in some cases. He noticed a growing concern for low-fat and convenient products.

In some instances, consumer preferences seemed to be paradoxical; for example, intramuscular fat that had a negative influence competes with juiciness and flavour. A lack of communication between the meat producers and the food industry has led to confusion among consumers. This lack of communication could be overcome with the use of brands and labels. The meat industry is changing from being a production-led to a consumer-driven industry. A clear need was identified for multi-disciplinary studies. Lastly, the researcher identified the need for non-verbal methodical methods of research since “whenever you ask the question, you will always get an answer, even if the question is an impossible one” (Issanchou, 1996; Köster, 1996).

Carpenter, Cornforth and Whittier (2000) investigated consumer preferences towards packaging, beef colour, and eating satisfaction in Utah, USA. It was found that participants preferred their cuts of meat in a polyvinyl chloride overwrap, with vacuum skin packaging and modified atmosphere packaging in second and third place respectively. Participants indicated that they preferred to purchase meat with a red appearance and with purple and brown being preferred to a lesser extent. After showing the meat product to the participants, they were served cuts of prepared meat with the same description as the different raw products that were shown. This was done to test whether appearance and packaging of the products would have an effect on the taste scores. In truth, participants were served pieces of meat cut from the same source. No significant differences were found with regard to the taste of this beef. Carpenter *et al.* (2000) concluded that while participants had preferences in terms of beef colour and packaging when buying meat, these preferences did not bias the taste scores in their test.

Ngapo, Braña, Varela and Rubio Lozano (2017) studied the point-of-purchase characteristics that Mexican consumers used for their beef purchase decisions. The most important characteristic was found to be the fat cover on the beef, with marbling being the second most important, followed by the colour of the meat. The colour of the fat on the beef was the least important of these characteristics but the authors still deemed it as important due to 43% of the consumers using either three or all four of the mentioned characteristics to make their decision.

An American study tested consumers' willingness to pay for state-certified beef labelling (Merritt, DeLong, Griffith & Jensen, 2018). It was found that consumers were willing to pay a premium for origin-certified beef, which in this case was Tennessee certified beef. Besides appreciation for state-of-origin certification, consumers also showed a willingness to pay for grass-fed beef and beef with no hormones administered. Educating consumers regarding the meaning of the labelling also led to higher premiums being paid.

An Italian study found that price, animal welfare, the breed of the animal, brand, and organic labels were the most important product descriptions. The study focused on the Piedmont area of northwest Italy and made use of a best-worst scaling choice experiment (Merlino, Borra, Girgenti, Dal Vecchio & Massaglia, 2018).

A study on American lamb retail and food service rank, definition, and relative preference of different quality attributes was conducted by Hoffman *et al.* (2016). Their study found that eating satisfaction was the most important quality attribute for consumers, followed by origin (locally raised) and sheep-raising practices (grass-fed). Nutrition and wholesomeness, along with the convenience of the product, were the least important of the attributes. Other findings included that the origin of the meat and sheep-raising practices showed the highest probability of being non-negotiable requirements of lamb purchases. Product assurance regarding the eating satisfaction of the product obtained the highest willingness-to-pay-premium from American lamb consumers.

A study conducted in Spain found that consumer preferences regarding lamb meat differed considerably depending on their frequency of consuming lamb meat. Nationally produced was the most important aspect that influenced the willingness of consumers to buy, followed by price. Occasional lamb consumers attached increasing importance to quality assurance schemes, which included protected geographical indicators (Bernabéu, Rabadán, El Orche & Díaz, 2018).

Another study from Spain found that the origin of the production of lamb meat was one of the most preferred attributes among the majority of the consumers, with local being the preferred choice. However, consumers were willing to pay a higher premium for a certain type of lamb meat than for locally produced lamb meat (Gracia & De-Magistris, 2013).

Risius and Hamm (2017) tested consumers' choice of labelling of different production practices and how additional information affected these choices in Germany. Organic and extensive suckler cow were two of the production practices tested in the study. Consumers appreciated additional labelling that showed information about production qualities. Prior to consumers receiving information regarding the production system, organic labelling was preferred to extensive suckler cow labelling. After providing consumers with information on what the labels meant, their preferences changed and the two production practices swapped positions.

Beef consumers' purchasing decisions for fresh beef steaks and roasts were explored in a study by Reicks *et al.* (2011). In their study, female consumers placed greater importance on the tenderness of the meat, ease of preparation, and nutritional value than male counterparts. Older consumers showed greater concern regarding the tenderness, product consistency, and nutritional value in the case of steak, whereas for roast their choices were influenced by flavour, product consistency, and nutritional value. Consumers with higher levels of education considered juiciness, nutritional value, and natural product aspects of less importance when choosing a product to purchase.

A sensory analysis study was conducted by O'Quinn *et al.* (2016) where different flavours were tested on different beef products in the USA. It was found that consumers generally preferred the following flavours: beefy/brothy, buttery/beef fat, and sweet flavours, while fishy, livery, gamey, and

sour flavours were disliked. Consumers preferred the flavour attributes of beef higher in intramuscular fat, which has greater amounts of monounsaturated fatty acids, odd-chain, omega-3, and trans-fatty acids.

An organic beef study in Spain by García-Torres, López-Gajardo and Mesías (2016) compared consumers' preferences of beef attributes that can be evaluated before and after purchase. In the study, two types of organic beef-production systems were tested against each other, as well as against conventional production practices. In the sensory analysis of the study, consumers scored organic grass-fed beef the highest on the colour of the raw meat, while other attributes of the organic grass-fed beef received the lowest rating of all the meat. Organic concentrate-fed beef and conventionally produced beef scored similar scores in the sensory analyses (taste tests) with both meats showing higher ratings than the organic grass-fed beef. In the taste test of the study where the after-purchase attributes were tested, the organic grass-fed beef proved to be preferred.

Consumer preferences regarding the ageing process of beef and the effect of misleading labelling were investigated by Stenström, Li, Hunt and Lundström (2014) in Sweden. In the first round of the study, it was found by means of a sensory test that consumers preferred dry-aged beef above bag-dry ageing and vacuum-aged beef. In the deceptive test, consumers were tested with incorrect labels being shown for the beef (for example, the label showed dry-aged but the sample of beef presented was actually vacuum-aged beef). In the deceptive test, the false labelling led to the majority of the consumers choosing the same label as in the sensory test, while the beef provided for tasting did not agree with the labelling.

Red meat research with the focus on consumers is not a new topic. When reviewing foreign red meat studies, insight is gained into the possibility of subjects that can be investigated among South African consumers. They can also be used to identify gaps in the available literature for future studies.

As seen from the literature presented above, researchers in many countries have deemed it important to investigate not only consumer preferences but also their willingness to pay, sensory preferences of red meat products, and their packaging preferences for red meat. The increasing trend of consumers wanting to know where their food was produced and how it was produced, as already identified earlier in the study, has enjoyed attention from researchers across the globe. From the presented literature it seems that developed countries have placed larger focus on investigating labelling aspects and claims, as well as on conducting sensory tests on consumers (García-Torres *et al.*, 2016; Hoffman *et al.*, 2016; Merlino *et al.*, 2018; O'Quinn *et al.*, 2016; Risius & Hamm, 2017; Stenström *et al.*, 2014). On the other hand, studies in developing nations tended to focus more of the physical appearance of meat, such as the colour of the meat and fat on the meat (Ngapo *et al.*, 2017). The strong emphasis that these studies place on labelling aspects should also be included in this study. The need as identified by Issanchou (1996) to make use of non-

verbal research methods can also be interpreted as a gap in the current field of red meat studies for the use of eye-tracking technology on the subject.

2.9.2 Related South African red meat studies

South African researchers have also focused on the red meat sector and its consumers. Relevant studies conducted on South African consumers are presented in this section.

In the beef value chain, the power has shifted from the supply side to the hands of the consumers (Labuschagne *et al.*, 2011). The demands and needs of beef consumers have changed. South African consumers prefer to buy fresh beef and not frozen beef (Labuschagne *et al.*, 2011). Consumers prefer to buy beef in butcheries due to the trust they have in them and the quality of the product, but will make use of supermarkets due to convenience and price. Convenience, price, and branding of beef were found to be the most important factors that affected beef consumers' purchasing decisions in the town of Alice in the Eastern Cape (Mabhera, 2014). The author found that consumers do not always express their concerns in their purchasing decisions and that more research on the factors that affect their conduct should be conducted. Mabhera's (2014) study determined that quality is more associated with the extrinsic attributes of beef such as value addition and information displayed, than with sensory and intrinsic attributes (Mabhera, 2014).

Consumer behaviour toward buying beef was investigated by Uys and Bisschoff (2016), who identified eight aspects that influenced consumer behaviour. They included quality of meat, buying preferences, farming practices, intention to buy, health, supplier, convenience, and packaging. Of these, the most important drivers that influenced consumers' beef buying behaviour were suppliers and packaging. The quality of the meat, farming practices, intention to buy, and health were also scored as important drivers that influenced beef purchases. The study found a positive correlation between quality and farming practices, quality and health, and quality and buying preferences.

A study in the Ikageng township by Liebenberg (2016) found that consumers spent 26% of their income on meat. Some of the factors that were found to influence consumers' preferences and were important when marketing meat in the township included the quality of the meat, which made the largest contribution to affecting consumers preferences. The presentation of the meat was ranked as second most important, followed by consumer-orientated business (ex. excellent service and larger variety of meat). Culture and religion also affected consumers' preferences but to a lesser extent than initially thought. Other factors that influenced consumers' preferences were specific choice criteria, visual stimuli, fat content, past purchasing experience, post-purchase evaluation, and personalisation (Liebenberg, 2016).

Breeding and feeding practices have caused a decrease in the fat content of South African beef since the 1930s. This allows beef to be seen as part of a healthy, balanced, and energy-controlled diet that can compete with other lean animal products (Hall, Schönfeldt & Pretorius, 2016).

Maré *et al.* (2013) investigated South African consumers' preferences of red meat. More specifically, the study focused on yellow and white fat on meats. Yellow fat is the product of grass-fed or veld-finished cattle, while white fat is a product of feedlot-fattened animals. The results showed that 43.74% of the consumers preferred white fat, 42.68% did not have a preference between white and yellow fat, and 13.59% of the consumers indicated that they preferred yellow fat. Furthermore, the results showed that consumers with higher levels of education preferred yellow fat. These consumers were more concerned about the physical and visual properties of the meat than about branding, classification, and packaging neatness. The participants who preferred white fat had lower levels of education, were more concerned with packaging neatness and Class, and were not concerned with the physical and visual properties of the meat. Characteristics that proved to be very important across all consumers in the study were sell-by date, price, neatness of the packaging, neatness of the cuts, blood in the packaging, meat colour, fat distribution, texture, classification, thickness of the cuts, and branding (Maré *et al.*, 2013).

A study by Vermeulen *et al.* (2015) identified aspects that consumers in different LSM groups considered when purchasing beef and mutton. The top five aspects per income group for raw beef and mutton/lamb purchases are shown in Table 2.3. The study concluded that the dominant consideration attributes when purchasing beef and mutton/lamb focused to a large extent on safety, appearance, price, and eating quality. Low- and middle-income groups paid more attention to the price, while middle- and high-income groups focused on expiry date. In addition to identifying these aspects, the study found that the poor consumer segment had a very limited understanding of red meat classification and paid little attention to it. Approximately half of the consumers in the middle- and high-income groups looked at red meat classification sometimes or often, despite their limited understanding of red meat classification. It was concluded that improved knowledge of the classification system could assist consumers in making more informed purchasing decisions. It was also found that an appropriate consumer-tested front-of-pack labelling system that can communicate red meat classification to consumers was needed (Vermeulen *et al.*, 2015).

Table 2.3: Aspects consumers in different socio-economic subgroups consider when purchasing raw beef and mutton/lamb

Marginalised group	Middle-class group	Wealthy group
LSM 1-4	LSM 5-8	LSM 9-10
Beef		
Price	Expiry date	Food safety
Appearance	Price	Expiry date
Cleanliness	Meat colour	Quality guarantee
Meat colour	Appearance	Taste
Quality guarantee	Clean meat (e.g. no blood)	Appearance
Mutton/Lamb		
Price	Price	Food safety
Meat colour	Appearance	Expiry date
Appearance	Expiry date	Taste
Easy to prepare	Taste	Meat colour
Clean meat	Food safety	Appearance

Source: Vermeulen *et al.* (2015)

Du Plessis and Du Rand (2012) investigated consumers' preferences with regard to Karoo Lamb meat attributes and specifically focused on traceability. The price of the products, which was one of the extrinsic attributes, proved to be the most important factor when consumers are making purchasing decisions. Safety and quality were also important to consumers, with safety being the more important of the two. The authors found that traceability can also be meaningful to consumers in an indirect manner. Traceability mostly benefits consumers in terms of providing safety and quality information.

Another study that investigated whether consumers and meat traders regarded animal welfare as a factor that influences the quality of the meat (Vimiso *et al.*, 2012) found that these parties did not perceive animal welfare as an influential factor in terms of the quality of beef. The study found a positive association between colour, fat, and price and the expected quality of the beef.

Aspects investigated by other countries have also enjoyed attention from South African red meat researchers. Labelling aspects, such as origin of the product, have been investigated, as well as the physical aspects of red meat. This could be due to South African consumers who associate extrinsic attributes of beef more when determining quality than they do with sensory and intrinsic attributes, as found by Mabhera (2014). Red meat research in South Africa has mostly been conducted by using self-reporting measures, such as questionnaires, to investigate consumers' purchasing preferences and willingness to pay. This also reveals the gap in South African studies in terms of the use of non-verbal research studies on red meat consumers.

2.10 EYE-TRACKING RESEARCH

Information is power. This simple term captures the market control and business success that stem from information (Smith & Albaum, 2012). Marketing research relates to the collection of information that provides decision makers with the power to find solutions for their business problems (Smith & Albaum, 2012). Everyone in marketing knows that getting consumers' attention is crucial. A common method used to measure attention towards advertising, among others, is using self-reported techniques (Milosavljevic & Cerf, 2008). Memory measures, however, can be poor indicators of what caught consumers' attention (Rosbergen *et al.*, 1997). The foundation of market research is not a new concept; however, advancements in technology have made a wider range of studies possible (Smith & Albaum, 2012). One such technology is eye-tracking.

Eye-tracking can be used to quantify an observer's overt visual attention and can be used to evaluate and compare individuals' visual search patterns in an array of situations (Tonkin *et al.*, 2011). Eye-tracking research should always be combined with a verbal questionnaire protocol since the technique on its own will not be able to study the cognitive processes underlying the eye movement (Graham *et al.*, 2012; Mitterer-Daltoé *et al.*, 2014).

The results compiled from eye-tracking data include heat maps, gaze plots, and measurement metrics (Tobii, 2016). Heat maps indicate which areas of the tested image (ex. packet of meat and advertisement) enjoyed the attention of the participants for a longer period of time. Gaze plots show the sequence of each consumer's fixations on the tested image. Amongst others, the metrics provide accurate data of the percentage of consumers fixating on each tested aspect and how long consumers spent on each aspect (Tobii, 2016). The workings of eye-tracking will be discussed in greater detail in Chapter 3.

2.10.1 Eye-tracking used in studies

Eye-tracking has been used in research in past years, and relevant studies are presented in this section to gain an idea of what the possibilities are for using the technology.

Vischers, Hess and Siegrist (2010) conducted the first study that investigated consumers' visual attention towards the nutritional information table (NIT) on food products by using eye-tracking. Emphasis was placed on the differences between health-motivated consumers and taste-motivated consumers. The attention given to a product's NIT proved to be influenced by the consumers' motivation and the product's design. Two-thirds (66%) of the consumers noticed the NIT; however, noticing the information does not mean that the information is taken into consideration when purchasing. Taste-motivated consumers proved to pay more attention to the other information on the packaging besides nutritional information, while health-motivated consumers paid more attention to the NIT and had deeper information processing. Simply designed products also more easily attracted the respondents' attention to the NIT.

Graham, Robert and Jeffery (2011) found that not only did participants tend to view relatively few label components during a simulated grocery shopping task, they also tended to view components less than what they self-reported doing while actually grocery shopping. Label components at the top of the label were viewed more than those at the bottom, and labels positioned in the centre of the packaging were viewed more than those located on the sides.

An investigation by Peschel and Orquin (2013) into the effect of label size on attention found that it can be explained by an object's signal strength, which is a function of visual acuity loss and distance to the centre. Increased signal strength serves as a proxy for visual attention. When observing a visual scene, the centre will be the focal point of attention. Surrounding objects compete for attention with less signal strength the further they are from the centre. Increasing the size of the object will compensate for the distance to the centre and enhance visual perception. By moving the stimulus closer to the centre, the signal strength will be improved but to a lesser extent than when the size is increased. Being located as close to the centre as possible enhances signal strength but is also dependent on the location and size of other objects in an advertisement. According to Goldberg, Probart and Zak (1999), alignment lines proved to provide more information than anchoring lines for search activities.

Van Herpen and Van Trijp (2011) found that by making use of eye-tracking, although consumers indicated that they most likely used the NIT to make a decision, the tables were unable to enhance healthy choices beyond the level in the control group without labels. Contrary to the NIT, logos (such as a health check) and multiple traffic light (MTL) labels¹ outperformed NITs in stimulating healthy choices. In the study, 50.6% of the consumers exposed to the tested logos made healthy choices and 34.6% of the consumers tested for MTL labels. In a follow-up experiment, it was confirmed that MTL labelling was just as effective as logos in stimulating healthy choices. The study also noted that logos required less attention than MTL labels and NITs in directing choices. Thus, logos do not draw consumers' attention away from other on-pack textual information as in the case of the other labels and allow consumers to pay attention to other information provided on the product.

Graham *et al.* (2012) compiled a literature review of available eye-tracking studies that investigated product labelling information and made research-based recommendations to improve product labelling. The following recommendations were made to assist the consumer in using labels effectively (Graham *et al.*, 2012:381):

- Labels positioned centrally;
- Nutrients positioned according to health relevance;
- Visual clutter surrounding NITs reduced;
- Visual salience of NITs increased (e.g. using contrast and/or orientation);
- Surface size of NITs increased; and
- Simplifying heuristics incorporated.

Ekman (2016) tested in-store advertisements by using eye-tracking technology. The study did not find a strong correlation between time spent looking at an advertisement and liking the advertisement. The opposite was found, with the best recalled advertisement receiving the lowest fixation duration. The results suggested that not only the size of the picture and text but also the number of letters have an effect on the visual attention. Marketers are advised to ensure they know what attracts visual attention before they make decisions regarding in-store displays. In-store advertisements also need to be clear and easily understood within a short amount of time.

Gere *et al.* (2016) used the data collected from a multi-alternative choice task and investigated the relationship between gazing parameters and choice, created a prediction model based on gaze data, and compared 13 statistical models to identify the most applicable one. The results from the models showed a strong relationship between consumers' gazing behaviour and the choices they made. It is suggested that food choices can be accurately predicted by gazing parameters using

¹ A nutritional labelling scheme that makes use of green, orange, and red to indicate the level of different nutritional elements.

decision tree algorithms, if possible, with ID3 models. A workflow was also suggested for similar eye-tracking studies.

The impact of menu label design on visual attention, food choice, and recognition was investigated by Reale and Flint (2016) with the help of eye-tracking technology. These authors manipulated the manner in which different dishes' nutritional values were represented on menus. This was done to enhance visual attention to the most relevant health information. The results suggested that menu labelling is a viable form of presenting nutritional information as long as it is presented in a salient manner. The motives for food choices were not significantly influenced by the design of the menu labels; however, the study indicated that presenting health logos and colours caused participants to be more concerned about their weight and health. If obesity and other illnesses linked to unhealthy consumption are planned to be reduced, colours and health logos on menus can be used to attract consumers' attention.

Rosbergen *et al.* (1997) suggested that consumers can be divided into three segments based on the qualitatively different patterns of visual attention identified in their study. These segments can be described as scanning, initial attention, and sustained attention. Visual attention differences coincided among the segments with regard to involvement, brand attitude, and advertisement recall.

Consumers' perceptions of the healthiness of different fish products and different side dishes were tested with the help of an eye-tracker. The study found that that first fixations were not important variables that could explain the participants' responses. Perceived healthiness was significantly affected by the tested fish products and side dishes, although their interaction was not. The study further suggested that the process of visualised information is better analysed by fixation duration and fixation count, which are better in assisting the determination of consumer engagement and mental processing (Mitterer-Daltoé *et al.*, 2014).

A South African study that investigated the packaging of white maize meal with the help of eye-tracking technology was conducted by Durr *et al.* (2015). The study found that eye-tracking research can be used to enhance product visibility, which will lead to increased sales and brand awareness. The study specifically investigated logos used on the packaging and the colour schemes of these logos. It was suggested that eye-tracking is a more scientific manner of gathering data on preference determination and the recall of brands.

These studies present some of the many ways eye-tracking can be used to investigate consumers' attention. The use of eye-tracking to improve the transfer of product information to consumers was noticed among the studies. Other aspects of products such as the colour, design, and positioning of products and the labelling of products all influence consumers' attention and must be kept in mind in this study.

2.10.2 Eye-tracking studies of meat products

Limited studies have made use of eye-tracking in research on meat or meat products. These studies are presented to enlighten researchers of the possibilities of how eye-tracking can be used in meat research.

Product choice and perception are largely influenced by visual search and attention (Wedel & Pieters, 2008). In terms of food product choices, few studies have incorporated visual search and attention (Bialkova & Van Trijp, 2010; Bialkova & Van Trijp, 2011; Graham *et al.*, 2012; Bialkova *et al.*, 2014). According to Banović, Chrysochou, Grunert, Rosa and Gamito (2016), hardly any studies on meat in general and on red meat specifically with the focus on visual attention and choice of meat have been conducted.

American red meat consumers were investigated with the use of eye-tracking technology to understand the gaps in consumers' knowledge of fresh beef cuts, as well as to determine the redesigning of on-pack information so that information will be shared in the most effective way (Beefretail, 2014). It was found that red meat consumers are wary of buying unfamiliar cuts of beef in fear of preparing it poorly. Recommendations from the study included that the best method of preparation, such as "best when grilled", should be included on the pack to promote the sale of unfamiliar cuts. Furthermore, consumers can be supplied with an on-pack recipe to assist them with preparing the specific cut of meat in an appropriate manner. This on-pack recipe or preparation sticker will draw further attention if it contains a photograph of the prepared meat. To assist consumers in understanding the different beef cuts, it is recommended that the common names of the cuts are used consistently (Beefretail, 2014).

Eye-tracking was used to determine the most effective elements that should be used in the labelling of pork meat (Cloud, 2013). The research identified images and messages that showed the best fit with consumers' needs and wants, causing them to buy the pork. Variables that were tested included taglines (brand taglines vs. call-to-action taglines), people images (people vs. no people), and meat images (whole cut vs. dish ingredients). It was found that, in general, consumers preferred images of whole cuts of pork, which attracted consumers' attention faster and proved to communicate meat types more effectively than dish images. It was also found that customers preferred labels that did not contain pictures of people. Labels without images of people ensured that the meat received attention much sooner. Taking into account the short amount of gaze time meat labels receive in a store, putting people in the picture may result in no attention being paid to the image of the meat. Lastly, call-to action taglines fared better than brand taglines (Cloud, 2013).

A Portuguese study by Banović *et al.* (2016) investigated the effect of fat content on visual attention and choice of meat, as well as the differences across genders. The study found that fat content (fat marbling, fat rim, and their combination) had an influence on consumers' visual attention and choice of red meat products. The more attention consumers pay to fat content, the more often they choose

meat products with lower fat content. Female consumers paid more attention to red meat products with lower fat content, more often chose these products, and did so in a smaller amount of time. The study found that low fat content is more important to female consumers than their male counterparts. Male consumers placed more emphasis on marbling as a decisive criterion than fat rim Banović *et al.* (2016).

Oliveira *et al.* (2016) used eye-tracking technology to investigate consumers' attention to functional food labels. In this study, only labels were shown to consumers and changes were made with regard to aspects such as product description and background of the label. According to the results, functional food labels provide information that is important for differentiating functional food from conventional food. The study suggested that consumers may not go into the detail of the functional aspects of the products, such as nutritional information and health claims. It was noted that in real-life settings, consumers' attention to these aspects may even be lower than in the study. As information density increased, consumers' interest in a specific area of interest (AOI) decreased. It is suggested that health claims should be written as concisely as possible to ensure that consumers fully process them (Oliveira *et al.*, 2016).

Another eye-tracking study showed that consumers who engaged with available information in the least detailed manner showed a lower descriptive ability (Antúnez, Ares, Giménez & Jaeger, 2016). Consumers with a higher level of label-claim understanding showed longer fixations on label claims. Consumers who understood the claims made by a label therefore looked at the label for longer. It could be argued that a greater understanding of these claims motivates consumers to look at labels longer while making purchasing decisions. Consumers who understood the labels to a greater degree had a higher level of trust and liking of the tested product but did not show purchase intention significantly different from consumers who had a lower understanding of labels. Higher levels of understanding sustainability- and process-related labels positively influenced purchasing decisions toward sustainable products. The issue of self-reported studies and consumers who are likely to give the "right" or "desirable" answers instead of stating how they truly feel was also mentioned (Samant & Seo, 2016).

From the studies reviewed, it was noticed that limited research has been conducted where consumers' attention to red meat products has been investigated. Available studies have focused on aspects such as price label information and additional labels such as NIT. A gap is still noticeable in terms of investigating consumers' attention to physical aspects of red meat. Limited research has also been conducted on quality indicator labelling placed on red meat. This, while a trend, has been noticed among consumers in terms of the importance of these types of labelling claims.

2.11 CONCLUSION

By reviewing available literature, it became clear that consumers are exposed to more advertisements of products than they can process. This emphasises the importance of drawing consumers' attention to a specific product to ensure the success of the product. Changing consumer trends show that meat is seen as an appropriate protein. Increases in the consumption of red meat products in South Africa are predicted for the years to come, allowing suppliers the opportunity to grow. The Banting diet serves as an appropriate example of where consumption changes, in favour of meat products, are seen not only among the wealthier but also the middle- and lower-income groups. Apart from an increase in red meat consumption, other food trends such as healthier and more convenient, were also identified and attention must also be paid to these aspects.

Furthermore, product differentiation and the forms of differentiation were discussed along with product packaging, branding, and labelling. From related consumer studies, it appears that the low-income group in South Africa focuses more on the price of red meat, while middle-income groups focus most of their attention on the expiry date, and the high-income groups are more concerned with food safety. Traceability was identified as one manner that can provide consumers with food safety and quality information.

Lastly, the chapter examined previous research that utilised eye-tracking to identify how consumers' attention can be better drawn to different aspects of a product. Some of these results suggested that labels should be placed centrally on the package/product. Nutrients should be positioned according to health relevance. Visual clutter surrounding NITs should be reduced, and the visual salience of NITs should be increased (e.g. using contrast and/or orientation). The surface size of NITs should be increased to increase attention. The use of logos and MTL labels can assist consumers in making healthier food product choices more effectively and in a shorter time than NITs. Packaging results suggest that consumers prefer pictures of whole cuts of meat instead of dished-up meat, and product labels should not contain images of people since this leads to meat only receiving attention later than on labels not containing images of people.

It is evident from the literature that consumers' attention patterns must be investigated to ensure the successful marketing of a product. An appropriate technology that can be used for this purpose is eye-tracking.

Providing red meat products according to consumers' preferences is of critical importance since the power in the value chain now lies with the demand side of the market and because the demands and needs of beef consumers have changed. It can be noted that traditional forms of research such as self-reporting techniques (questionnaires) provide the opportunity for consumers to report a "desirable" answer that they think is correct, whereas eye-tracking does not provide this opportunity. No available literature was found of cases where red meat products were tested under South

African conditions using eye-tracking. This is worrisome and indicates the need for an eye-tracking study that investigates the attention behaviour of red meat consumers. Such a study will allow producers to provide consumers with a product that contains the correct aspects that consumers are really paying attention to and not just saying they are paying attention to. This will allow retailers to be informed of the preferences that their red meat consumers have and they will then be able to ensure that their products comply with their consumers' preferences, which were correctly identified with the assistance of eye-tracking.

3.1 INTRODUCTION

This chapter presents the study area, discusses the process of eye-tracking and the process of data collection, as well as the processing of the collected data to answer the research questions.

3.2 STUDY AREA

The study area for this research was the Mangaung Metropolitan Municipality, which is situated in the Free State province of South Africa. The majority of the population in the area resides in Bloemfontein, Botshabelo, and Thaba Nchu. Figure 3.1 shows the locations of these areas, with Bloemfontein situated more to the centre of the metropolitan while Botshabelo and Thaba Nchu are situated more to the east of the metropolitan. Mangaung is the smallest metropolitan municipality in South Africa, with a population of 747 431 people (Stats SA, 2011). Apart from the size of the population, Table 3.1 also shows other statistics for the metropolitan. The majority of the population is black (83.3%), with Sesotho being the home/first language of the largest share (51.9%) of the population. According to statistics, 11.4% of the households in the municipality have no average monthly household income, and the largest income quintile that represents 20.2% of the population is R19 601 to R38 200. The metropolitan houses slightly more women (51.5%) than men (48.5%), and the largest educational group of the population is the group with some primary education (37.7%).

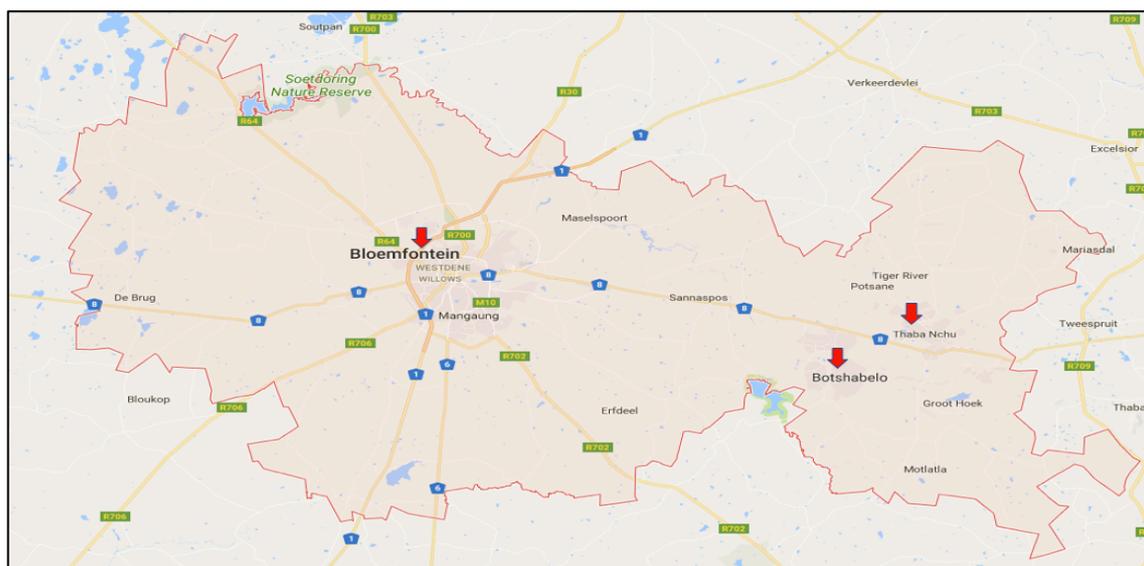


Figure 3.1: Mangaung Metropolitan Municipality

Source: Google Maps (2017)

Table 3.Error! Bookmark not defined.: **Population statistics for Mangaung Metropolitan Municipality as per Census 2011**

Language	Percentage	Average monthly household income	Percentage
Afrikaans	15.8%	No income	11.4%
English	4.2%	R1 – R4 800	4.6%
IsiNdebele	0.4%	R4 801 – R9 600	6.8%
IsiXhosa	9.6%	R9 601 – R19 600	17.2%
IsiZulu	0.9%	R19 601 – R38 200	20.2%
Sepedi	0.3%	R38 201 – R76 400	14.1%
Sesotho	51.9%	R76 401 – R153 800	10.3%
Setswana	12.3%	R153 801 – R307 600	8%
Sign language	1.1%	R307 601 – R614 400	5%
SiSwati	0%	R614 001 – R1 228 800	1.6%
Tshivenda	0.1%	R1 228 801 – R2 457 600	0.4%
Xitsonga	0.1%	R2 457 601+	0.4%
Other	0.60%		
Gender	Percentage	Level of education	Percentage
Female	51.5%	No schooling	3.3%
Male	48.5%	Some primary	37.7%
Race	Percentage	Completed primary	5.4%
Black African	83.3%	Some secondary	30.6%
Coloured	5%	Completed secondary	16.5%
Indian/Asian	0.4%	Higher education	3.7%
White	11%	Not applicable	2.7%
Other	0.3%		

Source: Stats SA (2011)

In order to test various red meat consumers across the metropolitan, the locations that were identified for data collection had to represent the various types of red meat retailers found in the metropolitan. The chosen location had to represent butcheries, supermarkets that sold red meat, as well as wholesalers of red meat. Besides representing red meat retailers, the test locations also had to be representative of all the consumers in the metropolitan, thus they had to represent consumers of all age groups, different levels of education, different races, different income groups, and from both genders. For this, various shops, malls, and butcheries were used as locations to collect data during the field survey. The locations used for data collection, as well as the shops and butcheries nearby where participants could buy their red meat products, are presented next.

Thaba Nchu

- Shoprite shopping complex – Shoprite, Sky Country Butchery, and Cambridge Food. This location was used due to its central location in the Thaba Nchu area and the number of red meat retailers found in close proximity of the test location.

Botshabelo

- Botshabelo Mall – Shoprite, Pick n Pay, and Roots Butchery. It was decided to test consumers at this location due to the number of red meat retailers found in close proximity.
- Shoprite Centre – Shoprite and Cambridge Foods. This location is centrally located in Botshabelo.

Bloemfontein

- Twin City Mall, Heidedal – Roots Butchery, Boxer, and Shoprite. This location was used to test consumers situated in the eastern part of Bloemfontein as they came to buy red meat from the different outlets.
- Southern Centre, Fichardt Park, and Pick n Pay Hyper. This centre was used to collect data from consumers residing in the south of Bloemfontein.
- Preller Square, Preller Woolworths, and Kwik Spar.
- Dave's Meat Market, General De Wet. This location was used to test consumers buying red meat directly from a butchery.
- Van Vuurens Wors, Westdene. Was used to test consumers buying red meat directly from a butchery.
- OK Grocer, Oranjesig. This venue is situated close to the Central University of Technology.

Using these locations to collect data ensured that meat-purchasing participants could be tested and that the required number of participants could be tested. The spread of visited locations also ensured that representatives from the whole metropolitan could be tested. This led to consumers from all income levels, ages, and different races being tested. To ensure representativeness among consumers, more consumers were tested per test location in the Thaba Nchu and Botshabelo area where fewer test locations were used, while fewer consumers per test location in Bloemfontein were tested.

3.3 THE USE OF EYE-TRACKING IN RESEACH

The foundation of research is not a new concept; however, advancements in technology have made a wider range of studies possible (Smith & Albaum, 2012). One such technology is eye-tracking. Eye-tracking can be used to quantify an observer's overt visual attention and to evaluate and compare visual search patterns of individuals in an array of situations (Tonkin *et al.*, 2011).

An eye-tracker is a piece of hardware used to measure the movement of eyes. Early forms of this technology were intrusive to users, for example the scleral contact lens. This lens had to be placed directly on the eye of the person tested (Duchowski, 2007). Non-intrusive techniques that were developed later and are still used include head-mounted and table-mounted systems. Video-based eye-trackers are far less intrusive and detect eye movements by measuring the point of regard (Duchowski, 2007). This can be done in one of two ways, namely the head must remain stationary so that the point of regard and the eye's position relative to the head are identical, or head

movement must be disambiguated from eye rotation by measuring a number of ocular features, for example corneal reflection and the pupil centre (Duchowski, 2007).

When using corneal reflection, light sources, for example infrared, are shone into an individual's eyes. The technology behind the infrared eye-trackers is based on the fact that an infrared light-emitting diode (LED) that is shone on the human eye causes a reflection spot that remains static regardless of the direction in which the eye is looking (Drewes & Schmidt, 2007). Specifically, light falling on the curved cornea is reflected back, creating the four Purkinje images, the first of which is tracked by video-based eye-trackers (Duchowski, 2007).

To gain insight into the overt location of visual attention, three types of eye movements are needed, namely fixations, smooth pursuits, and saccades (Duchowski, 2007). During fixations, the eye is held relatively still (Rayner, 1998) in order to perceive or “see” an object of interest. These periods of relative stillness typically last between 200 and 300 milliseconds (Rayner, 1998). However, it is impossible for the human eye to be held exactly still and even during fixations they are subject to small fixational movements, such as tremor, drift, and micro-saccades (Martinez-Conde & Macknik, 2008).

Saccades are the movements between desired fixation locations or ballistic movements used to position the eye over an object of interest (Gregory, 1966). Visual sensitivity is reduced during saccades (Rayner, 1998).

Smooth pursuits are the movements involved when visually tracking a moving target (Carpenter, 1977; Gregory, 1990; Leigh & Zee, 1991). Eye-tracking can be used in different ways, as seen from the previous types of eye movements, to understand consumers' actions and preferences when buying a product (Duchowski, 2007).

Apart from saccades and fixation, the human eye is also capable of pursuit, vergence, and vestibular movements (Rayner, 1998). These fixational movements are not relevant to this study. The alternating saccades and fixations allow a scan path to be constructed, showing the movement of the eye over a certain scene and where the eye was held still in order to see the object of interest (Rayner, 1998).

In order to closely process a specific object or location in a visual marketing stimulus, consumers have to move their eyes. When attention is focused on a particular location or object in a scene, the processing of non-selected locations and objects is suppressed, and the processing of the selected location is simultaneously enhanced (saliency) (Treisman, 1986; Durr *et al.*, 2015). An object “pops out” and is found instantaneously on the first eye fixation, based on pre-attentive processes, when it stands out in the scene because of a single perceptual feature, such as the way the brand stands out among homogeneously competing brands on the shelf. Colour, edges,

luminance, shapes, and sizes of objects in a scene are all included in these basic perceptual features (Treisman, 1986; Durr *et al.*, 2015). The essence of eye-tracking is accurately captured in the following quote: “The eyes don’t lie. If you want to know what people are paying attention to, follow what they are looking at” (Unknown, cited by Durr *et al.*, 2015).

To collect the data, a Tobii TX300 eye-tracker was used. This eye tracker is able to capture data at a rate of 300 hertz. The Tobii TX300 is a table-mounted, corneal reflection eye-tracker and may be seen as a normal monitor screen to participants (Duchowski, 2007). During the test, the participants were shown a series of beef and mutton images, including rump and T-bone steaks, mutton/lamb chops, quarter lamb, minced beef, and beef sausage (*boerewors*). The images were shown to the participants for a period of five seconds each and were counter-balanced (shown randomly) to prevent bias among the participants. These packs of meat shown on the images differed according to the variations summarised in Table 3.2.

Table 3.1: Different aspects shown on the images

Image aspect	Variation
Meat aspects	
Colour	Bright (cherry) red, dark red, and brownish
Fat on cuts	Very little, medium, and large amounts
Intramuscular fat (marbling)	No visible marbling vs. visible marbling
Meat packaging and price label information	
Packaging	Vacuum-packed vs. polystyrene plate vacuum-packed
Classification (Class)	Class A, B, and C for age, along with 0-6 for fat
Price per kg	Different prices per kg, along with the Class used on pack
Price per pack	Differed along with price per kg
Weight of the pack	Different pack weights were shown on the price label
Freshness indicators	Packaging date and sell-by date
Quality indicator labelling	
Nutritional information	NIT vs MTL label
Brand of meat	Different brands of meat such as Sparta
Breed of animal	Different breeds such as Angus
After-slaughter practices	“Top quality guaranteed”, “Aged” beef labelling, etc.
Traceability measures	“Proudly made in SA”, origin verification, etc.
Production practices	“Grass fed”, “100% organic”, etc.

The meat products that were shown in the test were manipulated test aspects that were tested in other studies, such as the colour of the meat and the amount of fat. Also, the labelling aspects that appear on most meat labels (price per kg, price per pack, packaging date, and sell-by date) were tested along with aspects such as the class of meat, which is not generally indicated on the labelling

of meat. To test consumers' awareness of quality indicators, different variations of existing quality indicators registered at the SAMIC were used or similar examples were created for the study.

After completion of the eye-tracking test, Tobii Studio® software was used for the visualisation of data. Gaze plots and heat maps are the two types of visualisation results from an eye-tracking test and were used for this study (Tobii, 2010).

The scan paths of participants are visually represented by a gaze plot, which is the sequence of aspects on an image that received attention from participants. Each circle on a gaze plot represents a fixation of the participant's eye, while the line between the circles represents saccades (note that saccades are drawn as straight lines even though they are not) (Tobii, 2016). The fixation sequence for every participant is shown on the gaze plot. Heat maps are colour overlays that aggregate gaze data over a stimulus. Warmer (redder) colours indicate higher numbers of fixations or areas that received longer periods of gaze (Tobii, 2010). These areas can also be defined as areas of interest (AOIs). An AOI is a polygon that is drawn around an area of the stimulus (image), which is deemed of importance or that should be seen as being important to the viewer. Once AOIs have been drawn, metrics can be extracted for each AOI and each stimulus in Tobii Studio®. These metrics centre on fixations and observations (Tobii, 2016). As previously mentioned, a fixation is any period of time that the eye is held relatively still, while an observation is the total time the eye gaze remains within the confines of an AOI and can comprise a number of fixations (Tobii, 2016). Observations are also referred to as visits. Metrics, which can be extracted and analysed, include, but are not limited to, the following (Tobii, 2016):

- Time to first fixation: "The time from the start of the stimulus display until the test participant fixates on the AOI or AOI group for the first time."
- Fixations before: "Number of times the participant fixates on the media before fixating on an AOI or AOI group for the first time."
- First fixation duration: "Duration of the first fixation on an AOI or an AOI group."
- Fixation duration: "Duration of each individual fixation within an AOI, or within all AOIs belonging to an AOI group."
- Total fixation duration: "Duration of all fixations within an AOI, or within all AOIs belonging to an AOI group."
- Fixation count: "Number of times the participant fixates on an AOI or an AOI group."
- Visit duration: "Duration of each individual visit within an AOI or an AOI group."
- Total visit duration: "Duration of all visits within an AOI or an AOI group."
- Visit count: "Number of visits within an AOI or AOI group."
- Percentage fixated: "Percentage of participants that fixated at least once within an AOI or AOI group."

Besides this information, the software is able to calculate the sum, mean, average, minimum, and maximum for these metrics. These data were processed by the Tobii® software to determine which factors attracted and maintained consumers' attention when shown pictures of packs of red meat. By using measures such as the time to first fixation, it is possible to determine which aspects of the tested image, in a general sense, enjoyed attention first, second, and third from red meat consumers.

3.4 DATA COLLECTION

The eye-tracking device was transported and set up at the identified test locations throughout the Mogaung Metropolitan Municipality. To avoid unnecessary distractions, the eye-tracking device was placed in vacant shops in the shopping centres and malls where consumers were tested. A canvass tent was used as shelter at locations where no other venue was available. The process of data collection took place between 22 May and 1 July 2017.

A convenience sampling technique was used as a method of data collection, where a form of interceptive survey was used to sample 350 red meat consumers. This number was set as the target due to the availability of time provided and funding available for the study. Interceptive surveys are a form of convenience sampling that can be used in a mall scenario (Battaglia, 2011). Participants were approached as they moved past the eye-tracking station. Only individuals who indicated that they bought red meat products were tested. The respondents were first asked to participate in the eye-tracking tests where they had to look at the different packs of red meat that were shown to them. Each participant was calibrated on the device before the eye-tracking test commenced. During the process of calibration, the characteristics of the consumers' eyes are measured and used along with an internal, physiological 3D eye model to calculate gaze data (Tobii, 2010). The participants were asked to look at a specific point (a calibration dot) on the screen during calibration. The results from the calibration are shown in the form of green lines of varying lengths to indicate the quality of the calibration. Longer green lines of offsets could be caused by various factors, such as the participant getting distracted during calibration (Tobii, 2010).

After completion of the eye-tracking survey, the participants were asked to complete a post-test questionnaire². This post-test questionnaire contained questions regarding the monthly household income of the participants, their monthly food budget, how often their households ate red meat, their cut preferences, and other related open-ended questions. Questions from the post-test questionnaire also focused on which aspect of the images could be recalled after the test; for example, which brands of beef were shown in the test. The participants took between 10 and 15 minutes each to complete the process. The data collected from the eye-tracker and post-test questionnaire were used in a mixed-methods methodology to provide both qualitative and quantitative results.

² See Appendix A.

The data from the post-test questionnaire were used to determine the red meat aspects that consumers reported as being important when buying red meat products. These aspects were then ranked to determine the importance of each among consumers in terms of what they indicated was important to them. To rank the aspects, Kendall's *W* test was used, which is discussed in more detail in Section 3.6.

These ranks identified from the self-reported data were then compared against ranks for the same aspects identified from the eye-tracking data. Eye-tracking data, which allow deeper insight into the visual activity of consumers, were used to determine whether consumers paid attention to the tested aspects and which percentage of the consumers paid attention to each aspect. These aspects were also analysed in a similar manner as the questionnaire aspects to determine whether consumers' actions (eye-tracking results) reflected what they reported to be paying attention to in red meat products.

3.5 SAMPLE SIZE

Cochran (1997) developed two formulas to calculate appropriate sample sizes for surveys. The one is for categorical data and the other is for continuous data. Continuous data need a smaller sample size than categorical data (Bartlett, Kotrlik & Higgins, 2001).

This study's questionnaire collected both continuous and categorical data. To ensure that the sample size was sufficient, the calculation for categorical data was used to calculate sample size. This formula can be expressed as:

$$N_0 = (t)^2 * (p)(q) / (d)^2 \quad (3.1)$$

Where:

N_0 = sample size (participants)

t = value of the selected alpha level (indicates the level of risk the researcher is willing to take so that the true margin of error may exceed the acceptable margin of error)

$(p)(q)$ = estimate of variance = 0.25 (maximum possible proportion (0.5)*1-maximum possible proportion (.5) produces maximum possible sample size)

d = acceptable margin of error for proportion being estimated = .05 (error the researcher is willing to take) (Cochran, 1977; Bartlett *et al.*, 2001).

If this calculation is applied to the study, and an alpha level of 1.65 (0.10), estimated variance of 0.5, and an error level of .05 are used, the formula to calculate a sample size of 272 respondents would be as follows:

$$N_0 = (1.65)^2 * (0.5)(0.5) / (.05)^2 = 272 \quad (3.2)$$

Note that if the sample size exceeds 5% of the population, the correctional formula of Cochran (1977), expressed as Equation 3.3, should be used to calculate the final sample size (Bartlett *et al.*, 2001):

$$N_1 = N_0 / (1 + N_0 / \text{population}) \quad (3.3)$$

Where :

N_0 = sample size

N_1 = final sample size

According to census data, 747 431 people reside in the Mangaung Metropolitan Municipality (Stats SA, 2011). Thus, 5% of this value is 37 372. It was therefore not necessary to use the correctional formula and a sample size of 272 should be sufficient for this study. By collecting data among 350 consumers, a representative study was ensured.

3.6 KENDALL'S COEFFICIENT OF CONCORDANCE

One of the sub-objectives of this study is to rank red meat consumers' preferences identified in the eye-tracking test and from the post-test questionnaire and compare the two sets of ranks to determine whether the red meat preferences that consumers rated as most important to them when selecting red meat products also enjoyed the highest share (fixation percentage) of attention when consumers were shown packs of red meat.

Kendall's W test was used to identify and rank consumers' preferences from both the eye-tracking and post-test questionnaire (Anang, Mensah & Asamoah, 2013). Kendall's W test is a nonparametric mathematical technique used in this research to categorise a set of red meat aspect preferences from the most important to the least important. Kendall's W is preferable to apply for ranking due to its statistical nature used to measure the ordinal association (the relationship between rankings) of different ordinal sets of red meat aspects or different rankings of the same variable, where a ranking is the assignment of the ordering label first, second, and so on, to different observations. In this case, the aspects of red meat products and the relationship between them was tested. Besides ranking the preferences, the test is also a measure of agreement between consumers regarding their preferences. Abdi (2007) highlighted the importance of Kendall's W for evaluating the degree of similarity between two sets of ranks given to a same set of objects. Preferences were assigned values from 1 (not important) to 5 (very important) in the case of the post-test questionnaire data. Individual preference scores were calculated and preferences with the highest scores were ranked as most important and the lowest-scoring preference placed as least important.

In the eye-tracking data, a rating system of 1 to 5 was used to rate the degree to which consumers paid attention to the tested red meat aspects. Similar to the questionnaire ranking, the highest-

scoring aspects would be ranked as the aspect that enjoyed the largest amount of attention from consumers and seen as the most important preference when consumers looked at the packs of red meat.

To compute Kendall's W , the total rank score was calculated and used to estimate the degree of agreement between respondents in the ranking. The equation for Kendall's coefficient of concordance can be expressed as (Edwards, 1964; Anang *et al.*, 2013):

$$W = \frac{12 [\sum P^2 - (\sum P)^2 / y]}{yx^2(y^2 - 1)} \quad (3.4)$$

Where:

- W = Kendall's coefficient of concordance
- P = sum of ranks for preferences being ranked
- x = total number of respondents
- y = total number of preferences being ranked

The coefficient of concordance (W) was tested for significance in terms of the F-distribution. The F-distribution, according to Anang *et al.* (2013), is represented as:

$$F = [(x - 1)W / (1 - W)] \quad (3.5)$$

Where the numerator degrees of freedom are given as:

$$(y - 1) - (2/x) \quad (3.6)$$

The denominator degrees of freedom are given in a similar manner as:

$$x - 1 [(y - 1) - 2/x] \quad (3.7)$$

Once these ranks were determined for both the questionnaire data and the eye-tracking data, the rankings could be compared against one another to determine where the actions of consumers did not agree with their words.

3.7 SUMMARY

Data for this study were collected from 350 red meat consumers in the Mangaung Metropolitan Municipality. To ensure that a representative data sample could be obtained, eight locations spread across the metropolitan were used as test locations. An eye-tracker was used to collect data from these consumers by showing them a series of red meat images in the eye-tracker test. Different cuts of red meat were shown to the participants and the aspects of the meat, packaging, price label, and quality indicator labels were changed between images to test consumers' attention to them.

These images were shown randomly to prevent bias in the collected data. The results obtained from the eye-tracker test included heat maps, gaze plots, and data metrics that can be used to determine which aspects of the test images enjoyed attention from consumers and how long these aspects were able to maintain consumers' attention. To determine the composition of the sample of consumers, a post-test questionnaire was used to collect relevant information from the tested consumers. Kendall's W test was used to compare the aspects which consumers ranked as important to the aspects they paid attention to during the eye-tracking test. By following this procedure, it was possible to determine whether the aspects that consumers ranked as most important also enjoyed the highest level of attention in the eye-tracking test. The results from the study are presented in Chapter 4.

4.1 INTRODUCTION

The aim of this study was to use eye-tracking technology to analyse and determine red meat consumers' preferences in the Mangaung Metropolitan Municipality of South Africa. This chapter presents the results of the study. First, the descriptive statistics of the sampled population are shown, after which findings from the data captured in the questionnaires and the results of the eye-tracking test are presented. This is followed by the differences identified between the eye-tracking and questionnaire results. Lastly, some special cases are presented where instead of using data metrics, heat maps of the images are used. The results from the questionnaires show red meat consumers' preferences according to what they self-reported as important, while eye-tracking data show the aspects that actually received attention from consumers.

4.2 DESCRIPTIVE STATISTICS

Data were collected from 350 participants at eight locations stationed across the Mangaung Metropolitan Municipality (see Figure 3.1). Some respondents did not complete the questionnaire and were unwilling to answer questions such as average household income and budget for meat. This could be due to shyness from the respondents on these issues. These respondents (43) were removed from the data to ensure that the data could be analysed accurately. A complete dataset for 307 respondents was extracted and was used to generate the results for this study.

Table 4.1 shows the demographic information of the respondents. The majority of the respondents were men (66.1%). The largest age groups that were tested were 18 to 30 (29.6%), 31 to 40 (27.4%), and 41 to 50 (20.5%). More than half of the respondents (51.1%) completed Grade 12, while 41.7% had at least a degree or diploma. The race demographics seem to correlate with available information of the municipality (Stats SA, 2011). The largest share of the participants (81.4%) were black (vs. 83.3% in the metropolitan), 14.7% were white (vs. 11% in the metropolitan), and 3.6% were coloured (vs. 5% in the metropolitan). Household income data show that the largest share (45.3%) of the participants fell in the marginalised or lower-income³ (LSM 1-4) consumer groups, middle-class consumers (LSM 5-7) represented 35.8% of respondents, and the wealthy class (LSM 8-10) represented 18.9% of the respondents.

³ While LSM is not only determined by household income, household income was used as the determinant of LSM category in this study.

Table 4.1: Demographic statistics of the respondents

Aspect	Option	Number	Percentage
Gender	Male	203	66.1%
	Female	104	33.9%
Age (years)	18-30	91	29.6%
	31-40	84	27.4%
	41-50	63	20.5%
	51-60	47	15.3%
	61-70	20	6.5%
	71-80	2	0.7%
Education	Primary (Grade 1 to 7)	22	7.2%
	Secondary (Grade 8-12)	157	51.1%
	Tertiary (degree or diploma)	128	41.7%
Race	Black	250	81.4%
	White	45	14.7%
	Coloured	11	3.6%
	Asian	1	0.3%
Income of household	LSM 1	67	21.8%
	LSM 2	26	8.5%
	LSM 3	29	9.4%
	LSM 4	17	5.5%
	LSM 5	39	12.7%
	LSM 6	42	13.7%
	LSM 7	29	9.4%
	LSM 8	15	4.9%
	LSM 9	25	8.1%
	LSM 10	18	5.9%

Information regarding household sizes and red meat budget obtained from the participants is shown in Table 4.2. The average size of households that participated in the study was 3.6 people, the largest household size was 10 people, and the households that were tested jointly represented 1 114 people. The combined monthly budget for meat purchases was R284 515. Average monthly meat budgets per household proved to be R926.80, with the minimum budget for meat purchases R40 and the maximum budget R10 000. This highlights the diversity in income levels that is experienced among consumers in the metropolitan. Besides the monthly budgets for meat, the questionnaire also asked for the monthly budget for beef and mutton/lamb. The maximum monthly budget for beef was R3 000, with the average among participants determined at R378.90. The maximum monthly budget for mutton/lamb meat was R2 500, with the average budget calculated at R314. Some participants indicated that they only bought either beef or mutton/lamb products and this led to minimum budgets of zero. Many participants also indicated that they did not buy mutton/lamb products often due to the higher price. This could also be part of the reason why the average budget of sheep meat is less than for beef. This suggests that consumers are in favour of buying red meat but are price sensitive and would more frequently buy a cheaper alternative red meat if it is available. It was interesting to see that the expenditure on beef and mutton represented just more than 65% of the total meat budget of the participating households.

This shows red meat consumers' openness to red meat products in the Mangaung metropolitan and could serve as a key success factor for red meat producers and retailers in the area.

Table 4.2: Participant household size and meat budget information

Variable	Sum	Minimum	Maximum	Average	Median
Size of household	1 114	1	10	3.6	4.0
What is your household's monthly budget for meat?	R284 515	R40	R10 000	R926.8	R650
What amount of your household's monthly budget is spent on beef?	R109 115	R0	R3000	R378.9	R250
What amount of your household's monthly budget is spent on mutton/lamb?	R75 999	R0	R2500	R314	R200

Meat consumption patterns are shown in Figure 4.1. These patterns show that just more than one-third (36%) of the participants indicated that they ate red meat at least once per day. Only 4% of the participants ate red meat three times a day, 10% ate red meat twice a day, and 22% ate some form of red meat once a day. During the interviews, some participants indicated that they only ate red meat over weekends and this was seen in the large percentage (40%) of participants who ate red meat less than 10 times per month. Equal to the percentage of participants (22%) who ate red meat once a day, other participants ate red meat less than five times a month. This difference seen in the consumption pattern of participants can also be part of the difference seen in household income levels.

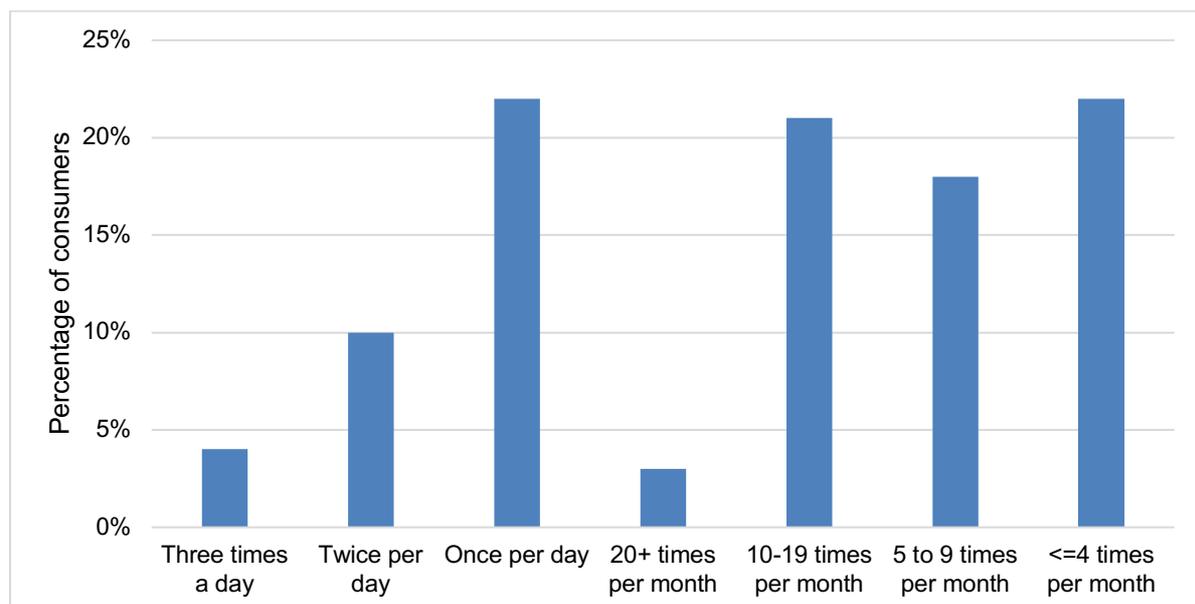


Figure 4.1: Meat consumption patterns of participants

The majority of the participants (65.5%) indicated that they preferred to buy their meat from butcheries (see Figure 4.2), while 28% of the participants indicated that they preferred to purchase their red meat from supermarkets. A small percentage (4.1%) of the tested sample indicated that they preferred to buy from wholesalers. Only one participant (0.33%) preferred to buy red meat from convenience stores,

while 0.76% of the participants bought their red meat directly from farmers. Just more than one percent (1.1%) of the tested participants indicated that they slaughtered their own animals for meat. The participants were asked to rank the different locations of buying red meat according to a scale: 1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = very often. Butcheries received an average score of 3.9, which was the highest, while supermarkets scored an average of 2.7.

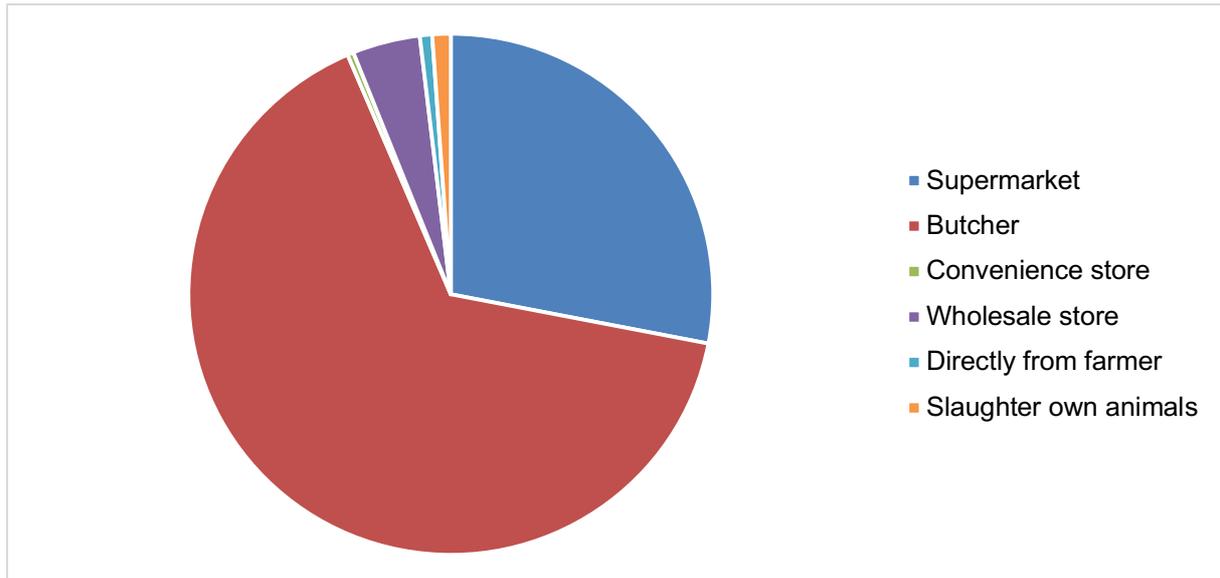


Figure 4.2: Preferred location to purchase red meat

The participants' behavioural investigation results are shown in Figure 4.3, where the average number of visits to the different meat retailers per month to buy meat is shown. Supermarkets had the highest visit rate with an average of 2.6 visits per month, convenience stores received 2.4 visits per month, and butcheries 2.2 visits per month. Wholesale stores and sales directly from farmers had the lowest visit rate. This can be explained by larger volumes of meat sold to the customer per visit, lowering the need to visit often for purchases. When the data from Figure 4.3 are compared to the data in Figure 4.2, it is clear that the majority of the participants preferred to buy their red meat from butcheries (65.5%), while supermarkets and convenience stores were only the preferred choice for red meat purchases of respectively 28% and 0.4% of the participants. The results would suggest that while most consumers preferred to buy their red meat from butcheries, they visit them less often for purchases. When visiting butcheries, bulk purchases may also be made to prevent more regular trips to butcheries. One could also argue that supermarkets are visited more regularly for general grocery purchases, which allows for more convenient purchases of red meat. While a very small number of participants preferred to buy their red meat from convenience stores, the high visit rate could be explained by the need for red meat occurring outside the business hours of the other meat-selling outlets.

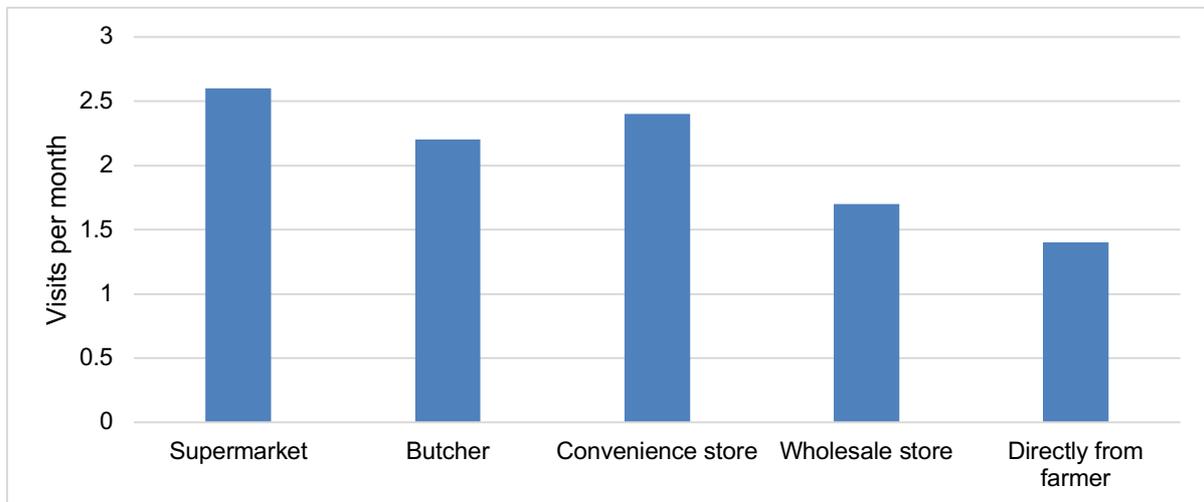


Figure 4.3: Number of times retailers are visited to buy red meat

Information on cuts bought by the participants is shown in Figure 4.4. According to the figure, beef sausage (*boerewors*) was the most commonly bought beef product with 57.1% of the participants indicating that they bought it most often. Steak cuts of beef were the second most common (56.3%) beef product bought, and minced beef the third most common (49.3%). While some participants indicated that they bought certain types of steak, the numbers were so low that individual types are not shown separately. In the lower-income areas, the participants indicated that they bought steaks but with further questioning said that it was not the types of steak one is familiar with in higher-income areas. These participants reported cuts such as chuck steak, whereas in the middle- and higher-income areas the participants more often reported buying rump or sirloin steak. The distribution in income levels can be noticed within the cuts bought by the participants, besides the more expensive beef products such as steak and biltong (0.7%). The participants also bought cheaper cuts such as liver (5.6%), tripe (2.4%), and bones (0.7%).

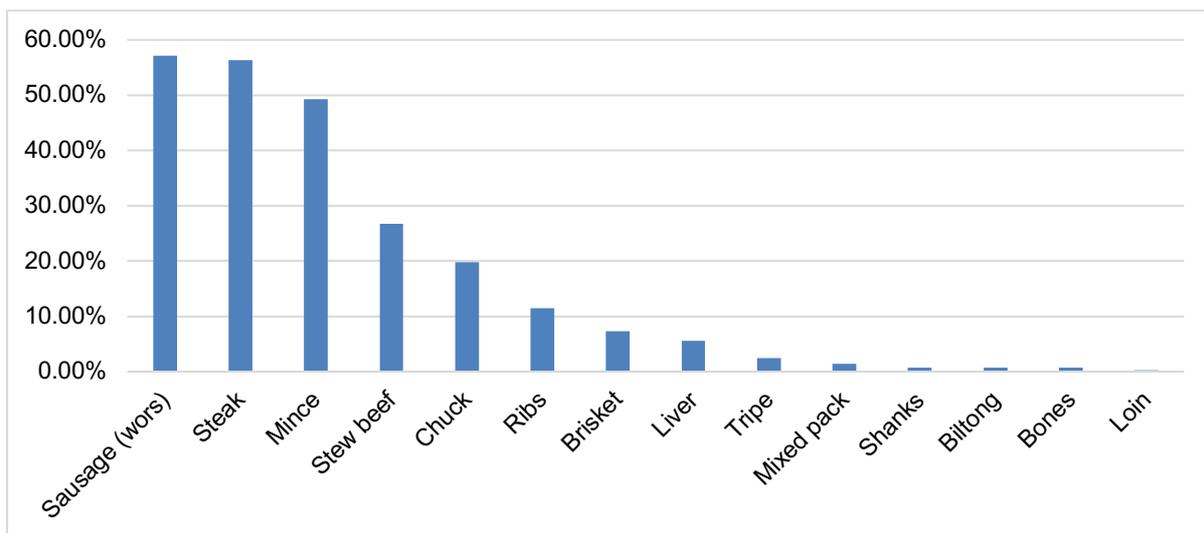


Figure 4.4: Beef cuts most often bought by participants

Data on mutton or lamb cuts, as shown in Figure 4.5, indicate that chops were the preferred cut of sheep meat at 67.4%. The second most often bought mutton cut was shoulder (14.9%), and the third most often bought cut was ribs (13.2%). Similar to steak, no differentiation was made for different types of chops. The interviews with the participants suggested that a “steak” and “chop” in their terms of reference referred to any slice of meat thick enough to barbeque. The income distribution can also be seen in the mutton/lamb purchases, with some participants buying tripe (5.4%) and others buying half and whole sheep (6.2%) at a time.

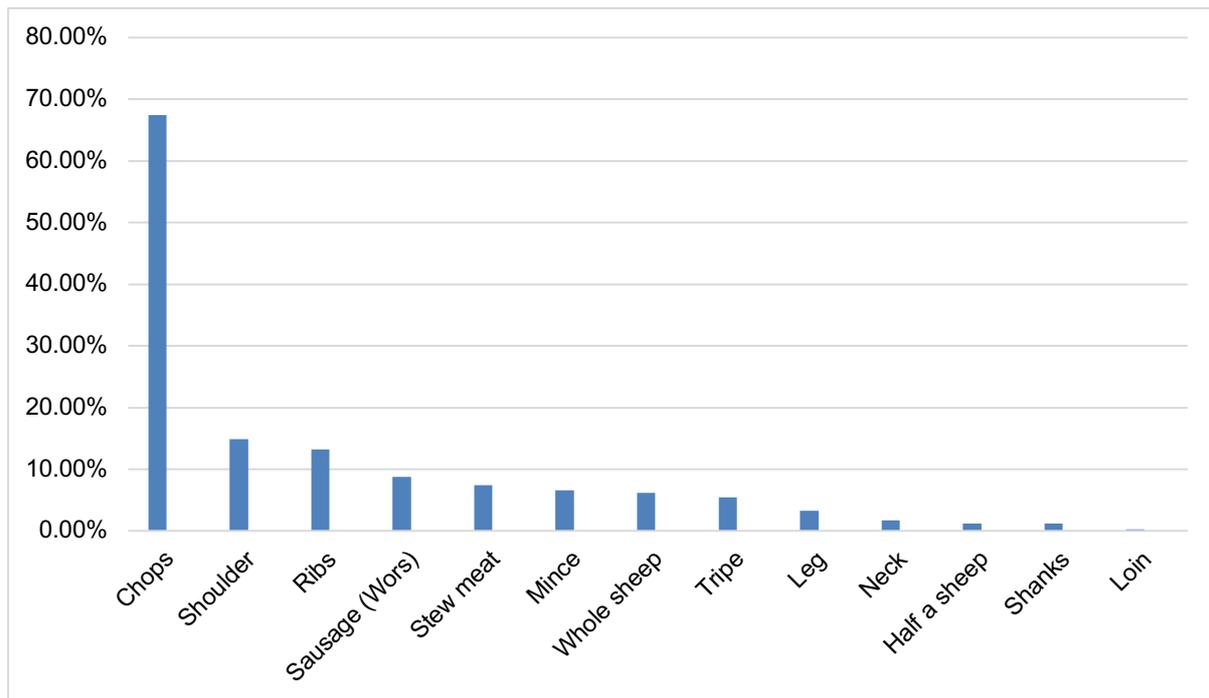


Figure 4.5: Mutton/lamb cuts most often bought by participants

In the post-test questionnaire, the participants were asked what the important aspects were that they took into account when buying meat. These aspects are shown in Table 4.3. In the case of beef, price (54.2%), fat (43.1%), expiry date (27.1%), colour (27.1%), and freshness (26%) were identified as the most important aspects. Aspects that mutton/lamb consumers indicated as important were the price (48.3%), fat (39.3%), colour (27.3%), expiry date (26.9%), and freshness (23.6%). It was interesting that only 4% of the participants indicated that they took the classification (class) of beef into account and roughly 1% of the participants indicated that they searched for the classification stamp on the meat they bought. This shows that a low percentage of the participants were aware of the classification system and how it works, as all of the animals bought for the meat market are classed according to the system. During the interviews, it became clear that the participants wanted to know how the classification system worked and more specifically what it meant to buy Class B2, C5, etc. meat. In some cases where participants said that they bought Class A meat, they were unable to explain what it meant. This could serve as a sign of the need for consumer education. Quality proved to be high on consumers' aspect list but quality is a generic term that is not linked to any of the tangible aspects.

This does, however, prove that there is room to improve meat sales if these products could be backed by a quality indicator of some sort that is also understood by consumers.

Table 4.3: Aspects evaluated by consumers when buying red meat

Most important aspects when buying beef		Most important aspects when buying mutton/lamb	
Price	54.2%	Price	48.3%
Fat	43.1%	Fat	39.3%
Expiry date	27.1%	Colour	27.3%
Colour	27.1%	Expiry date	26.9%
Freshness	26.0%	Freshness	23.6%
Quality	20.5%	Quality	21.1%
Thickness	14.6%	Thickness	12.8%
Bone ratio	8.7%	Bone ratio	7.0%
Packaging	7.3%	Neatness	6.6%
Size	6.9%	Packaging	6.2%
Neatness	6.3%	Blood	5.4%
Weight/kg	5.6%	Size	4.5%
Blood	4.9%	Classification (class)	4.1%
Classification (class)	3.8%	Quantity	3.7%
Cut	3.5%	Weight/kg	3.3%
Quantity	3.1%	Cut	2.9%
Age	1.7%	Classification/stamp	1.2%
Brand	1.4%	Condition	1.2%
Fresh meat, not frozen or packed	1.4%	Age	1.2%
Condition	1.4%	Protein content	0.8%
Protein content	1.0%	Fresh meat, not frozen or packed	0.8%
Classification/stamp	1.0%	Portion	0.8%
Marbling	0.7%	Sell-by date	0.8%
Portion	0.7%	Slaughter date	0.8%
Tenderness	0.3%	Brand	0.8%
Smell	0.3%	Packaging date	0.4%
Seasoned	0.3%	Marbling	0.4%
Origin	0.3%	Seasoned	0.4%
Bar code	0.3%	Lamb meat	0.4%
Sell-by date	0.3%	Smell	0.4%
Slaughter date	0.3%	Tenderness	0.4%
Packaging date	0.3%	Bar code	0.4%

4.2.1 Pricing label information

Consumer behaviour was further investigated with post-test questions that related to the price of the meat shown. The participants were asked to rate their behaviour towards the price of the pack of meat and the price per kg by indicating how often they looked at these aspects, where 1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = always. Price per kg received the highest average rating (4.3), with price per pack receiving an average rating of 4.2. It could be noted from this that the participants indicated in the self-reported data collection that they focused on price per kg more often than the price

of the pack. These data are compared to eye-tracking data in Section 4.4 to compare what the participants indicated they were looking at with what they were really looking at with regard to the price of the red meat they buy.

4.2.2 Recall of test labelling

The participants were asked to name all the labelling shown to them during the eye-tracking test (see Table 4.4). This was done to compare what the participants stated that they remembered from the test images to what the eye-tracking data showed they paid attention to. The results are discussed in terms of brands of meat, quality indicators, origin certification, and nutritional information.

4.2.2.1 Brand of meat

Sparta was the brand most recalled by the participants, which was remembered by 26.7% of the participants. This brand is involved in sponsoring certain events in the area (Macufe, 2018), as well as some sports teams (Free State Cheetahs, 2018).

4.2.2.2 Quality indicators

Animal breed claims showed a relative variation in recall, with Bonsmara beef being recalled by 16% of the participants and Angus beef by 9.1% of the participants. The “Halal” sign was remembered by 15% of the participants and the “100% organic” label by 14% of the participants. “Top quality guaranteed” was recalled by 1.6% of the participants.

4.2.2.3 Origin certification

The origin-verifying label proved to be more likely recalled during the post-test questionnaire. “Free State Meat” (23.1%) and “Proudly made in SA” (20.2%) both scored high recall scores in comparison to most of the other labels.

4.2.2.4 Nutritional information

The on-pack nutritional information presented in the form of NITs was recalled by 3.9% of the participants and MTL nutritional labels by only 1.0% of the participants.

Table 4.4: Labelling recalled by participants

Labelling options	
Labels shown	Percentage of participants
Brand of meat	
Sparta	26.7%
Sernick	3.6%
Quality indicator	
Bonsmara	16.0%
“Halal”	15.0%
“100% organic”	14.0%
“Free range”	10.1%
“No antibiotics”	9.4%
Angus	9.1%
“Grain fed”	8.5%
“Grass fed”	7.2%
“Aged”	6.2%
“No added hormones”	6.2%
“Certified humane”	2.6%
“Top quality guaranteed”	1.6%
Origin certification	
“Proudly made in SA”	20.2%
“Free State Meat”	23.1%
QR traceability code	1.0%
Nutritional information	
NIT	3.9%
MTL nutritional label	1.0%

4.2.2.5 Recall and preference of certain labels

The participants were asked to recall and also indicate their preference regarding a certain brand, breed, and origin claims for meat (see Table 4.5). Almost a third (30.6%) of the participants indicated that they preferred to buy their meat from a certain brand or producer. While 12.1% of the participants indicated that they were able to recall a breed of cattle shown in the test, only 9.2% of the participants could correctly name one of the breeds shown. The breed recall rate is slightly lower than the recall of labelling containing the Bonsmara logo (see Table 4.4). This could be because the participants were able to remember the logo but did not know that it is a breed of cattle.

During the interviews, 11% of the beef consumers indicated that they preferred beef from a certain breed of cattle. In the case of mutton/lamb meat, 7.9% of the participants indicated that they preferred meat from a certain breed of sheep. A relatively large percentage (38.1%) of the participants indicated that they preferred red meat from a certain origin. The majority of these participants indicated that the meat should be sourced from the Free State or South Africa. To a lesser extent, the participants indicated a preference for Northern Cape- and Karoo-sourced meat. In a question regarding the nutritional information that was provided on the labelling, 26.1% of the participants were able to recall that NITs were shown and 6.2% of the participants were able to recall that MTL labels were shown.

It must be kept in mind that the questions asked were more specific than what was asked in Section 4.2.2.4, where consumers were asked to name all the labels that were shown to them.

Table 4.5: Brand, breed, and origin claims preference and recall

Aspects shown		Percentage
Participant said that they could recall the brands shown		48.5%
Participant could correctly name the brands shown		41.7%
Participant preferred red meat from a certain producer/brand		30.6%
Participant said that they could recall the breeds of animals shown		12.1%
Correctly named a breed		9.2%
Participant preferred beef from a certain cattle breed		11%
Participant preferred mutton/lamb from a certain sheep breed		7.9%
Participant preferred red meat from a certain origin		38.1%
Can you recall labels indicating the nutritional value of the packs of red meat?	NIT	26.1%
	MTL label	6.2%

4.2.2.6 Importance of quality indicator labelling

The participants were asked to rate the importance of the different quality indicators that they would want to see on the meat they purchase on a scale from 1 to 5 (1 = not important; 5 = very important). The average scores and different labelling aspects that were tested are shown in Figure 4.6. Note that this labelling does not include price label information such as the price per pack, price per kg, and the sell-by date, and that all of these labels appeared in the eye-tracking test images. From the score results across the whole group of participants, the highest-rated labels were “Top quality guaranteed” (3.9), “Proudly made in SA” (3.8), brand certification (3.4), and origin certification (3.1). Labelling that received average scores were “Aged” meat (3.0), “Sustainably produced” (3.0), NIT (3.0), “No antibiotics” (2.9), “Grass fed” (2.9), “No added hormones” (2.8), “Certified humane” (2.7), “100% organic” (2.7), and “Grain fed” (2.7). The lowest scores were given to breed certification (2.6), “Free range” labels (2.6), QR codes (2.5), and “Halal” labels (1.8). These results suggest that consumers in the Mangaung metropolitan are most concerned with the quality of the red meat that they purchase and that they feel that a quality guarantee label is of greatest importance to them. Consumers are also highly in favour of South African meat and supporting known brands. According to the findings, consumers seem to be more concerned with the quality and origin of their red meat than they are with how the meat was produced (e.g. no antibiotics and no added hormones).

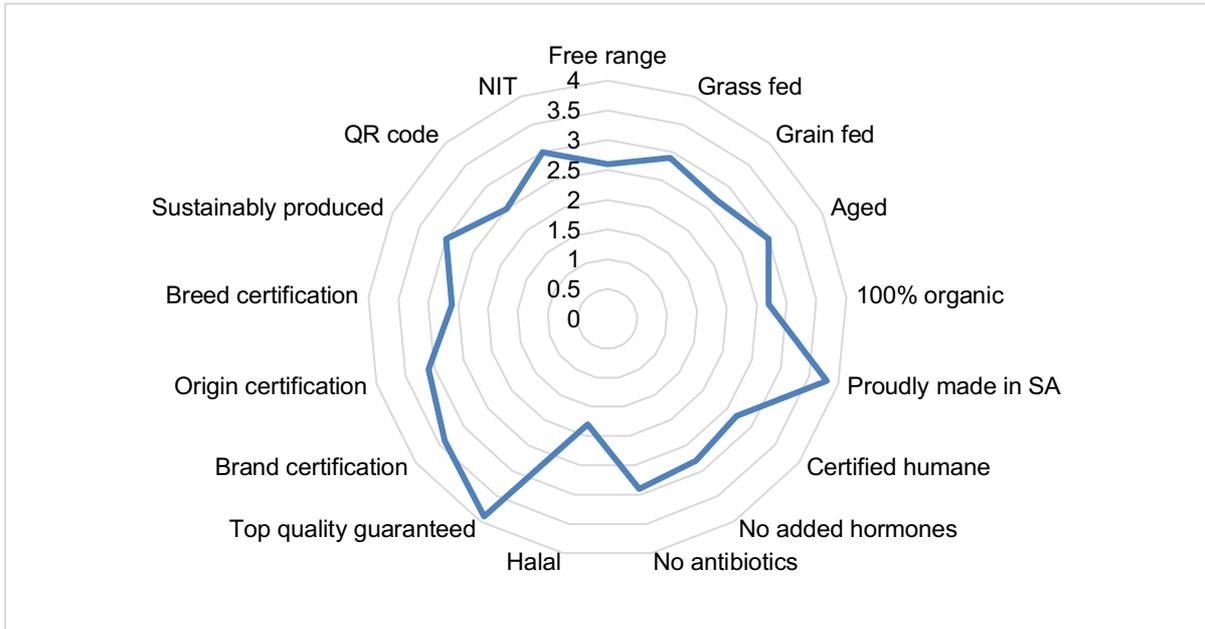


Figure 4.6: Ratings of labelling importance by participants

4.2.2.7 Colour preference

The colour preferences that the participants indicated for the meat they buy are presented in Figure 4.7 for mutton/lamb meat, and Figure 4.8 for beef⁴. For beef, the majority (70.2%) of the participants preferred to buy cherry-red meat, with 28.4% of the participants indicating they preferred dark-red beef. In the case of mutton, the participants preferred cherry-red meat (81.4%) and dark-red meat (32.6%). Consumers in the study area were more accepting of dark-red mutton/lamb meat than in the case of beef. Some respondents indicated that the cherry-red colour of meat is one of the indicators that they use to determine the freshness of the meat that they buy.

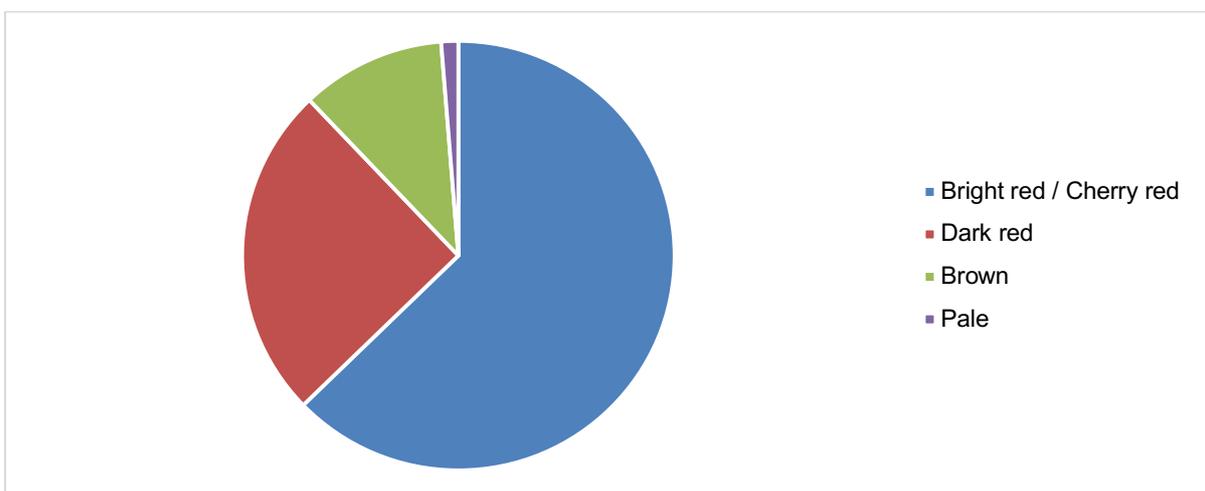


Figure 4.7: Lamb/mutton meat colour preference among participants

⁴ Note that some participants indicated that they preferred two colours of meat without discrimination between them and they were allocated for both colour options.

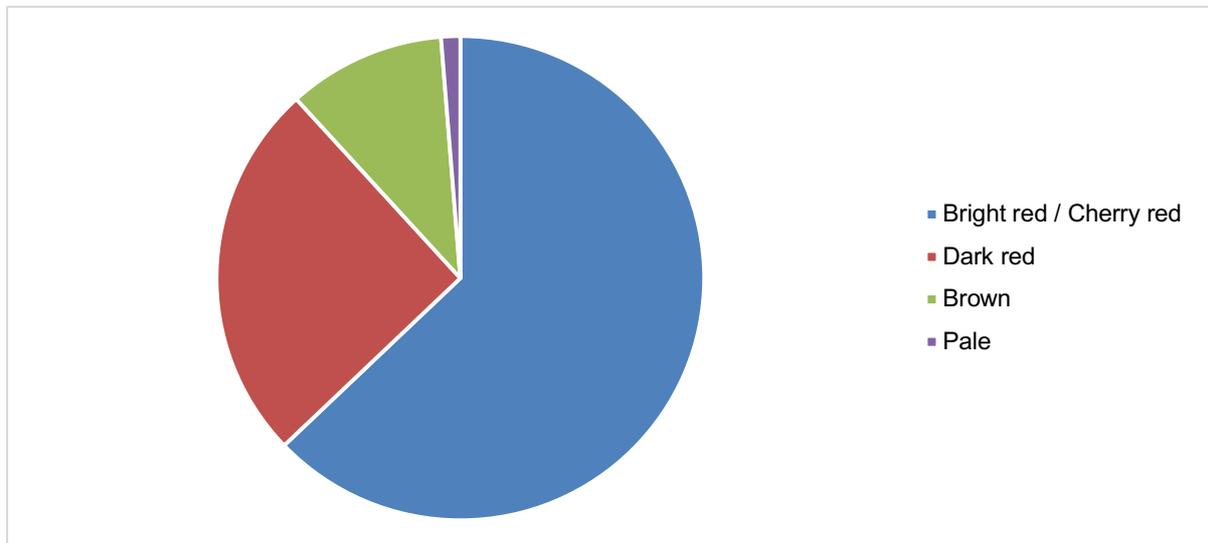


Figure 4.8: Beef meat colour preference among participants

4.2.2.8 Fat preference

The participants were asked to rate their fat preference⁵ of the meat they buy (see Figure 4.9). More than half (54.7%) of the participants gave a medium (3/5) rating for their fat preference. It seemed that the participants were more likely to prefer lower amounts of fat on their meat; rating it 1 and 2 out of 5, rather than 4 or 5 out of 5. This could suggest that consumers in the Mangaung metropolitan are also health conscious (BFAP, 2014).

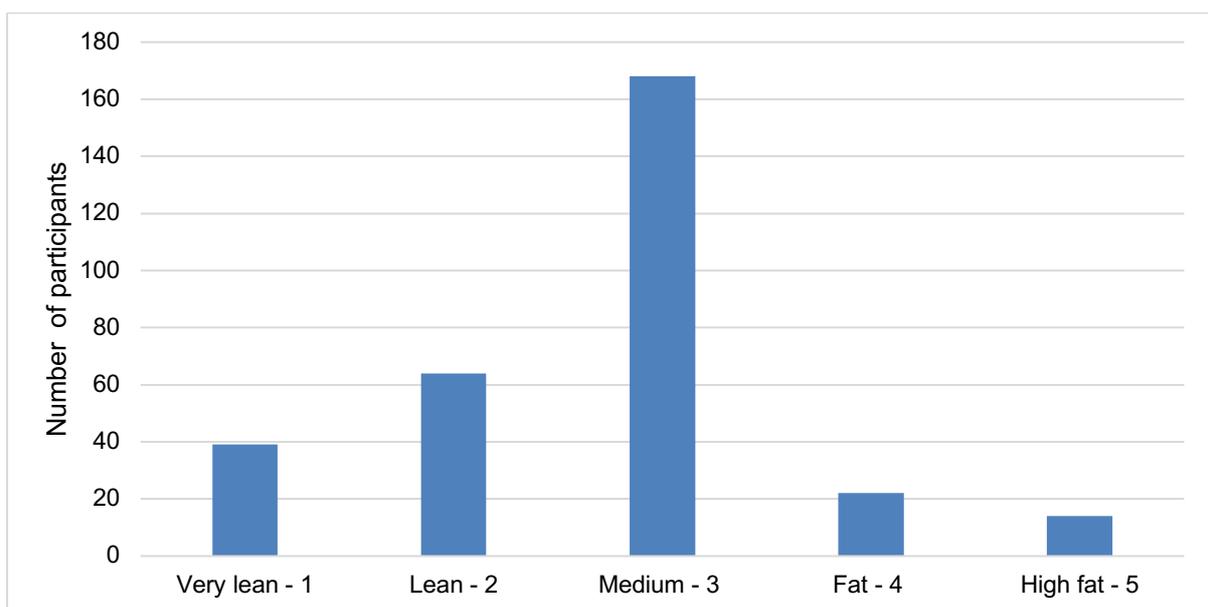


Figure 4.9: Preferred amount of fat on meat

⁵ How the classification system works with regard to fat was explained to participants if they did not know.

4.2.2.9 Importance of packaged meat aspects

Aspects of packaged meat when buying red meat were scored by the participants. These aspects relate to the physical appearance of the packaged product. The results are shown in Figure 4.10. The participants used the following scale: 1 = not important to 5 = very important. The aspects that received the highest average scores from all the participants were the colour of the meat (4.54) and the neatness of the cut (4.45). The bone-to-meat ratio and amount of fat on the meat proved to be less important, with both receiving an average score of 4.1. The amount of visible fat on the meat (3.9) and blood in the packaging (3.8) proved to be less important than the aforementioned aspects. The classification of the meat received the lowest average score, namely 3.6. According to these findings, consumers self-reported that they pay the most attention to the colour of their meat when purchasing meat, and the neatness of the meat cut was also ranked as very important. The classification of meat proved to be of the lowest importance to consumers. The difference between the highest and lowest ranked aspects was less than one on the rating scale and indicates that consumers might rank one aspect more important than the others while still paying attention to all the aspects.

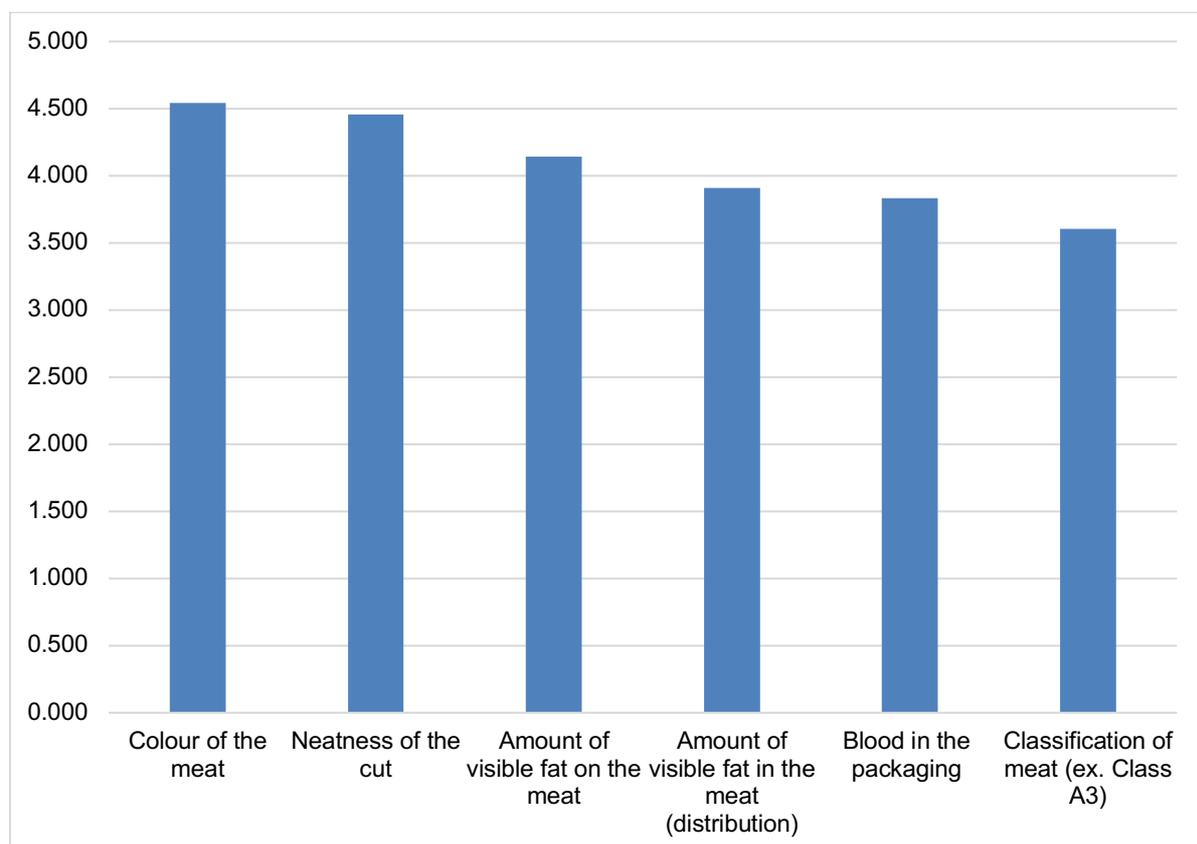


Figure 4.10: Importance of aspects when buying red meat

4.2.2.10 Meat-preparation techniques

The red meat preparation methods used by the participants were determined by asking them to score how often they used different cooking techniques to prepare red meat. The techniques were scored

according to 1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = very often, and the results are presented in Figure 4.11. The method used most often to prepare beef (3.5) and lamb/mutton (3.4) was stewing/boiling. Barbequing (3.1) was the second most used method to prepare red meat, while pan frying (2.6) and roasting (2.5) were used less often. Except for a slight difference found between the stewing of beef and mutton, other techniques were scored the same for the preparation of beef and mutton.

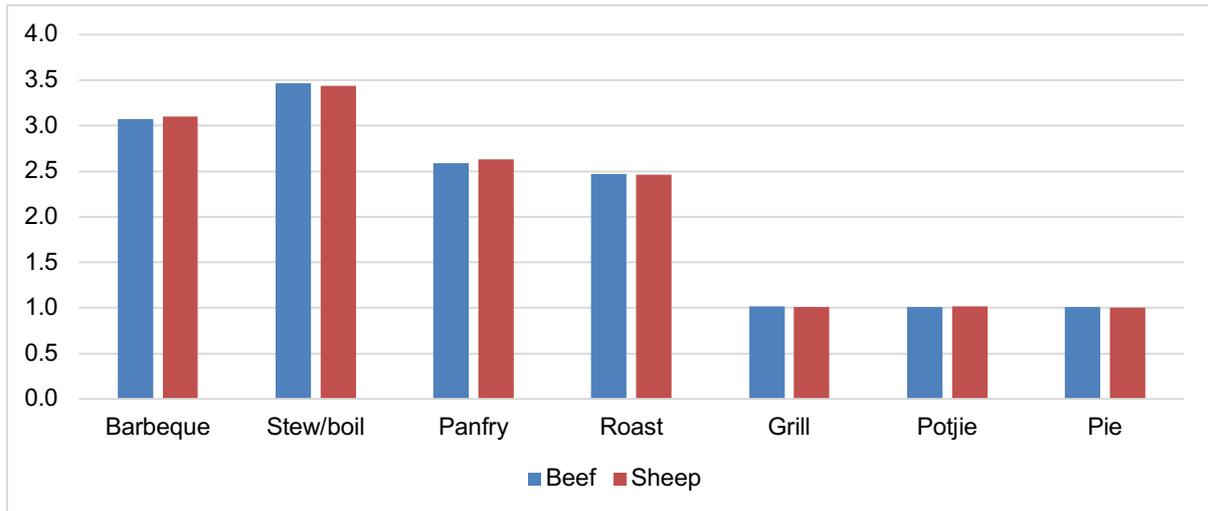


Figure 4.11: Methods used to prepare red meat

4.2.2.11 Packaging preferences

The packaging of red meat was scored by the participants according to the following five-point Likert scale: 1 = dislike a lot, 2 = dislike, 3 = neutral preference, 4 = like, and 5 = preferred choice. The results are shown in Figure 4.12. The highest preference was shown for vacuum-packed meat (3.4) that is not placed on a polystyrene plate. Meat placed on a polystyrene plate and then vacuum-packed scored the second highest preference score (3.3) and meat placed on a polystyrene plate and then wrapped in cling film scored the third highest score (3.2). Meat placed in plastic containers on the shelf scored lower (2.8) than the aforementioned, yet still higher than meat placed only in a plastic bag (1.7) and meat placed in a box before being wrapped in plastic (1.1). The majority of the participants who preferred red meat being placed in a plastic bag were from the lower-income groups and felt that this was the best packaging for freshly cut red meat.

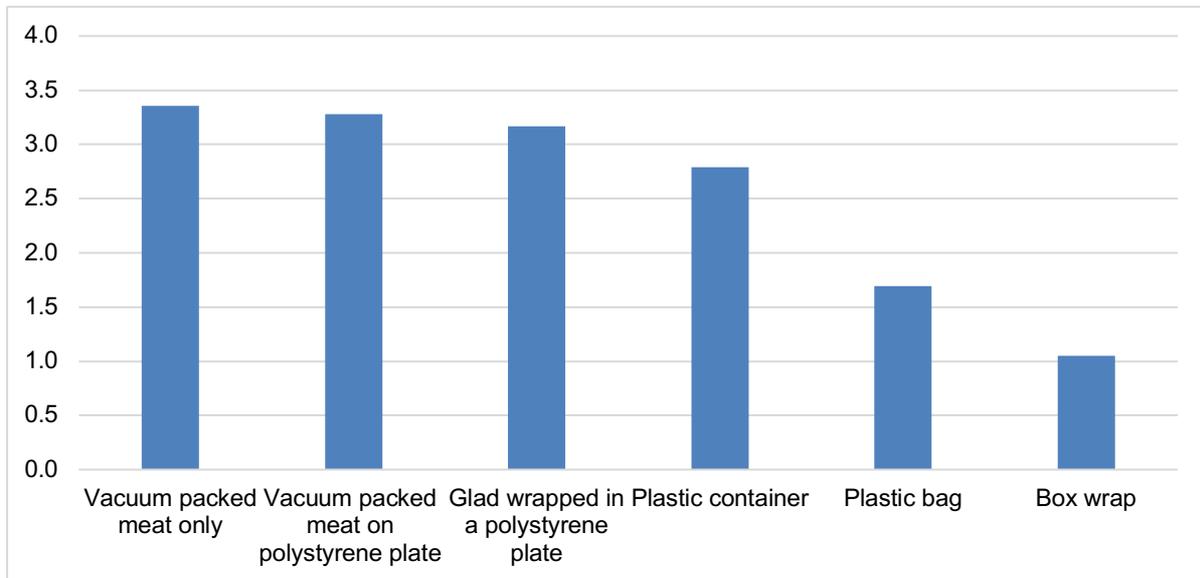


Figure 4.12: Participants' preference in terms of packaging red meat

This concludes the results for the questionnaires that related to the self-reported part of the test results. The results from the eye-tracking survey are presented in the next section. This section presented results based on the post-test questionnaires of the study. These findings could be seen as important by red meat retailers in the metropolitan to determine how they should direct their businesses' future. The results presented here are those aspects that consumers self-reported (thought) are important to them when purchasing red meat. In the sections that follow, these preferences will be compared to what consumers actually paid attention to. These self-reported results also provide valuable information regarding consumers' red meat buying behaviour that could be used by red meat retailers to better serve their clients.

4.3 EYE-TRACKING RESULTS

The presentation of the eye-tracking results follow a similar sequence as the results of the questionnaire results. These focus areas include price label information, quality indicator labelling (such as origin certification and brand of meat), aspects of red meat, and packaging aspects. The results of beef and mutton cuts and products are discussed under the specific focus areas. The products that were tested comprised beef steak (rump and T-bone), minced beef, beef sausage (*boerewors*), sheep chops, and bulk mutton. The results shown in the respective tables are based on the tested group of participants as a whole and can serve as the general results for the tested population. Important aspects from each table (test image) are discussed to highlight important trends and findings.

Following the general group results for each test image, subcategory results are also discussed below each of the general group discussions. In the subcategories, the following divisions are made: race (black, white, and coloured), level of education (Grade 1 to 7, Grade 8 to 12, and tertiary education), age group of consumers (18 to 30, 31 to 40, 41 to 50, 51 to 60, and 61 to 70), gender (male and female), and level of income (low, middle, and high income). Note that Indian participants and participants aged

71 to 80 were not discussed in separate groups due to the low number of these participants, which may lead to inaccurate conclusions.

The eye-tracking results shown in the tables consist of average measurements across the entire group for the following results:

- Fixation percentage (share of participants fixating on the aspect);
- Fixation count (number of times participants fixated on the aspect);
- Fixation duration (time spent on the aspect per fixation);
- Total fixation duration (total time spent on the aspect during all fixations combined);
- First fixation duration (time spent fixating on the aspect during the first fixation on the aspect);
- Time to the first fixation (how long it took before the aspect was fixated on); and
- Fixations before (how many fixations took place before fixating on the current aspect).

Besides fixations, visit measures are also provided, which include:

- Visit count (number of times the participants looked at the tested aspects area);
- Visit duration (time spent on the aspect per visit); and
- Total visit duration (total time spent looking at the area)

Note that all the duration times are presented in seconds.

4.3.1 Price label information

The results from the eye-tracker for the tested image of a beef steak with only the price label (see Image 4.1) is shown in Table 4.6. Aspects included on the price labels were the butchery's name, price per kg, price of the pack, weight of the pack, packaging date, sell-by date, name of the cut, classification of the meat, and a bar code.



Image 4.1: Beef steak with a pricing label

Table 4.6: Eye-tracking results for beef steak with a pricing label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	7%	1.6667	0.2010	0.3405	0.2176	2.4062	8.3333	1.1905	0.2981	0.3614
Bone in meat	39%	2.2645	0.2304	0.5045	0.2240	1.7930	6.0826	1.4545	0.3745	0.5608
Butcher name	44%	2.5259	0.1819	0.4508	0.1849	1.5056	4.9630	1.4370	0.3648	0.5195
Cut name	22%	2.0000	0.2327	0.4248	0.2388	2.0133	7.2388	1.3433	0.3645	0.4603
Classification	42%	2.0000	0.2068	0.3848	0.2063	1.8805	6.1385	1.3385	0.3147	0.4249
Packaging date	16%	1.6735	0.2543	0.4306	0.2561	3.1186	11.5918	1.1837	0.3718	0.4386
Price of pack	51%	2.8228	0.2037	0.5733	0.2065	1.8560	6.3987	1.6266	0.3931	0.6320
Price per kg	24%	2.0133	0.2396	0.4648	0.2572	2.5184	8.8933	1.2933	0.3887	0.4876
Sell-by date	21%	1.9063	0.2284	0.4298	0.2338	2.6555	9.5781	1.2188	0.4138	0.4666
Weight of pack	33%	1.8922	0.2475	0.4518	0.2479	2.0725	7.3529	1.4314	0.3442	0.4687

The results for the tested image of a steak with only a price label (see Table 4.6) suggest that the aspects that received the most attention from the participants were the price of the pack (51%), butchery name (44%), and classification of the meat (42%). The labelling aspects that received lower amounts of attention included the bar code (7%), packaging date (16%), and sell-by date (21%). The price of the pack received the highest average fixation count (2.822) and highest average total fixation duration (0.5733 seconds). The price of the pack was thus looked at more times than the other aspects, as well as for the longest period of time. The longest average first fixation duration measure was for price per kg (0.2572 seconds) followed by packaging date (0.2561 seconds). This indicates that a lower percentage of participants paid attention to the price per kg (24%) than the price per pack (51%) but those who looked at the price per kg did so for a longer time when first fixating their attention on the price per kg. This could be due to the participant determining the relationship between the price per kg and the price of the pack. The average time to first fixation could be used to interpret which aspect the participants paid attention to first. These results show that, on average, the butchery's name was viewed first (1.505 seconds), followed by the price of the pack (1.856 seconds), and classification (1.880 seconds). The aspects that received attention later on during the test were the packaging date (3.118

seconds), sell-by date (2.655 seconds), and price per kg (2.518 seconds). These measurements can be used to determine the sequence in which the participants looked at aspects of a pack of red meat.

Race

The subcategory results show that in terms of race compared to the average of the whole group, more white participants fixated their attention on the bone in the pack (49% vs. 39%), and fewer white participants paid attention to the butchery's name (38% vs. 44%), classification of the meat (29% vs. 42%), packaging date (7% vs. 16%), price of the pack (31% vs. 51%), price per kg (9% vs. 24%), sell-by date (16% vs. 21%), and weight of the pack (29% vs. 33%), than the average score of the whole test group. Contrary to the results from the white participants, the coloured participants showed higher fixation percentages for all the price labelling aspects on the pack than what was recorded for the whole group on average. Some of the noteworthy results are a fixation percentage of 55% (vs. 22%) for the name of the cut, packaging date of 36% (vs. 16%), sell-by date of 45% (vs. 21%), price per pack of 73% (vs. 51%), and price per kg of 45% (vs. 24%).

Age

With regard to age, the participants between 31 and 40 years old showed a tendency to fixate on labelling aspects to a larger extent (percentage fixated) than the group average. All of the tested labelling aspects, except the bar code, were fixated on by a larger share of these participants than the group average. These participants also paid more attention to the bone in the pack on average (48% vs. 40%). More participants between 18 and 30 years old made use of certain labelling aspects but this was only applicable to a smaller number of the aspects than mentioned for the participants between the ages of 31 and 40. The participants between 41 and 50 years old showed greater concern about the price of the pack than what was found for the whole sample on average (57% vs. 52%).

Gender

Men seemed to be more concerned about the freshness of the meat and paid more attention to the packaging date (17% vs. 14% for women) and sell-by date (25% vs. 13% for women). A larger percentage of women focused their attention on all the other tested aspects. This could suggest that men are less price sensitive than women but are more concerned about the freshness of the red meat than women.

Income groups

The middle-income group proved to have larger percentages of participants fixating their attention on the majority of the tested price labelling aspects (butchery's name, cut name, classification, price of the pack, sell-by date, and weight of the pack). Low-income groups showed the largest fixation percentages of the three income groups for packaging date and price of the pack. The high-income group showed the highest percentage fixation for the bone in the pack (50% vs. 39% for the group average). This would confirm the perception that low-income consumers are more price sensitive and high-income consumers are less price sensitive and more sensitive to other aspects such as the bone in the pack.

Education

Compared to the whole sample, on average the participants with degrees showed higher fixation percentages for the bone in the pack, butchery's name, price of the pack, price per kg, and weight of the pack. The group of participants with a Grade 8 to 12 level of education showed slightly higher fixation percentages towards the name of the cut, classification of the meat, packaging date, price per kg (same percentage as the high-income group), and sell-by date. It seems that the participants who were better educated made use of these aspects to a greater extent than participants with a lower education. It is interesting that the lower-educated participants (Grade 1 to 7) fixated on the bone in the pack and the butchery's name with percentages not much different from the other two groups, while the other aspects were fixated on at much lower percentages than in the other income groups.

In Image 4.2, a blood pad was added to test the influence it will have on consumers' attention. The results are shown in Table 4.7. By using this image, the plan was to investigate how a foreign object such as a blood pad will influence consumers' attention when fixating on a packet of red meat.



Image 4.2: Beef steak with a blood pad and pricing label

Table 4.7: Eye-tracking results for beef steak containing a blood pad and pricing label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	7%	1.7727	0.1659	0.2968	0.1741	2.8623	10.0455	1.2727	0.3200	0.3982
Blood pad	65%	3.3731	0.2160	0.6908	0.2035	1.0599	3.2338	1.6716	0.5314	0.8554
Butchery name	37%	2.4649	0.2068	0.4769	0.2071	2.0039	6.8333	1.3421	0.4122	0.5305
Cut name	27%	1.6867	0.2046	0.3316	0.2104	2.0031	6.8072	1.3012	0.2660	0.3496
Classification	31%	1.8854	0.2048	0.3943	0.1898	2.0729	6.9479	1.3438	0.2976	0.4257
Packaging date	13%	1.9250	0.3038	0.5243	0.2933	3.3825	11.9750	1.1250	0.4630	0.5528
Price of pack	47%	2.5417	0.2331	0.5605	0.2247	2.0699	6.6111	1.5417	0.4003	0.6025
Price per kg	24%	1.9600	0.2833	0.4921	0.2809	2.5539	8.9467	1.3467	0.3897	0.5096
Sell-by date	14%	1.6591	0.2541	0.3982	0.2548	3.4452	12.0455	1.0909	0.3920	0.4225
Weight of pack	30%	1.9890	0.2503	0.4716	0.2444	2.4987	8.6593	1.3516	0.3773	0.4921

Adding the blood pad to the test subject influenced the eye-tracking results (see Table 4.7). The largest share of the participants paid attention to the blood pad (65%), and on average it was one of the first tested aspects that they fixated on (1.0599 seconds). The blood pad received the highest fixation count at 3.3731 fixations. Labelling aspects received attention from fewer participants; the price of the pack, for example, received attention from 47% of the participants (compared to 51% in the previous image) and the butchery's name from 37% of the participants (44% in Image 4.1). Besides labelling aspects receiving attention from a smaller share of the participants, the sequence for aspects receiving attention from the largest share of participants remained relatively the same: price of the pack (47%), butchery's name (37%), and classification (31%). These results indicate that adding an object such as a blood pad to a pack of red meat will reduce the number of consumers paying attention to price label information (e.g. price of the pack and butchery's name). A possible reason for this occurrence could be that consumers were not shown other images of packets of red meat that contained items such as a blood pad. They thus become familiar with the general labelling items used on the tested packs of red meat and by adding this "new item" to the image that consumers are unfamiliar with, more consumers paid attention to the image. In a situation where different packets of red meat are presented alongside each other, where some packets contain visible blood pads and others do not, it could lead to consumers paying more attention to the blood pad than to the price label information and could lead to biased purchase decisions among consumers.

Race

The highest fixation percentage on all of the tested aspects in Table 4.7, except for the name of the butchery, was measured for coloured consumers. The blood pad was fixated on by a large percentage of coloured (73%) and black (66%) participants than was the case for white participants (62%).

Education

Education seems to influence the manner in which consumers pay attention to the red meat that they plan to buy. All the tested aspects had a lower fixation percentage from participants with an education of Grade 1 to 7. The blood pad was fixated on by slightly more participants with a degree or diploma (67%) than was the case for participants with a Grade 8 to 12 education (66%) and Grade 1 to 7 education (55%).

Age

An analysis of the relationship between the participants' age and the attention they paid to red meat showed that participants in the 18 to 30 year age category showed the highest probability of fixating on the blood pad (74%), while age groups 31 to 40 and 41 to 50 showed lower fixation percentages of 64% and 57% respectively. The 51 to 60 age group showed a much higher fixation percentage than the two younger groups (70%) and the fixation percentage for the blood pad decreased again in the older category (50%). This suggests that younger consumers are more aware of objects that are placed in red meat packs. Other aspects that were fixated on at a higher rate by the 18 to 30 age category than the group average was meat classification, price of the pack, price per kg, sell-by date, and weight of the pack. The 31 to 40 age category showed the highest fixation percentage between the age groups for the butchery's name, cut name, packaging date, price per kg, sell-by date, and weight of the pack. This suggests that younger consumers of 18 to 40 years old tend to fixate more of their attention on the labelling aspects than older consumers.

Gender

Women were more likely to fixate their attention on most of the labelling aspects (except packaging date, price per pack, and sell-by date) than men. Men fixated their attention more on the packaging date, price per pack, and sell-by date. This suggests that men are more concerned about the freshness of meat than women.

Income

When compared to the other income groups, the low-income participants paid more attention to the packaging date and the price per kg. It is surprising to find that none of the aspects were fixated on by the low-income group at the highest rate measured for the three groups. It seems that the low-income group participants were more concerned about the physical meat characteristics than the labelling aspects. The middle-income group showed the highest fixation percentage for the majority of the aspects, with the high-income group showing the highest fixation percentage for only the blood pad, packaging date (equal to low-income group), and the price per kg.

From the images that only tested the pricing label on the pack of red meat, it was found that the aspects that enjoyed the largest share of the participants' attention was the price of the pack of meat, the butchery's name, and the classification (class) of meat indicated on the label. This could be caused due to the butchery's name that was printed larger than other aspects on the price label or due to the fictional name that was created and used, and consumers are unfamiliar with the name. The high level of attention paid to the class of the meat could be an attempt by the consumers to verify the quality of meat this unknown butchery is offering. The weight of the pack also enjoyed attention from a larger share of participants than other aspects such as the packaging date and sell-by date. Apart from the labelling aspects, the bone in the pack enjoyed attention from a large share of potential buyers, as did the blood pad. The effect was seen where adding a blood pad to the pack resulted in a lower fixation percentage from the participants. This shows the effect that adding a foreign or unfamiliar item to the

packets of red meat might have on consumers' attention. From this it could be suggested that red meat retailers must ensure that the packets of red meat on their shelves have a consistent appearance. In other words, if blood pads are added, it must be added to all of the packets to prevent unnecessary biased reactions from consumers. Red meat retailers should focus on how the bone in the pack of meat should look, in accordance with consumers' preferences.

4.3.2 Quality indicators

4.3.2.1 Brand certification

This part of the study investigated consumers' attention and behaviour towards brands of beef. Sparta is one of the brands that were tested, as shown in Image 4.3, with the results provided in Table 4.8.



Image 4.3: Beef steak with a Sparta label

Table 4.8: Eye-tracking results for beef steak with a Sparta label

Aspect	Percentage mean	Fixations						Visits		
		Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	28%	1.5765	0.2881	0.4388	0.2828	1.7879	5.7529	1.2471	0.3876	0.4585
Butchery name	27%	1.9390	0.2539	0.4626	0.2490	2.1394	7.1463	1.1341	0.4466	0.5041
Cut name	21%	1.7576	0.2295	0.3920	0.2217	2.2724	7.8485	1.2727	0.3088	0.4067
Classification	18%	1.7222	0.2498	0.4324	0.2467	2.2437	7.7407	1.2222	0.3657	0.4467
Packaging date	23%	1.8750	0.2324	0.4421	0.2143	2.0256	7.1250	1.3056	0.3528	0.4701
Price of pack	45%	2.2628	0.2582	0.5945	0.2480	2.0660	6.8686	1.4526	0.4326	0.6266
Price per kg	27%	1.5595	0.2589	0.3881	0.2470	2.3161	7.9524	1.2619	0.3238	0.3975
Sell-by date	25%	1.9870	0.2539	0.5131	0.2529	2.0816	6.8961	1.4026	0.3810	0.5318
Sparta label	64%	3.8889	0.2492	0.9385	0.2267	1.0298	3.3434	1.6414	0.6859	1.0520
Weight of pack	31%	2.1563	0.2338	0.4786	0.2172	2.2864	7.4479	1.4375	0.3746	0.5089

The Sparta label (see Image 4.3) enjoyed attention from almost two-thirds (64%) of the participants (see Table 4.8). On average, the participants spent 0.9385 seconds fixating on the label and it took them on average 1.0292 seconds before fixating on the label for the first time. If these results are compared to the data in Table 4.6 for a pack only containing a pricing label, it is clear that the Sparta

label led to a decrease in participants viewing the butchery's name (27% vs. 44%) (see Table 4.6), cut name, classification, and weight of the pack. This could be due to the other labelling information that remained the same while a brand label was added and attracted the attention of consumers. While taking into account that the participants had more to look at on this image, the results indicate that they paid attention to the brand label to determine the purchase of the meat. Thus, in cases where the brand label is not presented, they will make use of the cut name, classification, and weight of the pack to decide. Increases were also seen in the participants fixating on the bar code, packaging date, price per kg, and sell-by date. This could suggest that the participants were expecting a different price per kg than that of the non-branded beef.

Subcategories

The Sparta label was fixated on by almost all of the coloured participants (91%), followed by the white (69%) and black (62%) participants. Education showed no clear correlation to the percentage fixated. Regarding age, the highest fixation percentage was measured for the 31 to 40 age group (70%), followed by the 18 to 30 age group (66%) and the 51 to 60 age group (64%). Men showed a slightly higher fixation percentage (66%) than women (64%), and middle-income participants (71%) showed the highest fixation percentage, followed by high-income participants (64%) and low-income participants (60%).

Certified Sernick beef labelling was tested with Image 4.4, and the results are presented in Table 4.9.



Image 4.4: Beef steak with a Sernick label

Table 4.9: Eye-tracking results for beef steak with a Sernick label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	31%	1.7604	0.2158	0.3810	0.2014	1.7248	5.2188	1.3021	0.2886	0.4058
Butchery name	20%	1.9677	0.2355	0.4329	0.2465	2.1323	6.4516	1.2581	0.3897	0.4665
Cut name	21%	1.5692	0.2392	0.3888	0.2368	2.3449	7.4769	1.1846	0.3382	0.3974
Classification	19%	1.8596	0.2677	0.4551	0.2775	2.5886	8.4386	1.2456	0.3996	0.5023
Packaging date	24%	2.0800	0.2696	0.5567	0.2773	1.8903	6.2133	1.4267	0.3909	0.5727
Price of pack	40%	2.4959	0.2568	0.6162	0.2553	2.0024	6.5610	1.4553	0.4939	0.6703
Price per kg	28%	1.8736	0.2690	0.4799	0.2587	2.0018	6.2644	1.3563	0.3974	0.4914
Sell-by date	25%	1.8961	0.2335	0.4343	0.2242	2.2894	7.1688	1.3377	0.3322	0.4640
Sernick label	63%	3.8964	0.2839	1.0162	0.2690	1.3482	4.3264	1.6114	0.7584	1.1388
Weight of pack	31%	1.6979	0.2765	0.4279	0.2661	2.1128	6.9792	1.3125	0.3472	0.4505

Similar eye-tracking results to the Sparta labelling were found for the Sernick label (see Image 4.4 and Table 4.9). The results show that 63% of the participants fixated on the label. The average total fixation duration (1.0162 seconds) and the average time to first fixation (1.3482 seconds) suggest that the participants focused on the label slightly longer than on the Sparta label, while it took them slightly longer to fixate on the label for the first time compared to the Sparta label. The rest of the results seem relatively similar to the Sparta labelling results. The differences noticed in the average time to first fixation and average total fixation duration could be due to Sparta's more aggressive marketing in the Mangaung area. This could have caused the participants to notice the label earlier and spend less time on extracting information from the label than compared to the Sernick label. One would also expect that the design of the brand label plays a role in this regard. From these results it seems that the Sparta label was catchier than that of Sernick due to the lower fixation percentage but it required more time to extract information due to the larger number of words shown on the label.

Subcategories

Similar to the Sparta label (see Image 4.3), the sequence of most viewed according to race was the same (coloured > white > black). Contrary to the Sparta label results, education was positively correlated with the fixation percentage, thus the more educated participants fixated on the label at a higher rate. Regarding age, participants in the 18 to 30 age group showed the highest tendency to fixate on the Sernick label, with no clear trend across the different age groups. Men were also more likely to fixate on this brand label (64% vs. 61% women) than in the previous image. The middle-income participants showed the highest tendency to fixate on the brand (75%), followed by high-income (67%) and low-income (51%) participants.

The results suggest that adding a brand label to the pack led to less attention paid to the price of the pack and the name of the butchery, while the brand labels showed high fixation percentages from the participants. Because the images were randomly shown to participants, these results could not simply be due to participants becoming accustomed to the labelling aspects used on all the test images. Fixation percentages on other aspects such as the packaging date and sell-by date showed measures closely correlating to the scores of Image 4.1, where no brand label was shown. These results suggest that consumers want to know where their meat comes from. If a brand label is added, they use it to

determine their choice of purchase, and if no brand label is present, they make use of the butchery's name and name of the cut to base their purchases on.

4.3.2.2 Breed certification

Breed certification was investigated by placing breed certification labelling on the test images (see Image 4.5). The eye-tracking results are shown in Table 4.10.



Image 4.5: Beef steak with a Bonsmara breed label

Table 4.10: Eye-tracking results for beef steak with a Bonsmara breed label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	10%	1.3750	0.1638	0.2425	0.1584	2.5306	8.2500	1.0938	0.2047	0.2519
Bonsmara beef label	63%	3.6753	0.2172	0.8408	0.2103	1.5659	5.3505	1.4485	0.7176	0.9581
Butchery name	20%	2.2333	0.1782	0.3937	0.1852	2.1418	7.7667	1.1333	0.3828	0.4347
Cut name	18%	2.0893	0.1664	0.3755	0.1664	1.8123	6.6250	1.2679	0.3261	0.4063
Classification	18%	1.9815	0.1754	0.3483	0.1730	2.3943	7.8148	1.1852	0.3187	0.3746
Packaging date	19%	1.8947	0.1804	0.3328	0.1902	2.6639	10.1404	1.3860	0.2623	0.3482
Price per kg	23%	1.9437	0.1986	0.3925	0.2000	2.3387	8.2676	1.3662	0.3062	0.4096
Price of pack	45%	2.3139	0.1879	0.4248	0.1892	1.8657	6.0365	1.5109	0.3080	0.4598
Sell-by date	33%	1.9010	0.2122	0.4036	0.2261	2.6582	9.2079	1.1881	0.3412	0.4304
Weight of pack	39%	2.2773	0.1967	0.4328	0.2007	2.1211	7.2605	1.4370	0.3247	0.4641

The Bonsmara beef certification label (see Image 4.5) enjoyed attention from 63% of the participants (see Table 4.10). This label received on average the longest total fixation duration (0.8408 seconds). The low value measured by this label for the time to first fixation (1.5659 seconds) indicates that it was the first labelling aspect that on average received attention from the participants. If the addition of the breed label is compared to a pack of meat only containing the pricing label (see Image 4.1), it is noticed that the butchery's name received fixations from less than half of the participants (20% vs. 44%) (see Table 4.15). A decrease is also seen in the percentage of participants fixating on cut name, classification, price per kg, and price per pack, while an increase is noticed for packaging date, sell-by date, and the weight of the pack.

Subcategories

In terms of race, the coloured participants (73%) were the most likely to fixate their attention on the Bonsmara label, followed by black (64%) and then white participants (53%). The level of education seems to be correlated with the fixation percentage on the Bonsmara label. Age showed a different picture, with the three age groups lower than the 51 to 60 age group showing a higher tendency to fixate on the Bonsmara label, with specifically the 41 to 50 age group showing a 70% fixation percentage. Men were more likely to look at the Bonsmara label (65%) than women (61%), and middle-income participants showed the highest tendency to pay attention to the Bonsmara label.

To investigate the differences that different breeds could have on the participants' behaviour, a similar label was designed for Angus beef (see Image 4.6 and Table 4.11). The concept was to give both breed labels similar chances of attracting the participants' attention (same colour, size, and label) but still measuring whether they investigated the label.



Image 4.6: Beef steak with an Angus breed label

Table 4.11: Eye-tracking results for beef steak with an Angus breed label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Angus beef label	51%	3.6266	0.2543	0.8111	0.2371	1.4228	4.2848	1.5570	0.7141	0.9792
Bar code	22%	1.6912	0.2119	0.3775	0.2009	2.0424	6.2500	1.3235	0.3099	0.4046
Butchery name	19%	1.8103	0.2395	0.4391	0.2495	2.1398	6.3621	1.2069	0.3648	0.4507
Cut name	20%	1.6885	0.2157	0.3749	0.2046	2.2200	7.1803	1.2295	0.3120	0.3898
Classification	21%	1.6212	0.2388	0.3856	0.2339	2.1353	6.5606	1.1667	0.3271	0.3997
Packaging date	27%	1.7381	0.2413	0.4395	0.2385	2.2105	6.9048	1.2500	0.3748	0.4699
Price of pack	41%	2.4240	0.2512	0.6142	0.2548	1.8913	5.6560	1.4480	0.4552	0.6486
Price per kg	29%	2.0227	0.2719	0.4868	0.2697	2.3285	6.8636	1.3295	0.3809	0.5217
Sell-by date	22%	1.9265	0.2568	0.5044	0.2454	2.4210	7.0441	1.2647	0.4066	0.5253
Weight of pack	28%	1.6941	0.2812	0.4467	0.2651	2.2016	6.5647	1.2471	0.3835	0.4702

In the second image, which contained the Angus breed label (see Image 4.6 and Table 4.11), the breed label received a lower share of views from the participants (51%) than with the Bonsmara image (63%) (see Image 4.5). The label still measured the highest average total fixation duration (0.8111 seconds) with the lowest average time to first fixation (1.4228 seconds). These results suggest that the Angus breed label was the on-pack labelling aspect that received the most attention from the participants (51%) for the longest average time (0.8111 seconds) and was the labelling aspect that was on average fixated on first (1.4228 second average time to first fixation). The difference seen in the fixated percentages between the two breeds (Image 4.5 vs. Image 4.6) could be due to the participants being more interested in the Bonsmara than the Angus breed.

The subcategory statistics for the Angus breed label showed similar results to what was found for the Bonsmara image; the difference being that all the races showed lower fixation percentages, while the fixation percentage according to race stayed in the same sequence (coloured, black, and white participants). This was also the case of education. Age showed a declining trend for fixations among older participants, with the highest fixation percentages measured in the 18 to 30 and 31 to 40 age category (58%). Men measured a higher fixation percentage on the Angus label (56%) than women (49%), and middle-income participants (59%) and low-income participants (49%) showed a higher fixation percentage than high-income participants (43%). These results show that the high-income participants did not pay the highest level of attention to breed certification labelling and that a more ideal market for such a form of labelling would be the middle-income group of consumers.

Similar to brand labelling, adding a breed verification label caused a reduction in the attention paid to the price of the pack, the butchery's name, and classification of the meat. While the Bonsmara breed label enjoyed attention from a similar percentage of participants than the brand label, the Angus breed label measured a somewhat lower fixation percentage among the participants. Note that the theme (colour and logo) of the two labels were kept the same, while only changing the breed name on the label. This may indicate that the participants were either more familiar with the Angus beef/breed term and did not need to pay much attention to the label, or that they were more in favour of purchasing Bonsmara beef. One should also keep in mind that the Angus label was placed on a T-bone steak, while the Bonsmara label was placed on a rump steak, thus consumers had more aspects that they could have paid attention to on the T-bone steak pack than on the rump steak during the five seconds of test time provided.

4.3.2.3 Production practice labelling

The results from production practice labelling are presented in this section. The results for "Grass fed" beef labelling (see Image 4.7 and Table 4.12) are presented first.



Image 4.7: Beef steak with a “Grass fed” label

Table 4.12: Eye-tracking results for beef steak with a “Grass fed” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	30%	1.7419	0.2660	0.4339	0.2808	1.9388	5.9570	1.3118	0.3544	0.4695
Butchery name	22%	2.0735	0.2432	0.4703	0.2450	2.3622	8.0588	1.2059	0.4463	0.5246
Cut name	21%	1.7121	0.2630	0.4120	0.2842	2.4283	7.9697	1.1970	0.3695	0.4379
Classification	15%	1.5778	0.2373	0.4027	0.2464	2.4251	8.0000	1.2000	0.3347	0.4180
“Grass fed” label	44%	4.2132	0.2351	0.9427	0.2120	1.4195	4.7500	1.4485	0.8291	1.0921
Packaging date	34%	2.0865	0.2599	0.5197	0.2531	2.0361	6.3173	1.2885	0.4363	0.5547
Price of pack	44%	2.4741	0.2451	0.5711	0.2416	1.8682	6.3259	1.4667	0.4167	0.6104
Price per kg	33%	1.9902	0.2221	0.4604	0.2145	2.1325	6.6765	1.3922	0.3346	0.4821
Sell-by date	31%	1.6702	0.2245	0.3773	0.2259	2.4391	8.0426	1.2447	0.3093	0.3916
Weight of pack	36%	1.7768	0.2546	0.4361	0.2694	2.2446	7.5268	1.3393	0.3435	0.4520

Besides breed, production practice labelling was tested and the results for grass-fed beef (see Image 4.7 and Table 4.12) are presented first. Of the labelling aspects, the “Grass fed” label was most likely to be focused on first (1.4195 seconds time to first fixation) and the most frequent (4.2132 fixation count), causing the longest average total fixation duration of 0.9427 seconds. It is interesting to note that the percentage of participants fixating on the “Grass fed” label and percentage fixating on the price of the pack are the same at 44%. One reason could be that consumers are interested in this form of production practice labelling but are expecting a higher price due to the “Grass fed” claim.

Subcategories

According to race, the highest fixation percentage on the “Grass fed” label was by the coloured participants, followed by black and then white participants. Higher-educated participants proved to have a higher tendency to fixate on the “Grass fed” label. This could be due to higher-educated people being more informed of the meaning of “grass-fed meat”. Younger participants showed a higher fixation percentage (18 to 30 age group: 53%), with older participants tending to show lower fixation percentages. Slightly more women fixated their attention on the label than men. Middle-income

participants showed the highest fixation percentage (50%), followed by high-income participants (47%) and low-income participants (39%).

“Free range” labelling was tested in the form of Image 4.8. The results are shown in Table 4.13.



Image 4.8: Beef steak with a “Free range” label

Table 4.13: Eye-tracking results for beef steak with a “Free range” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	31%	1.8737	0.2483	0.4475	0.2298	1.9956	5.7474	1.4000	0.3179	0.4675
Butchery name	21%	1.8769	0.2365	0.4320	0.2338	2.0235	7.1846	1.2615	0.3540	0.4488
Cut name	22%	1.8406	0.2435	0.4561	0.2359	1.9590	6.2899	1.2174	0.4145	0.4839
“Free range” label	41%	3.6850	0.2401	0.8730	0.2166	1.5969	5.2756	1.3858	0.7193	0.9680
Classification	17%	1.9412	0.2918	0.5143	0.2961	2.2788	7.3922	1.2157	0.4306	0.5424
Packaging date	32%	1.8687	0.2835	0.5065	0.2672	2.0871	6.2727	1.3535	0.3941	0.5240
Price of pack	40%	2.5772	0.2646	0.6093	0.2345	1.8338	5.6911	1.4878	0.4949	0.6697
Price per kg	30%	1.8132	0.2698	0.4465	0.2635	2.2525	7.0879	1.2857	0.3571	0.4699
Sell-by date	31%	1.9574	0.2282	0.4466	0.2218	2.1402	6.6596	1.2979	0.3606	0.4765
Weight of pack	31%	2.1458	0.2341	0.4939	0.2185	2.0559	7.0417	1.4792	0.3623	0.5329

The results for the “Free range” labelling image (see Image 4.8 and Table 4.13) correlate with the results from the “Grass fed” labelling in terms of the eye-tracking results. The “Free range” label received fixation from 41% of the participants for an average of 3.685 fixations per participant and an average total fixation duration of 0.8730 seconds.

Subcategories

According to race, the highest fixation percentages were measured for coloured participants (73%), followed by black (41%) and white (38%) participants. Education showed a mixed picture, with participants with a tertiary education scoring a fixation percentage of 47%, followed by participants with

Grade 1 to 7 at 45% and Grade 8 to 12 with 36%. Larger fixation percentages were measured for the three youngest participant age groups, with participants aged 31 to 40 years showing the highest fixation percentage at 48%. Gender showed very similar results (men: 41% vs. women: 42%), and middle-income participants (51%) and low-income participants (37%) showed a higher fixation percentage than high-income participants.

The preference for meat free from production ingredients such as antibiotics was investigated during the eye-tracking test with Image 4.9. The results are shown in Table 4.14.



Image 4.9: Beef steak with a “No antibiotics” label

Table 4.14: Eye-tracking results for beef steak with a “No antibiotics” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	30%	1.7609	0.2324	0.4097	0.2396	1.9897	5.9783	1.3478	0.2988	0.4185
Butchery name	18%	1.9259	0.1848	0.3585	0.1917	2.0326	6.9444	1.2778	0.2952	0.3889
Cut name	17%	1.5490	0.2190	0.3280	0.2133	1.9461	6.4902	1.2745	0.2614	0.3412
Classification	18%	1.6000	0.2489	0.3660	0.2575	2.2556	7.5273	1.2182	0.3284	0.3867
“No antibiotics” label	44%	3.9333	0.3157	1.1142	0.2716	1.5680	5.2444	1.4074	0.9805	1.3381
Packaging date	29%	1.7889	0.2604	0.4263	0.2496	1.9846	6.6667	1.3444	0.3410	0.4431
Price of pack	36%	2.6667	0.2150	0.6060	0.2056	1.8477	6.2793	1.5495	0.4147	0.6464
Price per kg	28%	1.7326	0.2409	0.4067	0.2258	2.0335	6.6628	1.2674	0.3537	0.4260
Sell-by date	30%	1.9565	0.2445	0.5210	0.2415	1.8596	6.3804	1.2717	0.4352	0.5389
Weight of pack	34%	2.0288	0.2334	0.4820	0.2214	1.9371	6.2115	1.4519	0.3258	0.4957

The eye-tracking results for Image 4.9, as shown in Table 4.14, suggest that this label was able to attract the attention of 44% of the participants, while the price of the pack and weight of the pack were able to attract the attention of 36% and 34% of the participants respectively. This label attracted more attention than other quality indicators such as “Free range” (41%), “Top quality guaranteed” (43%), and “Aged” beef (40%). One should expect that the colour of the label would also have an influence on

consumers' attention as in the case of product packaging as found by Ruumpol (2014). The labels also measured a relatively long average total fixation duration (1.1142 seconds) compared to the other production practice labels. This indicates that consumers are interested in red meat that is free of antibiotics.

Subcategories

The largest share of coloured participants (55%) fixated on the “No antibiotics” label, with 49% of white and 43% of black participants fixating on the label. Higher-educated participants showed higher fixation percentages to the label, with participants with a tertiary education showing a 48% fixation percentage. Regarding age, 52% of the participants in the 18 to 30 age group fixated on the label, with all the other age groups showing a declining trend when moving from young to older age groups. Just over half of the female participants (51%) fixated on the label compared to 40% of the men. A different trend was noticed in the income groups; an increase in fixation percentage was noticed as the income group increased, with the high-income group showing a 50% fixation percentage on the “No antibiotics” label.

Besides testing the fixation rate on the “No antibiotics” label, the study also investigated the “No added hormones” label, as presented in Image 4.10. The results shown in Table 4.15.



Image 4.10: Beef steak with a “No added hormones” label

Table 4.15: Eye-tracking results for beef steak with a “No added hormones label”

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	35%	1.6822	0.2087	0.3502	0.2012	1.9618	5.9346	1.2804	0.2724	0.3727
Butchery name	22%	1.7971	0.2629	0.4574	0.2552	1.9719	5.5942	1.1884	0.4154	0.4809
Cut name	19%	1.7069	0.2631	0.4286	0.2710	2.0517	6.0172	1.1897	0.3947	0.4688
Classification	17%	1.7692	0.2369	0.4071	0.2250	2.2894	7.5000	1.2500	0.3492	0.4288
“No added hormones” label	41%	3.7165	0.2912	1.1021	0.2390	1.6257	5.2205	1.3386	1.0125	1.2552
Packaging date	32%	1.7959	0.2968	0.5159	0.2711	1.9313	5.7143	1.2959	0.4085	0.5296
Price of pack	41%	2.4409	0.2694	0.5844	0.2740	1.7837	5.6220	1.4803	0.4518	0.6409
Price per kg	32%	1.8980	0.2184	0.4007	0.2143	2.2296	6.9898	1.3571	0.3264	0.4295
Sell-by date	31%	1.8021	0.2377	0.4267	0.2320	2.2754	7.1458	1.2708	0.3431	0.4457
Weight of pack	38%	2.0345	0.2629	0.5200	0.2535	2.1329	6.8190	1.3621	0.4201	0.5443

The “No added hormones” label (see Image 4.10) proved to be the aspect that was fixated on for the longest period of time of all the tested aspects in the image. It could be that the larger number of words on the label caused consumers to spend more time on the “No added hormones” label than other tested aspects. An average total fixation duration of 1.1021 seconds (see Table 4.15) was measured for this label. This label received views from the same percentage of participants as the price of the pack did (41%). Still, this percentage was slightly lower than what was measured for the “No antibiotics” label (see Image 4.9).

Subcategories

In terms of race, almost two-thirds of the coloured participants (64%) fixated on the “No added hormones” label, while 42% of the black and 31% of white participants paid attention to the label. Education, as in most of the other quality indicator labelling, showed an increase in the fixation percentages on the “no added hormones” labelling as the level of education increased. Age groups younger than 41 showed a tendency to fixate on the label at a higher rate than the average fixation percentage for the tested group as a whole. The highest fixation percentage (56%) was found for participants in the 31 to 40 age group. Women paid more attention to this form of labelling than men. The wealthy group showed the lowest fixation percentage towards “No added hormones” labelling and the middle-income group showed the highest fixation percentage (48%).

Organically produced meat labelling was investigated with Image 4.11, and the results are shown in Table 4.16.



Image 4.11: Beef steak with a “100% organic” label

Table 4.16: Eye-tracking results for beef steak with a “100% organic” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	35%	1.6667	0.2316	0.3931	0.2257	2.0803	6.5000	1.3148	0.3058	0.4201
Butchery name	23%	2.4429	0.2283	0.5187	0.2264	2.2016	7.4143	1.2286	0.4926	0.5603
Cut name	22%	2.0147	0.2626	0.5210	0.2541	2.3429	7.6176	1.3676	0.3941	0.5412
Classification	24%	1.8767	0.2629	0.5205	0.2649	2.1504	7.3288	1.3014	0.4100	0.5460
“100% organic” label	39%	3.3471	0.3124	0.8715	0.3016	1.7173	5.4628	1.3719	0.7664	0.9746
Packaging date	39%	1.8000	0.2452	0.4613	0.2412	2.0625	6.5250	1.3000	0.3547	0.4726
Price of pack	44%	2.7259	0.2227	0.6044	0.2240	1.5921	5.3556	1.5630	0.4239	0.6556
Price per kg	36%	2.0631	0.3081	0.5391	0.3249	1.9977	6.5045	1.3153	0.4759	0.5852
Sell-by date	30%	1.7957	0.2299	0.4217	0.2295	2.5398	8.3118	1.3011	0.3488	0.4374
Weight of pack	35%	2.0660	0.2434	0.4789	0.2357	2.1334	6.8396	1.3774	0.3604	0.5123

The “100% organic” label added in Image 4.11 was fixated on by 39% of the participants (see Table 4.16). This value is the same as the percentage that was found for the participants viewing the packaging date and lower than the share of participants fixating of the price of the pack (44%). Despite the lower fixation percentage, the “100% organic” label measured the highest total fixation duration (0.8715 seconds) and total fixation count (3.347) among the groups of participants.

Subcategories

The “100% organic” label showed a difference of 6% between the race that showed the highest fixation percentage (coloured participants: 45%) and the race that showed the lowest fixation percentage (black participants: 39%). The level of education showed a positive correlation to the fixation percentage, thus higher-educated participants were more likely to pay attention to the “100% organic” label. Organic labelling measured the highest fixation percentages among participants in the 31 to 40 age group (49%), followed by the 51 to 60 age group (40%). Women measured a fixation percentage that was 9% higher than the rate of men, indicating that women were more likely to fixate on the label than men. Income was also positively related to the fixation percentage.

Most of the beef produced in South Africa is grain-fed cattle finished in feedlots. To test the participants' attention to "Grain fed" labelling, Image 4.12 was tested, with the results from the test shown in Table 4.17.



Image 4.12: Beef steak with a "Grain fed" label

Table 4.17: Eye-tracking results for beef steak with a "Grain fed" label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	34%	2.0476	0.2586	0.4850	0.2476	1.8575	5.6381	1.4000	0.3561	0.5192
Butchery name	18%	2.0714	0.2345	0.4798	0.2293	1.9725	6.0357	1.1786	0.4380	0.5180
Cut name	19%	1.7288	0.2376	0.4332	0.2324	2.3047	8.3898	1.2712	0.3481	0.4400
Classification	22%	1.7536	0.2270	0.3719	0.2307	2.2401	7.7101	1.3188	0.3177	0.3994
"Grain fed" label	40%	3.2258	0.3071	0.8542	0.2865	1.7966	6.2258	1.4113	0.7297	0.9676
Packaging date	32%	2.0309	0.2637	0.5384	0.2448	2.1405	6.8557	1.2887	0.4376	0.5638
Price of pack	37%	2.6754	0.2117	0.5457	0.1998	1.9017	6.4386	1.5088	0.4017	0.6282
Price per kg	28%	2.1882	0.2535	0.5082	0.2661	1.9716	6.0235	1.3176	0.4359	0.5796
Sell-by date	28%	2.2235	0.2332	0.5100	0.2361	2.0553	6.3647	1.4235	0.3768	0.5429
Weight of pack	33%	2.0693	0.2688	0.5171	0.2644	1.9173	6.1089	1.4158	0.3920	0.5474

The results in Table 4.17 reveal that the aspect that had the highest fixation percentage was the "Grain fed" label (40%), followed by the price of the pack (37%). This value is 10% lower than the share of participants viewing the "Grass fed" label in Image 4.7. The "Grain fed" label measured a longer average time to first fixation (1.7966 seconds) than the "Grass fed" label (1.4195 seconds), which implies that the participants looked at the "Grass fed" label at an earlier stage than they looked at the "Grain fed" label. The "Grain fed" label was still the aspect with the shortest time to first fixation in Image 4.12. Thus, despite receiving attention at a later stage than the "Grass fed" label, it still received attention first in Image 4.12.

Subcategories

The "Grain fed" label measured the highest fixation percentage (47%) among white participants, followed by coloured (45%) and black (39%) participants. There were clear increases in the fixation percentage as the level of education increased. According to age, the two younger age groups (18 to

30 and 31 to 40) showed a higher fixation percentage (48% and 50% respectively) on the “Grain fed” label, with participants in the 31 to 40 age group scoring the highest fixation percentage at 50%. As in the case of most other production practice labelling, women were more likely to pay attention to the label than men. Higher income levels measured higher fixation percentages on the “Grain fed” label, with the wealthy group scoring a fixation percentage of 47%.

“Certified humane” was another production practice label that was tested. Image 4.13 was tested, and the results are shown in Table 4.18.



Image 4.13: Beef steak with a “Certified humane” label

Table 4.18: Eye-tracking results for beef steak with a “Certified humane” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	36%	1.7500	0.2214	0.3894	0.2088	2.0691	5.6786	1.4554	0.2810	0.4170
Butchery name	24%	1.7397	0.2348	0.4127	0.2400	2.2126	7.1644	1.1644	0.3616	0.4345
Cut name	19%	1.7241	0.2217	0.3776	0.2097	1.7634	6.3276	1.2414	0.3062	0.3876
Classification	23%	1.6338	0.2237	0.3596	0.2266	1.9579	6.4085	1.1831	0.3252	0.3699
“Certified humane” label	38%	4.0862	0.2819	1.1132	0.2689	1.9116	6.1379	1.3017	1.0028	1.2528
Packaging date	36%	2.0182	0.2350	0.4805	0.2255	2.1129	6.5182	1.4636	0.3279	0.4985
Price of pack	39%	2.3140	0.2340	0.5351	0.2422	2.0050	6.0165	1.4463	0.4045	0.5744
Price per kg	31%	1.9681	0.2628	0.5143	0.2615	2.0941	6.7660	1.3830	0.4173	0.5469
Sell-by date	31%	2.0417	0.2600	0.4808	0.2648	1.9345	6.2396	1.4479	0.3671	0.5022
Weight of pack	37%	1.9043	0.3125	0.5205	0.3098	1.9534	6.4348	1.3913	0.4000	0.5350

The results from Image 4.13 (see Table 4.18) show that despite adding the “Certified humane” label to the pack, the price of the pack received the largest percentage of consumer fixation (39%). The “Certified humane” label’s time to first fixation was the lowest of all the aspects. It should be reported that this measurement was closer to the average time to first fixation of the other aspects in Table 4.18 than what was tested for other production practice labels. The “Certified humane” label was fixated on by 38% of the participants for an average total fixation duration of 1.1132 seconds and average fixation

count score of 4.0862. These results indicate that the participants were less interested in the fact that their red meat was produced humanely than they were in the fact that their red meat was free of antibiotics.

Subcategories

The “Certified humane” label measured a 55% fixation percentage among the coloured participants, 38% among white participants, and 37% among black participants. The education subcategories showed the highest fixation percentages for participants with a tertiary education (45%), followed by participants with Grade 1 to 7 (36%) and participants with Grade 8 to 12 (32%). The two younger age groups measured the same fixation percentage at 44%, with all the other groups showing a decline in fixation percentage the older the groups become. Women were more likely than men to pay attention to the label, although the difference between the genders (2%) was smaller than in most of the other quality indicator labelling. The middle-income group showed the highest fixation percentage (45%), followed by the high-income group (34%) and the low-income group (33%).

4.3.2.4 Mutton meat production practice labelling

Mutton/lamb meat labelling was also tested. Image 4.14 shows one pack of meat that has a pricing label and a “100% organic” production practice label. The results are shown in Table 4.19.



Image 4.14: Mutton with a “100% organic” label

Table 4.19: Eye-tracking results for mutton with a “100% organic” label

Aspect	Percentage mean	Fixations						Visits		
		Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	9%	1.4444	0.1781	0.2563	0.1770	2.9867	11.2593	1.1481	0.2419	0.2693
Butchery name	23%	2.1127	0.2010	0.4194	0.1992	2.3599	8.0423	1.1690	0.4403	0.4877
Cut name	17%	2.1961	0.2286	0.4971	0.2259	2.4433	8.6078	1.2353	0.4478	0.5424
Classification	28%	1.9885	0.1915	0.3938	0.1902	2.1209	6.9885	1.2414	0.3197	0.4099
“100% organic” label	46%	3.1986	0.2533	0.7696	0.2391	1.7304	5.8723	1.3475	0.7119	0.8961
Packaging date	15%	1.6596	0.1932	0.3170	0.1915	2.9062	10.2128	1.1277	0.3081	0.3515
Price of pack	53%	2.6646	0.2170	0.5548	0.2017	1.9912	6.4329	1.4939	0.4074	0.6021
Price per kg	19%	2.1053	0.2089	0.4251	0.2128	2.7061	8.6140	1.2982	0.3625	0.4644
Sell-by date	25%	2.1974	0.2293	0.4983	0.2226	2.3737	7.6579	1.3421	0.4138	0.5371
Weight of pack	37%	1.8246	0.2539	0.4327	0.2510	2.3133	7.6579	1.4474	0.3165	0.4534

In terms of the labelling of mutton with a “100% organic” label (see Image 4.14), the results in Table 4.19 show that the price of the pack enjoyed the highest percentage of participants’ fixations (53%),

followed by the “100% organic” label (46%), and the weight of the pack (37%). With previous production practice labels, the price of the pack tended to be fixated on by a smaller percentage of participants. The difference between the percentage fixated on the price of the pack and the “100% organic” label might be caused by the higher price per kg for mutton as opposed to beef. Labelling aspects that were fixated on at an earlier stage of the test were the “100% organic” label (1.730 seconds), price of the pack (1.9912 seconds), and the classification of the meat. It seems that consumers were more wary of the price of pack for the mutton meat than that of the beef meat. This might be due to the results found from the post-test questionnaires where some consumers stated that they purchased sheep meat less often than beef due to the higher price. Labelling aspects that captured the attention of the participants for the longest periods of time were the “100% organic” label (0.7696 seconds), price of the pack (0.5548 seconds), and sell-by date (0.4983 seconds).

Subcategories

The “100% organic” label measured the highest fixation percentage from the coloured participants (64%), followed by black participants (46%) and white participants (38%). Education did not show a clear correlation to the fixation percentage on the label, with participants with a tertiary education scoring a 52% fixation percentage, followed by participants with Grade 8 to 12 (41%) and participants with Grade 1 to 7 (45%). Age groups showed an increasing trend in the fixation percentages up to the 41 to 50 age group, where the rate reached a maximum of 51%, and then decreased in the older categories. Gender statistics showed that 3% more women than men fixated on the label. According to income groups, the highest fixation percentage was measured in the middle-income group (53%), followed by the low-income group (42%), and high-income group (41%).

Image 4.15 shows the same cuts of mutton, but with a “Free range” label placed on the pack instead of a “100% organic” label as in Image 4.21. The results are shown in Table 4.20.



Image 4.15: Mutton meat with a “Free range” label

Table 4.20: Eye-tracking results for mutton with a “Free range” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	8%	1.4231	0.1896	0.2615	0.1904	3.0388	10.0000	1.2308	0.2158	0.2658
Butchery name	20%	2.2097	0.1839	0.4003	0.1939	2.4368	8.3710	1.1613	0.3806	0.4350
Cut name	14%	1.9535	0.2095	0.4226	0.2086	2.3374	8.8372	1.3721	0.2891	0.4335
“Free range” label	51%	3.2372	0.2044	0.6928	0.2047	1.8060	6.2564	1.2436	0.6803	0.7905
Classification	24%	1.7808	0.2016	0.3604	0.1952	2.2432	7.9452	1.2055	0.3373	0.4018
Packaging date	13%	2.1026	0.1828	0.4054	0.1918	2.7254	9.8462	1.3590	0.3008	0.4256
Price of pack	50%	2.5974	0.2016	0.5265	0.2027	2.0608	7.1299	1.5260	0.3777	0.5704
Price per kg	18%	2.0893	0.2016	0.4352	0.2000	2.8461	10.4643	1.2321	0.4002	0.4721
Sell-by date	18%	2.2364	0.2011	0.4425	0.2093	2.5695	9.3273	1.2364	0.3745	0.4765
Weight of pack	36%	2.0364	0.2062	0.4052	0.2202	2.2265	7.7545	1.3000	0.3355	0.4320

The results from Table 4.20 (for Image 4.15) show that unlike the previous image, the “Free range” label measured a higher fixation percentage among participants than the price of the pack (51% vs. 50%). It could be that the design of the “Free range” label was able to attract more attention from consumers than the “100% organic” label. This could be due to the number and size of words on the label, as well as the colour scheme of the label. The results might also suggest that consumers are more open to the concept of buying free-range mutton than organic mutton. The other labelling aspects showed similar results to the “100% organic” label image (see Image 4.32) in terms of the percentage of participants fixating on the labels. Time to first fixation also followed the same pattern; however, on average it took participants longer before fixating on the “Free range” label (1.8060 seconds vs. 1.7304 seconds) and the price of the pack (2.0608 seconds vs. 1.9912 seconds) in this image and the participants fixated on the aspects for a shorter time.

Subcategories

The “Free range” label’s fixation percentages showed similar results to the “100% organic” label, where coloured participants measured a fixation percentage of 82%, with black and white participants scoring 50% and 47% respectively. The level of education showed a positive relationship to the fixation percentage on the label, while age showed a negative correlation. Thus, older participants tended to pay less attention to the “Free range” label. The 18 to 30 age group measured a 56% fixation percentage. The results according to gender showed that a larger share of male participants than female participants paid attention to the label. Income groups showed that the fixation percentage on the “Free range” label increased as income increased.

4.3.2.5 After-slaughter practices

Adding the Halal sign on packs of beef was tested in Image 4.16. The eye-tracking results are shown in Table 4.21.



Image 4.16: Beef steak with a “Halal” label

Table 4.21: Eye-tracking results for beef steak with a “Halal” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	35%	2.0377	0.2138	0.4505	0.2072	2.0003	5.8396	1.3868	0.3635	0.5130
Butchery name	20%	2.1148	0.2705	0.5007	0.2767	2.0241	7.4262	1.1967	0.4464	0.5366
Cut name	16%	1.4792	0.2248	0.3365	0.2185	2.4079	8.2708	1.1458	0.3146	0.3456
Classification	18%	1.5818	0.2258	0.3531	0.2178	2.2540	7.5455	1.2545	0.3253	0.3925
“Halal” label	38%	3.3276	0.2763	0.8653	0.2656	1.6444	5.5431	1.4052	0.6950	0.9497
Packaging date	32%	2.0306	0.2362	0.4806	0.2337	2.0488	6.9898	1.3469	0.3845	0.5063
Price of pack	42%	2.4692	0.2435	0.5896	0.2248	1.8186	5.8154	1.4385	0.4618	0.6492
Price per kg	31%	2.0000	0.2963	0.5305	0.3024	2.1211	7.1263	1.4105	0.3905	0.5471
Sell-by date	32%	1.9293	0.2507	0.4854	0.2530	2.2237	7.1010	1.2929	0.4003	0.5109
Weight of pack	36%	2.1284	0.2640	0.5368	0.2782	1.9651	6.6055	1.3853	0.4225	0.5784

The “Halal” label (see Image 4.16 and Table 4.21) was fixated on by slightly fewer participants (38%) than other production practice labelling, and also measured a lower total fixation duration (0.8653 seconds) and lower average fixation count (3.3175 seconds). The price of the pack was viewed by more participants (42%) than the “Halal” label. Still, the average time to first fixation and fixations count before fixation on the “Halal” label suggest that the “Halal” label was fixated on first out of all the labelling aspects. The lower fixation percentage could be due to the participants being more familiar with the label and the claims it entails, or it was not important to locate the sign on the meat they buy.

Subcategories

The “Halal” label was fixated on by a larger share of coloured participants (64%) than black (38%) and white (31%) participants. Education did not seem to cause an increase in the percentage fixated of the participants. More younger participants tended to pay attention to the “Halal” label, with the 31 to 40 age group showing the highest fixation percentage (55%). Gender statistics showed that 10% more female than male participants fixated on the label. The middle-income group measured the highest fixation percentage (42%), followed the lower-income group (37%) and higher-income group (31%).

A “Top quality guaranteed” label was tested in the form of Image 4.17 and the results for participants’ attention to this quality guarantee are presented in Table 4.22.



Image 4.17: Beef steak with a “Top quality guaranteed” label

Table 4.22: Eye-tracking results for beef steak with a “Top quality guaranteed” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	29%	2.0667	0.2404	0.5293	0.2224	1.7810	5.3889	1.4889	0.3640	0.5567
Butchery name	19%	1.9661	0.2807	0.4785	0.2824	2.2302	6.6610	1.1695	0.4595	0.5254
Cut name	17%	1.5660	0.2036	0.3296	0.1936	2.2943	7.3396	1.2264	0.2713	0.3474
Classification	13%	1.8750	0.2433	0.4213	0.2490	2.1358	7.4500	1.2250	0.3703	0.4450
Packaging date	30%	2.1505	0.2547	0.5483	0.2415	2.3599	7.5914	1.4086	0.4203	0.5998
Price of pack	37%	2.5664	0.2527	0.6165	0.2473	1.7796	5.7522	1.4690	0.4952	0.6728
Price per kg	29%	1.9444	0.2394	0.4552	0.2282	2.2161	7.4667	1.3889	0.3294	0.4706
“Top quality guaranteed” label	43%	3.2290	0.2397	0.7981	0.2021	1.6911	5.5649	1.3893	0.6740	0.8844
Sell-by date	27%	1.8095	0.2905	0.4971	0.2829	2.0085	6.4881	1.1667	0.4925	0.5506
Weight of pack	31%	1.9789	0.2536	0.4685	0.2474	2.1409	7.1789	1.2842	0.3954	0.4966

The “Top quality guaranteed” label (see Image 4.17 and Table 4.22) measured the longest total fixation duration (0.7981 seconds) and the highest fixation count (3.2290). Contrary to the “Halal” label and similar to the “Grass fed” and “Free range” labels, more participants fixated on the “Top quality guaranteed” label (43%) than they did on the price of the pack (37%). Besides the quality guarantee, the aspects that enjoyed attention from the largest share of the participants were the price of the pack (37%), weight of the pack (31%), and packaging date (30%). One would expect that consumers would be in favour of a quality guarantee based on the measurements that were collected for the fixation percentages on the “Top quality guaranteed” label. The colour of the label might also have had an effect on consumers’ attention. Besides the “100%” written on the label, the rest of the words were smaller and could have led to the longer total fixation count.

Subcategories

The “Top quality guaranteed” label was viewed by the largest share of coloured participants (73%), followed by white (47%) and then black participants (41%). Higher levels of education seem to have

caused higher fixation percentages, with participants with a tertiary education scoring a fixation percentage of 51%. The two younger age groups measured a lower fixation percentage, with the 18 to 30 age group scoring 49% and the 31 to 40 age group scoring 55%. The older age groups all showed lower fixation percentages than calculated as the average for the whole group. Gender showed only a 1% difference between men and women, with women scoring a fixation percentage of 43%. This could indicate that a quality guarantee is virtually of the same importance to men as to women. Among the income groups, the “Top quality guaranteed” label seems to have enjoyed higher levels of attention from the high-income participants (47%), which is closer to the middle-income group’s score (49%), and also higher than the score for the lower-income group (36%).

Aged beef claims were tested in the form of an “Aged” label (see Image 4.18) to show that the beef has been aged. The results are shown in Table 4.23.



Image 4.18: Beef steak with an “Aged” label

Table 4.23: Eye-tracking results for beef steak with an “Aged” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
“Aged” label	40%	3.6803	0.2425	0.7880	0.2041	1.6958	5.4754	1.5410	0.6517	0.9426
Bar code	34%	1.9038	0.2271	0.4306	0.2213	1.9622	6.0865	1.4615	0.2969	0.4488
Butchery name	22%	2.1642	0.2193	0.4561	0.2225	2.0776	7.6269	1.2090	0.4146	0.4779
Cut name	22%	1.8955	0.2215	0.4328	0.2267	1.9582	6.6269	1.2836	0.3391	0.4493
Classification	22%	1.8235	0.2281	0.3821	0.2288	2.2869	8.0588	1.3529	0.3154	0.4241
Packaging date	32%	2.0408	0.2749	0.5290	0.2626	2.0367	6.2551	1.4082	0.3999	0.5510
Price of pack	41%	2.3386	0.2287	0.5329	0.2323	2.0967	6.8110	1.4094	0.4238	0.5817
Price per kg	32%	1.8660	0.2420	0.4371	0.2661	2.0113	6.6804	1.2990	0.3704	0.4697
Sell-by date	25%	1.9610	0.2458	0.4986	0.2639	1.9848	6.7662	1.2857	0.4082	0.5205
Weight of pack	37%	1.8070	0.2398	0.4284	0.2471	2.1094	6.9123	1.2544	0.3560	0.4427

The “Aged” label on the pack was fixated on by 40% of the participants (see Image 4.18 and Table 4.23). This is just less than the 41% of the participants who fixated on the price of the pack. Similar to the quality indicators already discussed, the “Aged” label measured the highest average fixation count

(3.683 seconds), as well as the longest average total fixation duration. This indicates that consumers in the tested area were more in favour of “Aged” beef labelling than “Halal” labelling; however, they are still more in favour of “Top quality guaranteed” labelling than “Aged” meat labelling. Religion and beliefs will also play a role in the attention paid to the “Halal” labelling. The lower fixation percentage on the “Aged beef” label could be due to the label being less salient than other quality indicators that were used. The wording on the label was larger than the previous images, which could have been read in a shorter period, leading to the slightly shorter total fixation duration.

Subcategories

“Aged” beef labelling enjoyed the highest fixation percentage among coloured (55%) and black participants (40%), while white participants measured the lowest score (36%). Mixed results were found for education, where participants with Grade 1 to 7 measured a 36% fixation percentage, participants with Grade 8 to 12 a 35% fixation percentage, and participants with a tertiary education a 46% fixation percentage. Again, the two younger age groups measured higher fixations scores (18 to 30 age group: 43% and 31 to 40 age group: 50%) than the whole group’s average, and the older groups all measured lower fixation rates. A 13% difference was seen between women’s fixation percentage (48%) and men’s fixation percentage (35%). Compared to the “Top quality guaranteed” label, where both genders measured similar results, these results show a clear difference between men and women. Women would be a more appropriate target market for “Aged” meat labelling than men. Income groups, as in most of the quality indicator labelling, showed the highest fixation percentage in the middle-income group (45%), followed by the lower-income group (37%), and the high-income group (34%).

The general picture sketched from the results for the quality indicators, which exclude aspects such as breed, origin, and brand, is as follows. These forms of labelling caused a reduction in the percentage of participants paying attention to the price of the pack, the butchery’s name, and the classification of the meat. Because the images were shown randomly to all consumers, it is not expected that the changes in terms of quality labelling caused a reduction in the attention paid to the price label information due to consumers becoming accustomed to the price label information used.

All these labels showed a relatively high fixation percentage from the participants, but it should be noted that it was at a lower level than measured by the brand and breed labels. Compared to Image 4.1, which only contained the price label, an increase in the percentage fixated on the packaging date and sell-by date was noticed for these packs of beef. This was not the case for mutton/lamb, which still showed low fixation percentages on the freshness indicators (sell-by and packaging date) and high fixation percentages on the price of the pack and the tested quality indicators. This could be explained by the higher meat price shown for mutton, causing consumers to be more price sensitive regarding buying mutton products.

4.3.2.6 Traceability measures

The participants’ attention to meat origin claims were tested with different labels. Some of the origin claims really exist while others were developed specifically for the study. One of the labels that was developed for the study was “Free State Meat” (see Image 4.19 and Table 4.24), which could be used to test consumers’ reaction to provincial origin claims.



Image 4.19: Beef steak with a “Free State Meat” label

Table 4.24: Eye-tracking results for beef steak with a “Free State Meat” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	24%	1.8649	0.2455	0.4564	0.2380	1.8926	5.8919	1.4459	0.3176	0.4738
Butchery name	22%	1.9130	0.2365	0.4239	0.2330	2.4968	8.5507	1.1884	0.4065	0.4754
Cut name	21%	1.6667	0.2415	0.4068	0.2302	2.5261	8.4848	1.2576	0.3271	0.4189
“Free State Meat” label	63%	4.4531	0.2618	1.1326	0.2634	1.3680	4.2500	1.6302	0.8367	1.2606
Classification	18%	1.4464	0.2241	0.3345	0.2404	2.9104	10.0893	1.1250	0.3055	0.3454
Packaging date	29%	1.6111	0.2251	0.3867	0.2214	2.3549	7.7556	1.2333	0.3086	0.4039
Price of pack	42%	2.3615	0.2355	0.5715	0.2252	2.1027	6.8538	1.5231	0.3995	0.6029
Price per kg	35%	1.9245	0.2271	0.4199	0.2311	2.0970	6.9906	1.3774	0.3154	0.4342
Sell-by date	31%	1.9255	0.2394	0.4693	0.2168	2.2296	7.6489	1.3191	0.3735	0.4899
Weight of pack	33%	1.6667	0.2260	0.3992	0.2141	2.4529	8.0882	1.2451	0.3089	0.4130

The “Free State Meat” label (see Image 4.19) measured a time to first fixation of 1.3680 seconds (see Table 4.24), with an average total fixation duration of 1.1326 seconds, and was fixated on by 63% of the participants. The low number of average fixations before fixating on the label for the first time (4.2500) and short time to first fixation suggest that the label attracted the participants’ attention with reasonable success. The “Free State Meat” label was on average fixated on more than double the number of times the other aspects were (4.4531 average fixation count). It is possible that the location of the label influenced the measurement recorded for the label. It seems that by placing the label on the meat and not beneath the meat improved the attention that the consumers paid to labelling.

The label used was also a fictional label and the unfamiliarity could have increased the percentage of consumers paying attention to the label.

Subcategories

Race showed the same trend, where coloured participants (91%) were more likely to fixate on the “Free State Meat” label than white (67%) and black (60%) participants. A clear increase can be seen with regard to education (Grade 1 to 7: 41%, Grade 8 to 12: 58%, tertiary education: 72%). Age showed a higher tendency for participants in the middle-aged group, with the 31 to 40 age group scoring a 67% fixation percentage, the 41 to 50 age group a 65% fixation percentage, and the 51 to 60 age group a 66% fixation percentage. A larger share of women fixated on the “Free State Meat” label (65%) than men (61%). The middle-income group showed the highest fixation percentage (73%), followed by high-income participants (69%) and low-income participants (52%).

Following the “Free State Meat” label that represents a province, a “Proudly made in SA” product label was added to the test image (see Image 4.20). The eye-tracking results are shown in Table 4.25.



Image 4.20: Beef steak with a “Proudly made in SA” label

Table 4.25: Eye-tracking results for beef steak with a “Proudly made in SA” label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	30%	1.8462	0.2295	0.4178	0.2201	1.8785	6.1758	1.4396	0.2979	0.4474
Butchery name	18%	2.4259	0.3096	0.6024	0.2957	2.2087	7.5000	1.2778	0.5119	0.6631
Cut name	16%	1.8776	0.2147	0.3755	0.2080	2.0490	7.1633	1.2449	0.3271	0.3986
Classification	19%	1.5517	0.2450	0.3847	0.2307	1.9976	6.5172	1.2069	0.3231	0.3902
Packaging date	33%	1.8800	0.2647	0.4812	0.2815	2.0436	6.8900	1.3900	0.3604	0.5012
Price of pack	38%	2.6186	0.2191	0.5775	0.2103	1.9871	6.3390	1.4915	0.4475	0.6364
Price per kg	31%	2.0938	0.2390	0.5101	0.2305	2.1149	6.9167	1.4375	0.3694	0.5410
“Proudly made in SA” label	38%	3.9145	0.2458	0.9479	0.2350	1.7107	5.4444	1.4615	0.7960	1.0950
Sell-by date	28%	2.3488	0.2508	0.5705	0.2626	2.0387	6.6628	1.3953	0.4244	0.6043
Weight of pack	34%	1.9038	0.2275	0.4224	0.2195	2.2194	7.1154	1.3269	0.3286	0.4403

The results from the eye-tracking test for the “Proudly made in SA” label (see Table 4.25) showed that 38% of the participants fixated on the label for an average total fixation duration of 0.9479 seconds. Time to first fixation for the “Proudly made in SA” label measured lower (1.7107 seconds) than for the

other aspects. Thus, the “Proudly made in SA” label was the labelling aspect that on average was focused on first. This measurement was, however, higher than the measurement obtained by the “Free State Meat” label (1.3680 seconds). The results suggest that the participants seemed more likely to notice their own province’s claims in a shorter time than national claims. This could be caused by consumers being more familiar with the “Proudly made in SA” label, which created less curiosity among consumers as in the case of newly created labelling. The location of the labelling could also have caused that fewer consumers fixated on the label during the five-seconds test period.

Subcategories

The “Proudly made in SA” label was viewed at a higher rate among the coloured participants (45%), followed by black (39%) and white (33%) participants. Fixation percentages on the label increased as the level of education increased. The age category that showed the highest fixation percentages for participants was the 18 to 30 age group (47%), with declining scores for older groups. More women than men paid attention to the “Proudly made in SA” label (40% vs. 37%). Interestingly, the income groups showed that the middle-income groups (41%) and lower-income groups (37%) paid more attention to the “Proudly made in SA” label than the high-income group (36%).

The effect of adding a QR code on the pack was investigated as a different form of traceability measure (see Image 4.21 and Table 4.26).



Image 4.21: Beef steak with a pricing label and a Quick Response (QR) code

Table 4.26: Eye-tracking results for beef steak with a pricing label and a QR code

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	19%	1.5439	0.1884	0.2949	0.1846	2.3446	6.9649	1.2456	0.2337	0.3109
Butchery name	23%	2.3889	0.2086	0.4894	0.2101	2.4558	8.7222	1.2639	0.4428	0.5421
Cut name	17%	2.2264	0.2136	0.5062	0.2272	2.5181	9.3585	1.3208	0.4142	0.5428
Classification	25%	1.9351	0.1921	0.3839	0.1823	2.1835	7.5584	1.2597	0.3138	0.4095
Packaging date	20%	1.8033	0.2331	0.4156	0.2395	2.1777	7.9508	1.3115	0.3493	0.4580
Price of pack	47%	2.8264	0.1924	0.5321	0.2074	1.7673	6.1111	1.5833	0.3738	0.5839
Price per kg	26%	2.1500	0.2101	0.4656	0.1996	2.1800	7.7375	1.3500	0.3766	0.4954
QR code	35%	1.6262	0.2221	0.3609	0.2157	2.0172	6.8785	1.2617	0.2966	0.3768
Sell-by date	43%	2.1053	0.2145	0.4597	0.2075	1.8868	6.3308	1.3759	0.3485	0.4850
Weight of pack	49%	2.3179	0.2338	0.5066	0.2293	1.7318	5.8278	1.4172	0.3872	0.5332

The results from the eye-tracking test for a pack of beef with a pricing label and a QR code are shown in Table 4.26. Compared to Table 4.28, which contains a QR code and an NIT on the pack, these results show an increase in the participants' viewing percentages for all the tested aspects. The QR code received fixations from 35% of the participants, compared to 26% in Image 4.23.

Subcategories

Subcategory data showed higher fixation percentages on the QR code for all of the races compared to Table 4.28, where the NIT was also on the pack along with the QR code. The highest fixation percentage was from the black participants (37%), followed by the coloured (36%) and white (24%) participants. Education showed a positive correlation to the fixation percentage of participants on the QR code. Regarding age, the data showed that in the 18 to 30 and 41 to 50 age groups the fixation percentages were higher than the group average score between all participants. Women measured a 9% higher fixation percentage than men on the QR code. The middle-income group paid the most attention to the QR code (38%), followed by low-income (35%) and high-income participants (28%).

These labels, which verified the origin of the meat in the pack, showed high fixation percentages as found for other forms of quality indicators. Adding these labels to the pack led to lower fixation percentages on the price of the pack, the butchery's name, and the classification of the meat. An increase was seen in the fixation percentages for the sell-by and packaging dates in these images. It should be noted how the fixation percentages differed between the label indicating provincial origin ("Free State Meat": 63%) and country of origin ("Proudly made in SA": 38%). This could be the result of two causes. The participants were all tested in the Free State province and might have a stronger feeling towards buying (provincially) locally produced meat than nationally (South African) produced meat. It might also be that the participants were more used to seeing the "Proudly made in SA" label on products than the tested "Free State Meat" counterpart and were thus more likely to fixate on the "Free State Meat" label than the "Proudly made in SA" label.

4.3.2.7 Nutritional labelling

The participants' attentional response to nutritional information shown on the pack of meat was also tested. To test their response, different forms of labelling that contain nutritional information were placed on the tested images.



Image 4.22: Beef steak with a pricing label and nutritional information table (NIT)

Table 4.27: Eye-tracking results for beef steak with a pricing label and NIT

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	14%	1.4186	0.1863	0.2656	0.1891	1.9830	6.0233	1.2558	0.2156	0.2721
Butchery name	17%	2.2745	0.2039	0.4769	0.2102	1.8484	6.8627	1.3137	0.4069	0.5096
Cut name	17%	1.7647	0.2065	0.3761	0.1992	1.9225	6.6667	1.2941	0.3063	0.3878
Classification	18%	2.0536	0.2252	0.4689	0.2102	1.8636	6.4286	1.3036	0.3736	0.4975
NIT	63%	4.2240	0.2123	0.9020	0.1907	1.8448	5.7448	1.3490	0.8421	1.0539
Packaging date	15%	1.7556	0.1938	0.3373	0.1998	2.2749	7.9333	1.1111	0.3191	0.3664
Price of pack	45%	2.7372	0.1993	0.5442	0.1936	1.7982	6.1606	1.5620	0.3969	0.6072
Price per kg	22%	1.9104	0.2157	0.4173	0.2148	2.4654	8.8060	1.3433	0.3354	0.4466
Sell-by date	27%	1.7143	0.2079	0.3632	0.2062	2.1496	6.9643	1.1786	0.3115	0.3876
Weight of pack	40%	1.9839	0.2149	0.4260	0.2046	1.7668	5.9032	1.3710	0.3366	0.4433

The nutritional information added to the pack of meat (see Image 4.22) had an influence on how the participants looked at labelling information (see Table 4.27). The added NIT was the aspect that received attention from the largest share of the participants (63%). When compared to Table 4.6, which tested the pack containing only the pricing label, adding an NIT caused a reduction in the percentage of participants fixating on the price of the pack (45%), the butchery's name (17%), and the classification of the meat (18%). However, an increase in the percentage of participants' fixation on the weight of the pack and the sell-by date was seen. The increase seen in the attention given to the weight of the pack could be due to the nutritional information that is shown per serving size indicated in grams and the participants' attempt to determine the nutritional information of the specific portion of meat in the pack. The addition of the NIT not only led to a reduction in the percentage of participants fixating on the price of the pack but also caused slight reduction in the average fixation count on the price of the pack (2.737 vs. 2.822 in Table 4.6), as well as a slight reduction in the average total fixation time on the price of the pack (0.5442 seconds vs. 0.5733 seconds in Table 4.6).

Subcategories

When focusing specifically on the subcategories' attention to the NIT, it was noted that a larger share of the black and coloured participants paid attention to the NIT (64% for both groups) than was the case for white participants (53%). Participants with degrees showed a slightly higher tendency to fixate on the NIT (70%) than participants with Grade 1 to 7 (50%) and Grade 8 to 12 (59%). Age showed a

decreasing trend from the age group 18 to 30 years (74%) to age group 51 to 60 years (45%), with an increase again in the 61 to 70 age group (65%). Women showed a 10% higher fixation percentage than men on the NIT. According to income groups, the highest fixation percentage was measured by the middle-income group (70%), followed by the low-income (59%) and high-income groups (57%).

Besides adding an NIT to the pack on the test image, a QR code was also added (see Image 4.23 and Table 4.28) to test the participants' awareness of the QR label.



Image 4.23: Beef steak with a pricing label, NIT, and a QR code

Table 4.28: Eye-tracking results for beef steak with a pricing label, NIT, and a QR code

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	19%	1.3860	0.1742	0.2521	0.1747	1.8616	6.0000	1.1404	0.2091	0.2595
Butchery name	21%	2.1111	0.1994	0.4141	0.1952	2.4010	8.1111	1.1746	0.3940	0.4467
Cut name	13%	1.9500	0.1783	0.3665	0.1765	1.8723	6.4500	1.3250	0.3068	0.4008
Classification	20%	1.6167	0.2077	0.3370	0.1918	2.4715	8.7167	1.1833	0.3073	0.3517
NIT	65%	4.2450	0.1992	0.8593	0.1866	1.7868	5.7400	1.4600	0.7432	1.0108
Packaging date	14%	1.3864	0.2300	0.3093	0.2309	2.2909	7.9773	1.1364	0.2793	0.3152
Price of pack	44%	2.6370	0.2069	0.5419	0.2083	1.7521	5.5407	1.4000	0.4176	0.5927
Price per kg	21%	1.9531	0.2056	0.4092	0.1969	2.1025	7.1250	1.2813	0.3305	0.4267
QR code	26%	1.6076	0.2065	0.3220	0.2044	2.1808	7.7975	1.2532	0.2710	0.3425
Sell-by date	30%	1.9462	0.2048	0.4334	0.2065	2.0047	6.7097	1.2258	0.3918	0.4603
Weight of pack	38%	2.0085	0.2063	0.4001	0.2103	1.8275	5.8559	1.3644	0.3208	0.4329

The results for the image that contained an NIT and a QR code are shown in Table 4.28. Adding the QR code led to an increase in the percentage of participants fixating on the NIT (65% vs. 63% in Table 4.27). The QR code received attention from 26% of the participants for an average total fixation time of 0.3220 seconds. The results furthermore show a 1% decrease in the participants' viewing of the price of the pack, packaging date, and price per kg. The number of fixations before fixating on the QR code suggest that the QR code, with a relative high measurement (7.7975), received the participants' attention at a later stage in the test than compared to the price of the pack (5.5407) and the NIT (5.7400). It seems that adding more labels to the pack provides consumers with more information but less time to pay attention to each element.

Adding the QR code along with the NIT showed that black participants fixated on the QR code the most (29%), followed by white participants (11%). Adding the QR code to the pack caused an increase in the fixation percentage of all the races on the NIT.

A higher level of education seems to have caused higher fixation percentages on both the NIT and the QR code. The increase in the NIT fixation percentage was much larger than for the QR code between education levels. The highest fixation percentage for both aspects was measured in the 18 to 30 age group. Moving to older groups, the NIT scored higher fixation percentages from older consumers. The QR code results showed that the fixation percentages decreased among older consumers up to the 51 to 60 age group, with an increase again for the 61 to 70 age group. Men paid more attention to the NIT in this image than women, while slightly more women paid attention to the QR code. The NIT enjoyed the largest share of attention from the middle-income group (69%), followed by the high-income (67%) and low-income (61%) group. The QR code also measured the highest fixation percentage among the middle-income group (28%), but the low-income group (27%) outscored the high-income group (17%).

Besides testing the application of an NIT to inform consumers about the nutritional information of meat, MTL labels were also added to the pack (see Image 4.24 and Table 4.29).



Image 4.24: Beef steak with a pricing label and a multiple traffic light (MTL) label

Table 4.29: Eye-tracking results for beef steak with a pricing label and an MTL label

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	12%	1.3333	0.1892	0.2689	0.1894	1.9478	7.0278	1.1389	0.2356	0.2756
Butchery name	21%	2.1231	0.1855	0.3832	0.1828	2.1082	7.7538	1.1538	0.4140	0.4494
Cut name	19%	2.2069	0.1971	0.4372	0.1772	2.0688	7.6207	1.3966	0.3643	0.4907
Classification	22%	2.2464	0.2033	0.4599	0.1971	1.8774	6.7826	1.4058	0.3401	0.4899
MTL table	57%	2.7314	0.2091	0.5523	0.2110	1.6889	5.6629	1.3771	0.4986	0.6571
Packaging date	21%	2.1587	0.1889	0.4005	0.1819	2.6949	9.3651	1.3651	0.3425	0.4400
Price of pack	53%	2.8232	0.1882	0.5522	0.1881	1.8874	6.5488	1.5305	0.4099	0.6275
Price per kg	28%	2.2907	0.2224	0.5092	0.2136	2.1127	7.7442	1.4767	0.3758	0.5348
Sell-by date	36%	2.1376	0.2065	0.4598	0.2068	2.1476	7.2202	1.3394	0.3738	0.4839
Weight of pack	41%	1.9440	0.1985	0.3867	0.1938	1.8824	6.4160	1.4000	0.2906	0.4078

Adding an MTL label to the test image (see Table 4.29) was compared to the results of Table 4.27, which tested the NIT. The MTL label enjoyed attention from 57% of the participants. It was also the

labelling aspect that received attention for the longest average total duration of fixations (0.5523 seconds). The price of the pack enjoyed the second highest share of participants viewing the aspect (53%), with an average total fixation of 0.5522 seconds. Adding the MTL label to the pack instead of the NIT, with the exception of the bar code, caused an increase in the share of participants viewing the different aspects. This could be due to the lower amount of information presented to consumers when making use of an MTL label that contains less information than an NIT label. Here the opposite is seen from the previous image, where providing less information on the packets of meat (e.g. MTL rather than NIT label) led to consumers having more time to fixate on each element of the image.

Subcategories

The MTL label received attention from slightly more coloured (64%) and white (60%) participants than from black (56%) participants. The level of participants' education did not seem to influence the fixation percentage on the MTL label. Age showed the highest fixation percentage (66%) of participants among the 18 to 30 age group. This score decreased in the two older groups (31 to 40: 54% and 41-50: 51%) and started to increase again in the 51 to 60 age group (53%) and the 61 to 70 age group (60%). A smaller share of men (55%) fixated on the label than women (61%). The middle-income groups (62%) were the most likely to pay attention to the label, followed by the high-income (55%) and low-income (54%) groups.

The effect of adding a QR code along with an MTL label on a pack of meat was also investigated (see Image 4.25 and Table 4.30).



Image 4.25: Beef steak with a pricing label, MTL label, and a QR code

Table 4.30: Eye-tracking results for beef steak with a pricing label, MTL label, and a QR code

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bar code	32%	1.6495	0.2270	0.3900	0.2200	1.9905	6.0515	1.2577	0.3124	0.4055
Butchery name	21%	2.2969	0.2233	0.5175	0.2386	2.1781	7.5469	1.2813	0.4258	0.5742
Cut name	26%	1.7875	0.2304	0.3896	0.2308	2.3279	7.5875	1.2625	0.3224	0.4215
Classification	21%	1.7500	0.2106	0.3952	0.1967	2.4748	8.4688	1.2813	0.3081	0.4094
MTL label	50%	3.0844	0.2397	0.7240	0.2189	1.7336	5.6558	1.6623	0.4753	0.7875
Packaging date	30%	1.9348	0.2555	0.5109	0.2435	1.9248	6.0000	1.3261	0.4179	0.5259
Price of pack	40%	2.1290	0.2323	0.5026	0.2238	2.0686	6.9516	1.3871	0.3937	0.5381
Price per kg	34%	2.0097	0.2454	0.4971	0.2369	1.7138	5.6990	1.3883	0.3601	0.5159
QR code	39%	1.8667	0.2150	0.3983	0.1979	1.9523	6.5167	1.3833	0.3021	0.4302
Sell-by date	25%	1.6494	0.3156	0.4757	0.3160	2.4169	7.4805	1.1688	0.4300	0.4935
Weight of pack	34%	1.8932	0.2319	0.4183	0.2396	2.0397	6.5922	1.3592	0.3175	0.4391

The addition of the QR code (see Table 4.30) led to a reduction in the share of the participants' fixation on the MTL label (50% vs. 57% in Table 4.28) and price of the pack (40% vs. 53% Table 4.28). The QR code received attention from 39% of the participants, which is higher than the viewing results where the QR code was placed in combination with an NIT (26%) (see Table 4.28).

Subcategories

Similar to the previous image, the highest fixation percentages were measured for the coloured participants for both the MTL label (82%) and the QR code (64%). It seems that adding the QR code increased the attention paid to the MTL by the coloured participants, while it decreased the measurement for white (31%) and black (52%) participants. In this image, higher-educated participants also correlated with higher fixation percentages (55% for participants with tertiary education) on the MTL. However, this was not found for the QR code, where participants with Grade 8 to 12 measured the highest score (41%). Age was in most age categories negatively correlated with the fixation on the MTL, while the QR code showed more variation in the participants' fixation percentages. The highest fixation percentage was measured for the 31 to 40 age category (49%). Women were more likely to fixate their attention on both the MTL (55%) and QR code (44%) than men. Under the income categories, all groups were more likely to pay attention to the MTL when a QR code was also placed on the pack than in the previous image. Middle-income participants showed the highest fixation percentage for the MTL at 62%, and high-income participants showed the highest fixation percentage on the QR code (41%).

The addition of an NIT caused a reduction in the attention paid to the butchery's name and classification of the meat. Also, with the exception of the MTL label (see Image 4.24), adding an NIT on the pack caused a reduction in the attention paid to the price of the pack. This could suggest that consumers are concerned about their health and the nutritional value of the red meat they eat, and they tend to be less price sensitive when presented with the nutritional value of their red meat products. Both the NIT and the MTL measured higher fixation percentages than the price of the pack, with the NIT measuring the higher fixation percentage of the two forms of nutritional labelling. It should also be taken into account that the price label information mostly stayed the same between the images and might also have had an effect on the attention consumers paid to the images.

4.3.3 Physical meat product aspects

The focus of the study next shifts to attention paid specifically to the aspects of the meat presented in the images. This section presents results for meat in packs, fat on the meat, marbling, and blood in the pack.

4.3.3.1 Blood, fat, and marbling results

In these images, packets of red meat were used where all of the labelling aspects were removed. This was done to specifically investigate consumers' attention to the physical aspects of the meat presented in the images. Image 4.26 shows a beef steak with blood in the pack, without any labelling on the pack.



Image 4.26: Beef steak with no labelling, with blood in the pack

Table 4.31: Eye-tracking results for beef steak with no labelling, with blood in the pack

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Blood in pack	52%	2.2893	0.2673	0.5469	0.2695	1.8804	6.2013	1.5472	0.4029	0.5934
Fat on meat	86%	5.0492	0.2168	1.0612	0.2207	0.8885	2.3826	2.5682	0.5425	1.2634
Marbling	20%	1.6452	0.1800	0.2874	0.1815	2.1340	6.7419	1.2742	0.2448	0.3074

By showing a pack of meat without any labelling (see Image 4.26) to the participants, their attention to specific meat aspects was investigated. Table 4.31 shows the results from the eye-tracking test for this test image. In terms of meat aspects, the aspect that received attention from the largest share of participants (86%) was the fat on the meat. The low time to first fixation measured (0.8885 seconds) suggests that the fat on the meat was the meat aspect that on average received attention first from the participants. The participants also fixated on the fat on the meat the longest, with a total fixation duration of 1.0612 seconds. Blood in the pack was fixated on by 52% of the participants on average after 1.8804 seconds and was fixated on for 0.5469 seconds by the participants on average. Marbling measured an average time to first fixation of 2.1340 seconds, with an average total fixation duration of 0.2875 seconds and was fixated on by 20% of the participants. These results show that fat on the meat is the

most important meat aspect (excluding the appearance of the meat) that attracts consumers' attention. Blood in the pack can also be regarded as important but was found to be less important than the fat on meat.

Subcategories

Regarding race, the blood in the pack measured the highest fixation percentage among coloured participants (73%), followed by black (52%) and white participants (47%). Fat on the meat measured the following fixation percentages among the difference races: coloured 100%, white 89%, and black participants 85%. Marbling measured the highest fixation percentage among black participants (21%), followed by white (20%) and coloured participants (9%).

Regarding education, higher levels of education seemed to have a positive correlated influence on the fixation percentage for the blood in the pack, fat on the meat, and marbling.

Regarding age, the highest fixation percentage for blood in the pack was measured in the 31 to 40 age group (63%), followed by the 18 to 30 age group (62%). The fixation percentage showed a declining trend in all groups older than 40 years. Fat on the meat received attention from the largest share of participants between 18 to 30 (91%), with a decline in fixation percentage when moving to older groups. Thus, older participants tended to pay less attention to fat on the meat than younger participants. Marbling measured the highest fixation percentage (26%) among participants aged 51 to 60 years, followed by the 18 to 30 age group (25%), the 31 to 40 age group (16%), and the 61 to 70 age group (0%). It should be noted how the fixation percentages differed between the highest fixation percentage on the fat on the meat (91%) and that of marbling (26%) between the age groups. This could serve as evidence of how important fat on the meat is compared to the marbling of the meat.

Regarding gender, in the case of all three tested aspects, women were more likely to fixate on them than men. While fat on the meat (men: 85% vs. women: 88%) and marbling (men: 19% vs. women: 22%) were closely related, fixation on the blood in the pack showed a larger difference (men: 48% vs. women: 59%).

Regarding income, blood in the pack was fixated on by the largest share of middle-income participants (60%), followed by a smaller share of low-income participants (50%) and high-income participants (41%). Fat on the meat showed higher fixation percentages from all the income groups than the blood in the pack. The middle-income groups showed a fixation percentage of 92%, with the high-income group at 91% and low-income income group at 79%. Marbling showed the direct opposite, with the largest fixation percentage by the low-income group (24%), followed by the high-income (19%) and middle-income groups (16%).

In Image 4.27, two packs of beef steak were tested side by side to reveal how the participants would react to packs placed next to each other that had different packaging types and characteristics. The results for the image are presented in Table 4.32.



Image 4.27: Vacuum-packed meat with and without polystyrene plate

Table 4.32: Eye-tracking results for vacuum-packed meat with and without polystyrene plate

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Vacuum-packed higher-fat beef on polystyrene plate										
Blood in pack	42%	1.7209	0.2088	0.3636	0.2192	2.3668	7.9690	1.2868	0.3428	0.4227
Fat on meat	57%	2.1761	0.2482	0.4916	0.2525	1.8450	6.3580	1.4716	0.3748	0.5284
Meat only	86%	4.9091	0.2062	0.9906	0.1859	0.6366	1.6288	2.5985	0.4793	1.1558
Whole plate	90%	8.2274	0.2196	1.7041	0.2016	0.4792	1.0361	2.3646	1.0405	2.1542
Vacuum-packed lower-fat beef without polystyrene plate										
Blood in pack	2%	1.6000	0.1760	0.2280	0.1720	3.5140	12.4000	1.0000	0.2500	0.2500
Fat on meat	63%	2.0469	0.2265	0.4211	0.2249	2.0020	6.3385	1.5104	0.3268	0.4478
Meat only	86%	4.6084	0.2098	0.9473	0.2140	1.1937	3.4411	2.2776	0.5812	1.1673
Whole pack	92%	6.9502	0.2127	1.4259	0.1975	0.7232	1.5409	2.3843	0.8939	1.8426

Image 4.27 contains two images of beef that were placed next to each other. The beef steak on the left had more fat and was vacuum-packed on a polystyrene plate. The steak on the right had less fat on the meat and was only vacuum-packed. The investigation of attention paid to the whole areas (meat, fat, and packaging) of the two packs showed that 90% of the participants (see Table 4.32) fixated on the steak on the left, while 92% of the participants fixated on the steak on the right. The time to first fixation results suggest that on average the participants were more likely to fixate their attention on the high-fat pack first (0.4792 seconds) before moving their attention to the low-fat pack (0.7232 seconds). It could be caused by the procedure of reading from left to right that also influenced consumers' manner of paying attention to the presented packets of red meat.

The participants spent on average 1.7041 seconds fixating on the pack of meat on the left and 1.4259 seconds fixating on the pack on the right. Measurements of the different meat aspects show that 86% of the participants fixated on the meat (fat, etc. excluded) on both of the cuts. The high-fat cut received a slightly longer average total fixation duration (0.9906 seconds) than the low-fat cut (0.9473 seconds).

The fat on the high-fat steak received fixations from a smaller percentage of participants (57%) than on the low-fat steak (63%). It can be noted that despite the fat on the high-fat cut receiving fixations from a smaller share of the participants, the fat on the high-fat cut was fixated on for longer (0.4916 seconds average total fixation duration) than the fat on the low-fat cut (0.4211 seconds).

Regarding the blood in both packs, 42% of the participants fixated on the blood in the high-fat pack, while 2% viewed the blood in the low-fat pack. The blood in the high-fat pack was also on average fixated on for longer during the tests than the low-fat pack (0.3636 seconds vs. 0.2280 seconds). It must be mentioned that the white polystyrene plate placed under the meat helped to make the blood more prominent in the image. This indicates how packaging can result in assisting some aspects to enjoy more attention.

Subcategories

Regarding race, both packs of meat were fixated on by all the coloured participants, while the pack of meat on the polystyrene plate was fixated on by 91% of the white and 90% of the black participants. The vacuum-packed meat was fixated on by 89% of the white participants and 92% of the black participants. The blood in the polystyrene-plated pack was fixated on by 46% of the black participants, 27% of the coloured participants, and 24% of the white participants. The blood in the vacuum-packed pack measured much lower fixation percentages from all the racial groups: white (4%), black (1%), and coloured (0%).

The fat in the vacuum-packed meat that measured a higher average fixation percentage from the whole group of participants than its equal in the polystyrene-plated pack showed that the highest fixation percentage was in the coloured group (82%), followed by black (64%) and then white (51%) participants. The fat in the polystyrene-plated meat pack showed a similar trend among the different races, with all showing a lower fixation percentage than in the aforementioned fat scenario.

The meat (excluding the areas of fat) measured the same fixation percentages in both the test images among the different race groups. The coloured participants showed a 100% fixation percentage, with black and white participants measuring 86% and 80% respectively.

Regarding education, the fixation percentages for the whole pack showed a positive correlation to the vacuum-packed-only pack. The meat placed on the polystyrene plate measured a 91% fixation percentage from the least-educated group of participants and a fixation percentage of 90% among both the two higher-educated groups.

The blood in the pack showed a negative correlation to the level of education in terms of the polystyrene-plated meat; with participants with a tertiary education scoring a fixation percentage of 38%, and participants with Grade 1 to 7 a 59% fixation percentage. The blood in the vacuum-packed meat measured much lower fixation percentages, with the highest score from the participants with a tertiary education at 2%, and a 1% and 0% in the two lower education groups respectively. The fat on the meat in both the images was positively correlated to the level of education.

Age showed a negative correlation to the fixation percentage on the vacuum-packed meat's total area. The blood in the polystyrene-plated meat showed a decrease in fixation percentages from the 31 to 40 group to the 41 to 50 group and then increased again in the two older groups. With the vacuum-packed meat, blood was fixated on by 4% of the 18 to 30 age group and the highest score was from the 61 to 70 age group (5%). In both images, fixation percentages for the fat as well as for the meat only were negatively correlated to the age groups.

Regarding gender, with the polystyrene-packed meat image, men were more likely to fixate their attention on the blood (44%), while women paid more attention to the fat (60%), meat only (88%), and the whole area of the pack (91%). In the vacuum-packed meat, women were more likely to fixate on all of the tested aspects.

Regarding income, the results show that for the polystyrene-plated meat, the low-income participants (6%) were more likely to pay attention to the blood in the pack, while middle-income participants (67%) paid more attention to the fat on the meat and the meat-only area. Wealthy participants measured the lowest rate for blood in the pack (5%) and fat on the meat (50%). With the vacuum-packed meat image, the middle-income group (4%) paid the most attention to the blood, fat, and meat-only areas, with the wealthy group (0%) paying the least amount of attention to blood in the pack and the fat on the meat. The low-income participants measured the lowest score (81%) for the meat-only area.

The blood was fixated on by a much larger share of the participants when the meat was displayed on a polystyrene plate on vacuum-packed lining than when only vacuum-packed without the polystyrene plate. The fat on the meat received more attention than the marbling (fat in the meat), while with the meat-only areas of both the vacuum-packed and polystyrene-plated vacuum-packed products, the total area of the vacuum-packed meat measured a slightly higher fixation percentage from the participants, indicating that vacuum-packed-only meat was more likely to enjoy attention from the participants.

Meat colour

The participants' attention to meat colour was tested with Images 4.28 and 4.29. The results from the different colours of meat are shown in Tables 4.33 and 4.34.



Image 4.28: Bright-red and dark-red meat combo

Table 4.33: Eye-tracking results for bright-red and dark-red meat combo

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bright-red meat results										
Bright-red meat	79%	3.9959	0.1943	0.7737	0.1826	1.0340	3.2448	1.9751	0.4891	0.9304
Bar code	6%	1.4706	0.1894	0.3112	0.1735	3.3682	10.6471	1.1765	0.2729	0.3194
Butchery name	14%	1.7857	0.2026	0.3524	0.2055	2.5429	8.8571	1.1429	0.3419	0.3740
Cut name	8%	1.7600	0.2364	0.4060	0.2396	2.6400	9.5200	1.2400	0.3336	0.4268
Classification	15%	1.7826	0.2150	0.4211	0.2096	2.5809	9.4565	1.1957	0.3328	0.4287
Packaging date	4%	2.1538	0.2108	0.4069	0.2092	3.0600	9.9231	1.4615	0.2923	0.4254
Price of pack	28%	1.8118	0.2251	0.4028	0.2255	2.4261	8.7882	1.1647	0.3627	0.4308
Price per kg	7%	1.8571	0.2162	0.3895	0.2257	2.3238	8.8095	1.0476	0.3986	0.4124
Sell-by date	11%	1.4412	0.2082	0.3047	0.2056	2.3426	8.5882	1.2647	0.2421	0.3150
Weight of pack	18%	1.6607	0.2111	0.3348	0.2000	2.8150	9.9643	1.1786	0.3007	0.3675
Dark-red meat results										
Dark-red meat	75%	4.2140	0.2236	0.8719	0.2318	1.2478	3.9214	1.7729	0.6478	1.0614
Bar code	20%	1.8000	0.1970	0.3475	0.2140	1.8893	6.4500	1.3667	0.2883	0.4040
Butchery name	19%	2.0678	0.2234	0.4634	0.2293	2.1403	7.4746	1.2881	0.3939	0.4910
Cut name	19%	1.5345	0.1893	0.2914	0.1814	2.5309	9.0690	1.2241	0.2441	0.3040
Classification	25%	1.6883	0.2079	0.3245	0.2100	1.9834	6.8442	1.2987	0.2726	0.3534
Packaging date	21%	1.5397	0.2417	0.3711	0.2394	2.4049	8.1905	1.2222	0.3079	0.3760
Price of pack	43%	1.9466	0.2614	0.4424	0.2561	1.9049	6.5573	1.4122	0.3618	0.4715
Price per kg	24%	1.8243	0.2077	0.3619	0.1989	2.1059	7.2568	1.2703	0.3127	0.3908
Sell-by date	21%	1.5000	0.2647	0.4150	0.2595	2.0568	7.1515	1.2424	0.3235	0.4229
Weight of pack	38%	1.8448	0.2045	0.3758	0.1932	2.0634	7.2845	1.2845	0.3058	0.4107

In Image 4.28, two packs of beef steak were tested alongside each other. The pack on the left contained bright-red meat, while the pack on the right contained a darker cut of meat. The results from the test (see Table 4.33) show that the bright-red meat received fixations from 79% of the participants and the dark meat from 75% of the participants. The darker meat showed a longer total fixation duration (0.8719 seconds) than the bright-red meat (0.7737 seconds). Besides the meat, the data on the labelling aspects show that all the aspects on the dark meat pack were viewed by more participants than on the bright-red meat pack. This could suggest that the participants were searching for differences in the labelling that could explain the darker cut of beef. It could be that consumers expected the darker meat

to be closer to the sell-by date of the pack or that they expected a cheaper price for the darker packet of meat. The average time to first fixation results suggest that the bright-red meat was on average fixated on first (1.0340 seconds) before the average participant's attention moved to the dark meat (1.2478 seconds), and the labelling aspects of the dark meat, such as classification (1.9834 seconds), price of pack (1.9049 seconds) and sell-by date (2.0568 seconds). Only after this point did the participants fixate on the sell-by date (2.3426 seconds) and the price of pack (2.4261 seconds) of the bright-red meat's labelling.

Subcategories

While all the coloured participants paid attention to both the packs of meat, a larger percentage of white (78% vs. 73%) and black (78% vs. 74%) participants paid attention to the bright-red pack of meat. Between images it seems that the labelling aspects of the dark meat in most cases measured higher measurements than the bright-red pack of meat. Education levels in most instances were linked to higher fixation percentages on the labelling of the meat and also indicated that all levels of education were more likely to fixate on the dark meat's label than on the bright-red meat's label. The fixation on the dark meat positively correlated with the level of education.

Besides testing the participants' interest in cuts of beef, packs of minced meat and beef sausage (*boerewors*) were also tested in the eye-tracking test. Image 4.29 contains two packs of minced meat shown to the participants.



Image 4.29: Bright-red and dark-red minced meat

Table 4.34: Eye-tracking results for bright-red and dark-red minced meat

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bright-red meat										
Bright-red meat	77%	3.0928	0.1958	0.5875	0.1922	1.3033	4.0084	1.9578	0.3557	0.6663
Bar code	7%	1.5909	0.2045	0.3050	0.2118	2.4486	8.0000	1.1818	0.2745	0.3177
Butchery name	20%	1.8065	0.2176	0.3785	0.2210	2.0702	7.0161	1.1935	0.3440	0.3984
Cut name	13%	1.5854	0.2078	0.3376	0.1959	2.5002	8.4146	1.2439	0.2861	0.3502
Classification	19%	1.5932	0.2053	0.3281	0.1983	2.4849	8.7627	1.1864	0.2861	0.3419
Packaging date	8%	1.6000	0.2192	0.3596	0.2032	2.8140	9.4400	1.2000	0.3016	0.3668
Price of pack	41%	2.0000	0.2126	0.4214	0.2034	2.0735	7.1840	1.4000	0.3301	0.4484
Price per kg	13%	1.6500	0.2125	0.3413	0.2168	2.7200	9.1500	1.2000	0.3108	0.3528
Sell-by date	18%	1.6786	0.2084	0.3314	0.2063	2.9307	10.2321	1.2143	0.2954	0.3584
Weight of pack	26%	1.6709	0.2276	0.3635	0.2270	2.0176	7.2911	1.2785	0.2904	0.3738
Dark-red meat										
Dark-red meat	69%	3.0657	0.2035	0.5911	0.2001	1.5041	4.8685	1.7324	0.4083	0.6795
Butchery name	20%	1.6721	0.2364	0.3839	0.2226	1.8002	6.0984	1.1639	0.3597	0.4166
Bar code	29%	1.8295	0.1989	0.3797	0.2120	1.9697	6.4886	1.3523	0.2905	0.3968
Cut name	21%	1.7077	0.2389	0.3762	0.2417	2.2388	7.5538	1.2308	0.3334	0.3945
Classification	22%	1.4925	0.1967	0.2893	0.1990	2.2670	7.8657	1.2388	0.2436	0.2982
Packaging date	24%	1.6027	0.1962	0.3304	0.1862	1.9501	6.7123	1.2192	0.2681	0.3436
Price of pack	49%	2.4832	0.2010	0.4905	0.2026	1.9668	6.7785	1.4832	0.3654	0.5268
Price per kg	34%	1.5243	0.2077	0.3145	0.2023	2.1932	7.1650	1.2039	0.2672	0.3283
Sell-by date	29%	1.9091	0.2267	0.4136	0.2256	2.5124	8.9886	1.3523	0.3310	0.4323
Weight of pack	34%	1.7308	0.2201	0.3448	0.2167	2.2213	7.7885	1.2308	0.2963	0.3659

The two packs of minced meat both contained meat that was placed on a polystyrene plate before being vacuum-packed (see Image 4.29). The pack on the left contained meat that was a bright-red colour, while the pack on the right contained a slightly darker meat. The results from the image (see Table 4.34) shed light on how the participants reacted towards different colours of minced meat placed in similar packaging. The bright-red minced meat was viewed by 8% more of the participants (77%) than the dark-red minced meat (69%). The average time to first fixation shows that the participants were more likely to first fixate their attention on the bright-red meat (1.3033 seconds) than on the dark-red meat (1.5041 seconds). The average fixation count between the bright-red and dark-red meat proved to be very closely correlated to each other (3.0928 fixations for bright-red meat and 3.0657 fixations for dark-red meat), as well as the average total fixation duration (0.5875 seconds vs. 0.5911 seconds). While fewer participants fixated on the dark-red meat, the labelling aspects on the dark-red meat were fixated on by more of the participants. The labelling aspects that enjoyed significantly higher levels of attention on the dark-red meat included the price of the pack (49% vs. 41%), sell-by date (29% vs. 18%), price per kg (34% vs. 13%), weight of the pack (34% vs. 26%), and packaging date (24% vs. 8%). Still, the percentage of the participants who fixated on the butchery's name was equal for the two packs (20%). While, on average, the bright-red meat was fixated on first (average time to first fixation), followed by the dark-red meat, the labelling aspects on average of the dark-red meat were fixated on at an earlier stage than the same labelling aspects of the bright-red meat. These findings correlate with the findings of the bright-red and dark-red meat images. The data suggest that the bright-red meat was visually more appealing to the participants because it attracted their attention first before their focus moved to the dark-red meat, and it seemed like the participants were searching for information on the labels as to why the meat that was packed the same differed in colour.

Subcategories

The race results showed that the white (82%) and black (76%) participants fixated on the bright-red pack of minced meat at a higher rate than the coloured participants (73%). The opposite was found for the dark-red meat, where 91% of the coloured participants fixated on the meat, as opposed to 69% of the white participants and 68% of the black participants. Here it seemed that the coloured participants were more attracted to dark-red minced meat than other ethnic groups. The packaging date and sell-by date also measured higher fixation percentages from all races on the dark-red meat pack. The bright-red meat and the dark-red meat were positively correlated to the level of education, with the increase of fixation percentage on the bright-red meat being higher between the education groups. Participants with a tertiary education measured an 82% fixation percentage for the bright-red meat, vs. a 71% rate on the dark-red meat.

Age did not show any clear trends towards the two packs of minced meat. The bright-red pack measured the highest fixation percentage among the participants aged 51 to 60 and the dark-red meat from participants 61 to 70 years old. A larger share of male participants (78%) fixated on the bright-red meat than women (76%). The opposite was true for the dark-red meat pack. This trend was also seen for the sell-by date where men outmeasured women, and the group average for both genders was higher on the dark-red meat's sell-by date. The income-based results showed that the fixation percentages on the bright-red meat were consistently higher than the dark-red meat percentages among all the income groups. The largest share of participants from the middle-income group (82%) paid attention to the bright-red meat, followed by the high-income (81%) and low-income (72%) groups. This was higher than the dark-red meat, where 74% of the high-income, 72% of the middle-income, and 65% of the low-income participants paid attention to the meat.

To investigate the attention paid to meat colour, two packs of beef steak were used in the first image and two packs of minced beef in the second. This would show whether the participants reacted differently when considering the colour of higher- and lower-valued red meat products. In both images, the brighter-red (cherry red) meat images measured higher fixation percentages than the dark-red packs of meat. Besides the higher fixation percentage on the bright-red meat, all the labelling aspects of the bright-red meat packs measured lower fixation percentages than the dark-red packs of meat. This was the case for both the steak and the minced beef, and it would suggest that the participants investigated the labelling of the darker-red meat with more attention to determine why the meat had different appearances.

4.3.3.2 Packaging options

Besides Image 4.27, where the participants were tested with steak packaged differently, minced meat and beef sausage were also packaged in different forms to investigate attentional reaction to the packaging. Image 4.30 shows one pack of minced meat placed on a polystyrene plate before being vacuum-packed (left) and one pack of minced meat vacuum-packed without the polystyrene plate (right).



Image 4.30: Minced meat in different packaging

Table 4.35: Eye-tracking results for minced meat in different packaging

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first Mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Polystyrene-plated minced meat										
Polystyrene plate area	88%	6.9111	0.2082	1.4262	0.1911	0.8041	2.2259	1.9037	1.0889	1.7654
Bar code	7%	1.5217	0.1565	0.2513	0.1500	2.7309	9.4348	1.1304	0.2239	0.2583
Butchery name	14%	1.9545	0.1845	0.3602	0.1948	1.9725	6.3182	1.1818	0.3195	0.3791
Cut name	12%	1.6111	0.2167	0.3494	0.2289	2.0669	7.7222	1.1667	0.3161	0.3614
Classification	19%	1.6780	0.2163	0.3827	0.2058	1.9712	6.6610	1.2203	0.3366	0.3931
Packaging date	9%	1.7407	0.2104	0.3230	0.2070	2.5933	10.0370	1.2963	0.2752	0.3393
Price of pack	37%	1.9115	0.2100	0.3934	0.2057	2.1503	7.3274	1.3097	0.3146	0.4188
Price per kg	11%	1.2857	0.2131	0.2706	0.2149	2.7586	9.9429	1.1429	0.2417	0.2731
Sell-by date	16%	1.6875	0.2052	0.3473	0.2206	2.7292	9.8542	1.2917	0.2835	0.3590
Weight of pack	24%	1.5467	0.1928	0.3233	0.1855	2.5872	8.9867	1.2133	0.2603	0.3340
Vacuum-packed minced meat										
Vacuum-packed	91%	9.3835	0.2058	1.9108	0.1954	0.7115	1.9964	1.9821	1.4965	2.4398
Bar code	26%	1.7342	0.2196	0.3681	0.2114	2.2065	7.4557	1.2025	0.3334	0.3952
Butchery name	24%	1.9200	0.2357	0.4155	0.2295	1.9787	7.1067	1.2133	0.3644	0.4464
Cut name	24%	1.8356	0.1900	0.3411	0.1858	1.8371	6.7671	1.2740	0.2712	0.3600
Classification	20%	1.7705	0.2105	0.3631	0.1969	2.6795	9.4426	1.2131	0.3297	0.3931
Packaging date	32%	1.7010	0.2192	0.3875	0.2172	2.1416	6.7216	1.2062	0.3222	0.3988
Price of pack	50%	2.1104	0.2001	0.4242	0.1992	2.1247	7.5974	1.3636	0.3336	0.4562
Price per kg	32%	1.6667	0.1904	0.3126	0.1862	1.8549	6.5051	1.2727	0.2717	0.3377
Sell-by date	27%	1.7738	0.2063	0.3952	0.1951	2.4499	8.7143	1.2262	0.3123	0.4088
Weight of pack	33%	1.7255	0.1994	0.3466	0.1963	2.3460	8.2843	1.2353	0.2932	0.3676

Table 4.35 shows the eye-tracking result for the two packs of minced meat packaged in different packaging (see Image 4.30). The pack of minced meat only vacuum-packed (on the right) was fixated on by 91% of the participants, while the minced meat on the polystyrene plate was fixated on by 88% of the participants. Contrary to the previous image, the pack that had the higher fixation percentage (vacuum-packed only) also had the shortest average time to first fixation (0.7115 seconds vs. 0.8041 seconds). Average total fixation duration for the vacuum-packed-only meat was slightly longer (1.9108 seconds vs. 1.4262 seconds). All the following vacuum-packed-only minced meat label aspects received attention from more participants than the polystyrene-packed meat: butchery's name (24% vs. 14%), cut name (24% vs. 12%), packaging date (32% vs. 9%), price of the pack (50% vs. 37%), price

per kg (32% vs. 11%), sell-by date (27% vs. 16%), and weight of the pack (33% vs. 24%). The labelling aspect that tested the closest to the other pack was the classification of the meat (20% vs. 19%). The difference seen between the two packs could be due to the difference in packaging, which led to 3% more participants fixating on the vacuum-packed-only meat. In contrast with previous images, the pack on the right was on average fixated on first by the consumers. This indicates that consumers did not necessarily fixate on packets of meat on the right-hand side of the test images due to their reading habits.

Subcategories

Both packs of minced beef measured equal fixation percentages from coloured (100%) and white participants (89%), while black participants showed an 87% fixation percentage for the polystyrene-plated meat and a 91% fixation percentage for the vacuum-packed meat. Labelling aspects such as the price per pack, sell-by date, and packaging date measured higher rates among all races on the vacuum-packed meat than the polystyrene-plated meat. The meat placed on the polystyrene plate showed a positive correlation to the level of the participants' education. In the case of the vacuum-packed meat, the highest fixation percentage was from the participants with Grade 8 to 12 education (92%), followed by participants with a tertiary education (91%), and participants with Grade 1 to 7 (82%).

Age was negatively correlated to the fixation percentage for both of the packs, with the average fixation percentages on the vacuum-packed meat being slightly higher in most cases per age group than the polystyrene-plated meat.

Women measured a higher fixation percentage for both of the packs, with the score of the vacuum-packed meat (92% vs. 90%) being closer between the two genders than on the polystyrene-plated (91% vs. 90%) image. No difference between income groups was seen for the fixation percentage on the polystyrene-plated meat; all groups measured an 88% rate, while the vacuum-packed meat showed a 95% fixation percentage from the middle-income group, 91% from high-income group, and 88% from the low-income group.

Image 4.31 shows the test image that was used to gauge participants' attention to beef sausage (*boerewors*) in different packaging.



Image 4.31: Beef sausage in different packaging

Table 4.36: Eye-tracking results for beef sausage in different packaging

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Beef sausage on polystyrene plate and vacuum-packed										
Polystyrene plate and vacuum-packed	88%	7.6185	0.2120	1.5609	0.1872	0.7790	2.2481	2.0630	1.1207	1.9535
Bar code	10%	1.3226	0.2032	0.2694	0.1987	2.5458	8.9355	1.0645	0.2494	0.2729
Butchery name	16%	1.9000	0.2286	0.4252	0.2180	1.9362	6.7800	1.2200	0.3974	0.4578
Cut name	8%	1.3077	0.2254	0.2977	0.2181	1.9615	7.0000	1.0769	0.2773	0.3000
Classification	23%	1.7361	0.2126	0.3513	0.2099	2.3451	8.1667	1.1944	0.3192	0.3754
Packaging date	6%	1.4118	0.2265	0.3412	0.2235	2.5512	8.4706	1.1765	0.3094	0.3471
Price of pack	39%	1.9916	0.2459	0.4742	0.2378	2.2608	7.9916	1.3025	0.3782	0.4927
Price per kg	11%	1.2941	0.2853	0.3556	0.2959	2.5418	9.6471	1.1471	0.3109	0.3576
Sell-by date	19%	1.5965	0.2130	0.3300	0.2142	2.6891	9.3333	1.2105	0.2881	0.3411
Weight of pack	30%	1.5870	0.2097	0.3374	0.2098	2.1930	7.7283	1.2717	0.2721	0.3483
Beef sausage vacuum-packed only										
Vacuum-packed	91%	8.6547	0.2285	1.8278	0.1842	0.5721	1.4209	2.1223	1.2944	2.2861
Bar code	25%	1.6711	0.2571	0.3799	0.2491	2.1674	7.5658	1.2763	0.3121	0.3925
Butchery name	18%	1.8393	0.2107	0.3970	0.2148	2.0338	7.4107	1.1607	0.3559	0.4168
Cut name	12%	1.3684	0.2255	0.3129	0.2353	2.1508	7.8947	1.1579	0.2697	0.3153
Classification	21%	1.5238	0.2005	0.2970	0.1924	2.2910	8.2222	1.1746	0.2571	0.3025
Packaging date	21%	1.5469	0.2736	0.3920	0.2708	2.1544	7.8281	1.2344	0.3266	0.4063
Price of pack	39%	1.7769	0.2050	0.3688	0.1959	1.8658	6.4876	1.3058	0.3057	0.4005
Price per kg	22%	1.3731	0.2249	0.3110	0.2131	2.2149	7.9403	1.2388	0.2631	0.3325
Sell-by date	27%	1.7619	0.2158	0.3827	0.2164	2.0401	6.9048	1.2619	0.3164	0.4240
Weight of pack	38%	1.7500	0.2355	0.3897	0.2268	2.1416	7.5690	1.2845	0.3104	0.4021

Image 4.31 presented two packs of beef sausage. The pack on the left represented a roll of beef sausage placed on a polystyrene plate before being vacuum-packed, and the image on the right is a roll of beef sausage that was only vacuum-packed. The results for the image (see Table 4.36) show that more participants focused on the sausage that was only vacuum-packed (91%) than on the sausage that was placed on a polystyrene plate before being vacuum-packed (88%). The average time to first fixation was shorter for the vacuum-packed-only sausage (0.5721 seconds vs. 0.7790 seconds) and the average total fixation duration was longer (1.8278 seconds vs. 1.5608 seconds). This means that the vacuum-packed-only sausage was able to attract the participants' attention quicker and keep their attention for longer. The results for the other labelling aspects show similar results to the minced

meat image for the two different forms of packaging. All the labelling aspects on the vacuum-packed-only sausage pack (except for price of the pack, which was the same for both packs at 39%) were fixated on by more participants than on the polystyrene-plated meat. Furthermore, the vacuum-packed sausage received on average one more fixation (8.6547 vs. 7.6185) per participant. Taking these results into account with the result from the previous image where minced meat was also packaged differently, it would suggest that red meat products that are only vacuum-packed were able to attract more attention from consumers and also did so in a shorter time than meat placed on a polystyrene plate before being vacuum-packed.

As shown earlier, the participants tended to fixate more on vacuum-packed meat when it came to higher-priced meat (see Image 4.27). These results show the same trends for cheaper cuts of meat, both minced meat and beef sausage, where the participants proved more likely to pay attention to vacuum-packed-only meat. With the exception of the price of the pack for the sausage, where the two packs measured the same fixation percentage, all other labelling aspects on both the pack of vacuum-packed sausage and vacuum-packed minced meat measured higher fixation percentages than the polystyrene-plated vacuumed-packed meat.

4.3.3.3 Fat preference on other meat products

Besides the fat preference tested in Image 4.27 on steak, other red meat products were also tested to determine whether the type of product will influence how consumers pay attention to the fat in the pack. Packs of high- and low-fat beef sausage were made up for the test and placed next to each other in Image 4.32 to test the participants' attentional behaviour to fat in the sausage.



Image 4.32: High-fat and low-fat beef sausage

Table 4.37: Eye-tracking results for high-fat and low-fat beef sausage

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
High-fat sausage										
Whole sausage	88%	7.8303	0.2068	1.5663	0.2030	0.6937	2.0295	2.1181	1.1452	2.0303
Bar code	8%	1.2917	0.2021	0.2558	0.1988	2.6721	9.8750	1.1250	0.2367	0.2608
Butchery name	19%	1.8772	0.2060	0.3851	0.2118	2.7009	9.8246	1.1404	0.3814	0.4305
Cut name	10%	1.4667	0.2453	0.3400	0.2460	2.6120	9.5333	1.2333	0.2947	0.3450
Fat in sausage	17%	1.6923	0.1875	0.3290	0.2079	2.4237	8.7308	1.2115	0.2735	0.3529
Classification	18%	1.6429	0.1855	0.3132	0.1864	2.2634	7.7500	1.2321	0.2486	0.3223
Packaging date	8%	1.7200	0.2336	0.3696	0.2376	2.9368	10.8000	1.2000	0.3136	0.3872
Price of pack	31%	1.8750	0.2275	0.4127	0.2226	2.1614	7.6250	1.3229	0.3334	0.4358
Price per kg	10%	1.3125	0.2438	0.3309	0.2488	2.7897	10.2813	1.0938	0.3172	0.3338
Sell-by date	23%	1.4857	0.1867	0.2836	0.1827	2.7071	9.5571	1.1714	0.2444	0.2909
Weight of pack	32%	1.5816	0.2201	0.3418	0.2228	2.4113	8.5000	1.2449	0.2874	0.3572
Low-fat sausage										
Whole sausage	89%	8.2022	0.2165	1.7092	0.1774	0.6438	1.7132	2.1397	1.1661	2.1033
Cut name	18%	1.1636	0.2127	0.2444	0.2144	2.3076	8.1273	1.0364	0.2378	0.2478
Butchery name	19%	1.6724	0.2198	0.3393	0.2234	2.2098	7.3966	1.1034	0.3503	0.3776
Bar code	25%	1.5974	0.1964	0.3100	0.1986	2.1325	7.2597	1.1818	0.2703	0.3266
Classification	20%	1.5167	0.2098	0.3137	0.2025	2.5413	8.3833	1.1833	0.2805	0.3290
Packaging date	17%	1.5769	0.2087	0.3175	0.2044	1.8790	6.9038	1.2308	0.2606	0.3254
Price of pack	38%	1.9322	0.2246	0.4309	0.2232	2.1369	7.5424	1.3305	0.3407	0.4525
Price per kg	17%	1.5849	0.2292	0.3366	0.2392	2.0340	7.6981	1.1698	0.3066	0.3498
Sell-by date	22%	1.6029	0.2079	0.3304	0.2004	1.9868	6.9853	1.1765	0.2851	0.3460
Weight of pack	38%	1.8879	0.2315	0.4157	0.2067	2.2272	7.8448	1.2672	0.3450	0.4360

Image 4.32 shows two packs of beef sausage that were packaged in the same manner (vacuum-packed only). The sausage on the left contained more fat (high-fat), while the image on the right was kept the same (low-fat) as other images of sausages in the test. The results for Image 4.32 are shown in Table 4.37. The percentages of participants who fixated on the two packs of sausage were relatively similar (88% high fat vs. 89% low fat), with the low-fat product measuring a higher fixation percentage. Also, the average time to first fixation proved to be quite similar (0.6937 seconds vs. 0.6438), with the low-fat sausage receiving attention slightly earlier. The average total fixation duration for the low-fat sausage was longer (1.7092 seconds vs. 1.5663 seconds) and also received more fixations on average per participant (8.2022 vs. 7.8303). The average time to first fixation results for the labelling aspects suggest that all labelling aspects on the low-fat sausage, except for classification, caught the participants' attention at an earlier stage than the labelling equivalents on the high-fat sausage. With the exception of two aspects (butchery's name and sell-by date), the percentage of participants fixating on the labelling aspect of the low fat-fat sausage was higher. This creates the impression that the high-fat sausage did not attract the participants' attention to itself or its labelling, but rather caused the participants to be more focused on the labelling of the low-fat sausage. The fat in the high-fat sausage was fixated on by the participants on average after 2.4237 seconds by 17% of the participants for an average fixation duration of 0.3290 seconds. In this image, the fat in the packaging (or in the product) seemed less important to the participants compared to Image 4.25, where respectively 57% and 63% of the participants fixated on the fat on the cut of beef at an earlier stage of the test and for a longer period. Part of the explanation could be that consumers expect to see fat in the beef sausage they buy and do not pay attention to the fat specifically, but they do, however, compare low-fat sausages when tested next to each other. These results also indicate that the packaging used for red meat products has a larger influence on consumers' attention than the fat content of the red meat product.

Subcategories

The fixation results between the races showed that all the coloured participants fixated on the low-fat sausage, while 91% of all the participants fixated on the high-fat sausage. Slightly more white participants fixated on the low-fat sausage (87% vs. 82%), while more black participants fixated on the high-fat sausage (89% vs. 88%). Fat visible in the high-fat sausage measured fixation percentages of 18% from coloured and black participants, while 13% of white participants paid attention to the fat. Education showed an increase in fixation percentages on both packs of sausage when moving from participants with Grade 1 to 7 education to Grade 8 to 12, while no further significant increase was noticed when moving to higher levels of education. The lowest level of education group showed a fixation percentage of 73% for the high-fat sausage and an 82% rate for the low-fat sausage. Education seemed to be somewhat correlated to the attention paid to the fat in the sausage, where 5% of the participants with a lower level of education, 19% of the participants with Grade 8 to 12, and 16% of the participants with a tertiary education paid attention to the fat.

Regarding age, the high-fat image showed a decrease in fixation percentage as the age of the participants increased. The low-fat sausage also showed a decreasing trend but a delayed reaction was seen where the fixation percentage spiked among the 31 to 40 age group at 95% (fixation percentage), where after it continued to decrease in the older groups.

Both packs of sausage scored a 93% fixation percentage from women and 86% from men. The fat in the sausage proved to be more likely fixated on by women (21%) than men (15%). Income-based fixation percentages showed very similar results between the two packs, where the largest fixation percentages were measured from the middle-income group (92% for low-fat and 91% for high-fat), followed by the low-income (88% for both) and high-income (84% for both) groups. The fat in the sausage measured the highest fixation percentage from the middle-income groups (21%), followed by the lower-income group (17%) and high-income group (10%).

Mutton/lamb was tested in the eye-tracking test and the images and results are presented in Table 4.38. Image 4.33 shows three packs of mutton that represent the following: medium-fat meat, high-fat meat, and lower-fat / highly marbled meat.



Image 4.33: Medium-fat, high-fat, and lower-fat / highly marbled mutton

Table 4.38: Eye-tracking results for medium-fat, high-fat, and lower-fat / highly marbled mutton

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Left – bright medium-fat meat	82%	4.0830	0.2105	0.8143	0.2168	1.3075	4.0040	1.7115	0.6388	0.9762
Middle – paler high-fat meat	90%	7.1841	0.2109	1.4071	0.2065	0.3774	0.6823	2.7437	0.7198	1.7564
Right – high marbling red meat	89%	5.4066	0.2088	1.0910	0.2192	1.2523	3.7802	1.7546	0.8490	1.3417

The results for the medium-fat meat, high-fat meat, and lower-fat / highly marbled meat from the test (see Image 4.33 and Table 4.38) show that a relatively high percentage of the participants fixated their attention on all three the packs: 82%, 90%, and 89% respectively. The high-fat meat measured the highest fixation percentage at 90%, with the lowest time to first fixation (0.3774 seconds) and the longest average total fixation duration (1.4071 seconds). The average fixation count was the highest for the high-fat meat (7.1841). The results for the other two packs show that highly marbled meat was on average fixated on earlier (1.2523 seconds vs. 1.3075 seconds) and fixated on more times (5.4066 vs. 4.0830), and for longer (1.0910 seconds vs. 0.8143 seconds) than the medium-fat meat. The results suggest that the high-fat meat caught consumers' attention first, followed by the highly marbled meat and the medium-fat meat. The position of the high-fat meat (middle) might have influenced consumers' attention when shown the test image.

Subcategories

Regarding race, the coloured participants fixated on all the packs of meat. The white participants paid the most attention to the highly marbled pack of meat on the right (87%) and the lowest amount of attention to the pack on the left (69%). The black participants paid the most attention to the high-fat meat in the middle (91%), followed by the highly marbled meat (89%). In all three images, the fixation percentage increased as the level of education increased. Of all the images, the high-fat meat measured the highest score from participants with a tertiary education (92%). The medium-fat pack measured the highest fixation percentage from the participants aged 18 to 30 years (90%), with lower rates from the older groups. For the high-fat and highly marbled meat, the scores reached a maximum among the 31 to 40 age group (96% and 94% respectively), with a decrease in fixation percentage among the older groups. In all three images, women (left to right: 89%, 92%, and 92%) were more likely to fixate on the images than men (left to right: 79%, 89%, and 87%). The highest fixation percentage for men was measured on the high-fat meat. This suggests that women are constantly searching for meat products with an adequate amount of fat, while men's attention is easily attracted to and kept on high-fat mutton. The highest fixation percentage was measured from the middle-income group on the high-fat meat (92%). The highest fixation percentage for the medium-fat meat was measured from the middle-income group (87%), followed by the low-income (80%) and high-income participants (79%). For the high-fat meat, the highest fixation percentage was measured by the middle-income group (92%), followed by the low-income (91%) and high-income (86%) participants. The highly marbled meat measured the

same fixation percentage from the middle- and high-income group (91%), followed by the low-income group (86%).

In terms of the sausages, lower-fat products measured a slightly higher fixation percentage than the higher-fat sausages. With the exception of the sell-by date on the higher-fat sausage, all labelling on the lower-fat sausage measured the same or higher fixation percentage than the high-fat sausage. This suggests that a higher-fat product caused slightly more participants to pay attention to the sell-by date of the product. However, lower-fat sausages will be able to draw more consumers' attention to the labelling aspects. In terms of the tested mutton/lamb chops, the highest fixation percentage was measured by the paler high-fat meat, followed by the marbled brighter-red meat with a 1% lower fixation percentage. This could indicate that when it comes to higher-valued red meat products, consumers pay more attention to the fat on the product than was the case for cheaper red meat products. Women seemed to consider all the presented options of mutton, while men paid more attention to the high-fat mutton.

4.3.3.4 Bulk packaging testing

Larger packs of mutton were also tested in the eye-tracking test. Image 4.34 contains two bulk packs of mutton in different packaging.



Image 4.34: Bulk mutton packs

Table 4.39: Eye-tracking results for bulk mutton packs

Aspect	Fixations							Visits		
	Percentage mean	Count mean	Duration mean	Total duration mean	First duration mean	Time to first mean	Fixations before mean	Count mean	Duration mean	Total duration mean
Bulk mutton pack vacuum-packed only – Pack A										
Vacuum-packed only	83%	4.8359	0.1993	0.9504	0.1885	0.9589	2.6133	2.0820	0.6068	1.1338
Bar code	3%	1.0000	0.1720	0.1720	0.1720	2.1620	7.0000	1.0000	0.1720	0.1720
Butchery name	13%	1.6341	0.1946	0.3337	0.1802	2.8610	9.7561	1.2195	0.2893	0.3500
Cut name	4%	1.1538	0.1492	0.1662	0.1485	3.2892	11.4615	1.0000	0.1662	0.1662
Classification	16%	1.6400	0.2478	0.3776	0.2430	2.3198	7.8000	1.2200	0.3026	0.3878
Packaging date	2%	1.1429	0.2700	0.3000	0.2686	2.8300	11.2857	1.0000	0.3000	0.3000
Price of pack	21%	1.4286	0.2116	0.2903	0.2054	2.9000	9.9206	1.1746	0.2613	0.2940
Price per kg	3%	1.1000	0.1680	0.1880	0.1690	2.7400	8.8000	1.1000	0.1680	0.1880
Sell-by date	15%	1.3913	0.2154	0.3113	0.2004	2.4020	8.0870	1.1522	0.2733	0.3257
Weight of pack	22%	1.3731	0.2778	0.3772	0.2745	3.0210	10.3731	1.1343	0.3331	0.3810
Bulk mutton vacuum-packed and on cardboard – Pack B										
Vacuum-packed on cardboard	87%	5.5933	0.2063	1.0919	0.2006	0.7075	1.7351	1.9627	0.8615	1.4769
Bar code	6%	1.6471	0.2400	0.4153	0.2453	1.3329	4.6471	1.1765	0.3688	0.4529
Butchery name	23%	2.1286	0.1884	0.3907	0.1756	2.1224	7.0714	1.2143	0.3714	0.4561
Cut name	17%	1.8462	0.2037	0.3306	0.1960	2.4923	8.4231	1.2308	0.3119	0.3831
Classification	17%	1.7647	0.1588	0.2645	0.1622	2.2592	7.8039	1.3137	0.2192	0.2906
Packaging date	12%	1.4167	0.1914	0.2797	0.2019	2.2111	7.7222	1.1944	0.2269	0.2883
Price of pack	32%	1.9694	0.2274	0.4049	0.2164	2.4597	8.5102	1.3265	0.3289	0.4258
Price per kg	14%	1.3488	0.1812	0.2488	0.1765	2.8198	9.3488	1.0465	0.2384	0.2616
Sell-by date	10%	1.5625	0.2122	0.3206	0.1719	2.6297	9.1875	1.1563	0.3175	0.3463
Weight of pack	21%	1.7846	0.3058	0.4718	0.2940	2.7355	9.6308	1.2923	0.3838	0.4846

Table 4.39 shows the eye-tracking results for Image 4.34. The mutton pack on the left was vacuum-packed only. The price label on the pack was different from the mutton pack on the right to investigate participants' behaviour when investigating the pack. The pack on the left was labelled as a C3 classification with a lower price than the other one and is referred to as Pack A. The bulk mutton pack on the right was placed on a piece of cardboard before being vacuum-packed. The labelling on this box showed an A4 classification (lamb meat) and a higher price. This pack is referred to as Pack B.

Pack B was viewed by 4% more participants (87% vs. 83%) than Pack A. Besides the higher fixation percentage on Pack B, all the labelling aspects of Pack B received higher fixation percentages than Pack A. The average time to first fixation data show that, on average, the participants first paid attention to Pack B before moving to Pack A. With the exception of price per kg and sell-by date, all the labelling aspects on Pack B were fixated on earlier in the test on average than the corresponding Pack A labelling aspects. According to the average total fixation duration, Pack B was fixated on for 1.0919 seconds, while Pack A was fixated on for 0.9504 seconds. Individual labelling aspects that received the longest average fixation durations were the weight of Pack B (0.4718 seconds), the bar code on Pack B (0.4153 seconds), and the price of Pack B (0.4049 seconds). The results from this image suggest that, contrary to previous results, where meat that was vacuum-packed only enjoyed attention from a larger share of consumers, meat that is first placed on cardboard before being vacuum-packed enjoyed attention from more consumers. It might be the case where bulk packs of meat are packaged and not presented in smaller quantities as in the previous images.

Subcategories

All the coloured participants fixated on both of the packs of mutton. The meat placed on the cardboard before being vacuum-packed measured higher fixation percentages from black and white participants than the vacuum-packed-only meat. The level of participants' education showed a positive correlation with the fixation percentage on Pack A, while the same cannot be said for Pack B, where participants with Grade 1 to 7 scored a fixation percentage of 86%, participants with Grade 7 to 12 scored 82%, and participants with a tertiary education scored an 85% fixation percentage. Age group data showed that the participants in all the age groups younger than 61 years measured a higher fixation rate on Pack A, while the 61 to 70 age group showed a higher fixation percentage on the vacuum-packed-only meat. Women proved to be more likely to fixate on both packs of meat. The fixation percentages for Pack B was higher than Pack A for both men and women. Income-based results show that the middle-income group paid the most attention to both packs. The high- and low-income groups measured the same fixation percentage for Pack A, while the high-income group measured a higher value than the low-income group with regard to fixation percentage on Pack B.

Pack B measured higher fixation percentages from the participants. The meat was slightly brighter, which could have led to the participants' attention being drawn to the pack. All the labelling aspects, except for the sell-by date, measured higher scores on Pack B than Pack A. The higher fixation percentage noticed for the sell-by date on Pack A somewhat correlates to what was seen for Image 4.33, where the paler meat scored a higher fixation percentage from the participants. The sell-by date could have been used by the participants to determine why the meat in the pack was paler than the meat in the pack next to it.

4.4 IDENTIFYING DIFFERENCES BETWEEN EYE-TRACKING AND QUESTIONNAIRE RESULTS

This part of the thesis focuses on statistically ranking the importance of the different aspects tested during data collection. The main focus of this section is to compare what red meat consumers indicated they looked at (questionnaire) to what they actually looked at (eye-tracking). To statistically rank the importance of aspects, Kendall's W test was used and the results are presented in the tables that follow. The results from these tests include the mean ranks from the participants between the different aspects to determine more and less preferred aspects, as well as the extent to which the participants agreed regarding preferences and attention paid to the different aspects.

The aspects were divided into main themes, subdivided into categories under each theme, and tested within these categories (see Figure 4.13). Separate Kendall's W tests were conducted for each category on the eye-tracking data and questionnaire data respectively. To ease the comparison of the questionnaire and eye-tracking results, the two sets of results for each category are presented in a combined table. The ratings used from the questionnaire data were the ratings the participants gave to the different aspects according to importance. A Likert scale of 1 (not important) to 5 (very important)

was provided to the participants for rating. The data used for the eye-tracking part of the analysis entailed the fixation percentages of individual participants, which showed whether each participant paid attention to the tested aspect or not when presented with the packs of red meat products.

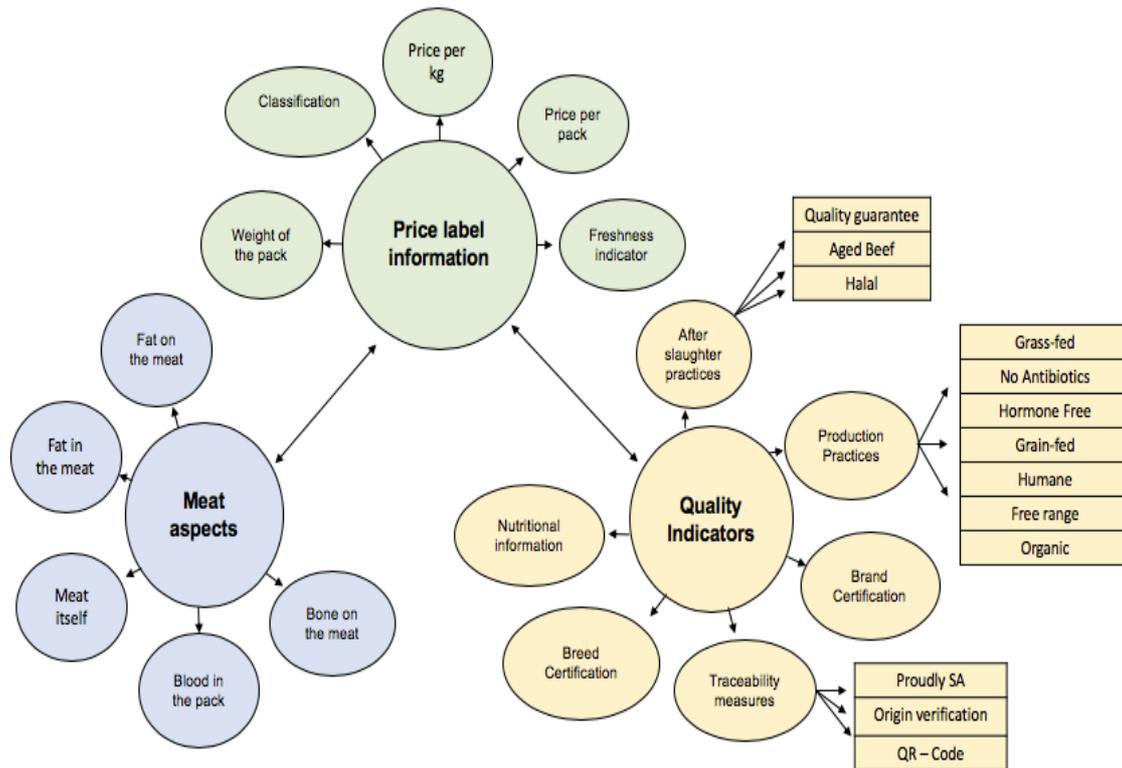


Figure 4.13: Framework used for the tested aspects

Source: Author's own illustration

The themes of the aspects are shown in Figure 4.13, and include quality indicators (yellow), meat aspects (blue), and price label information (green). The different quality indicators consisted of the following categories: brand certification, breed certification, nutritional information on the pack, after-slaughter practices, traceability measures, and production practices. After-slaughter practices in turn consisted of “Halal”, “Top quality guaranteed”, and “Aged” beef labelling. The average scores of these three aspects were used as a score for after-slaughter practices in Kendall’s W test. Traceability measures consisted of “Proudly made in SA”, origin verification (other than proudly South African), and QR code labelling scores. Production practices included all aspects relating to the production of the meat prior to slaughter. Thus “Grass fed”, “No antibiotics”, “No added hormones”, “Grain fed”, “Certified humane”, “Free range”, and “100% organic” labelling scores were all used to calculate the score for production practices. Price label information represented all the aspects that were tested and shown on all the price labels of the images. The classification of the meat, price per kg, price per pack, freshness indicators, and the weight of the pack all fall under the price label information label. Meat aspects all relate specifically to the meat itself and the physical appearance of the meat. The categories grouped under the meat aspects theme include fat on the meat, fat in the meat, meat itself, blood in the pack, and bone in the meat.

The presented results firstly focus on the quality indicator labels, after which the three subdivided categories of quality indicators are tested and presented. This is followed by price label information and meat aspect results. The different categories of quality indicators based on the questionnaire and eye-tracker data were tested and are shown in Table 4.40. Kendall's *W* test was separately conducted on both the questionnaire and eye-tracking data to determine the preferences within each of the two test datasets.

Table 4.40: Kendall's *W* test results for quality indicators

Questionnaire ranks		Eye-tracker rank	
Aspect	Mean rank	Aspect	Mean rank
Brand certification	4.08	Brand certification	4.19
Traceability	3.77	Nutritional information	3.97
Nutritional information	3.59	Breed certification	3.96
After-slaughter practices	3.28	Traceability	3.08
Breed certification	3.20	Production practices	2.93
Production practices	3.08	After-slaughter practices	2.86
Test statistics		Test statistics	
N	307	N	307
Kendall's <i>W</i> ^a	.059	Kendall's <i>W</i> ^a	.121
Chi-square	90.501	Chi-square	186.048
df	5	df	5
Asymp. Sig.	.000	Asymp. Sig.	.000

a. Kendall's coefficient of concordance

According to Kendall's *W* test (see Table 4.40) for the questionnaire data, the most important quality indicator was brand certification, followed by traceability, nutritional information, and after-slaughter practices. Breed certification and production practices were ranked the lowest in this regard. From the eye-tracking results it was found that brand certification enjoyed the largest share of attention from the participants, followed by nutritional information and breed certification. The lower-ranked scores include traceability, production practices, and after-slaughter practices.

These results show that the participants placed a high value on brand certification. They not only indicated that it was important but also showed that it was an important aspect by paying attention to it. This could serve as proof to red meat producers and retailers of the weight that a good brand of meat carries in the eyes of consumers. Further comparison between the questionnaire and eye-tracker results show that the participants paid more attention to nutritional information, breed certification, and production practices than stated in the questionnaire (comparison between the two sets of ranks), while paying less attention to traceability aspects and after-slaughter practices than indicated in the post-test questionnaire. These results suggest that producers should first focus on supplying consumers with a known brand of meat, on-pack nutritional information, and breed certification before focusing on the traceability, production practices, and after-slaughter practices with regard to labelling.

Following the quality indicators, the individual after-slaughter practices were tested. The results are shown in Table 4.41.

Table 4.41: Kendall’s W test results for after-slaughter practices labelling

Questionnaire ranks		Eye-tracking ranks	
Aspect	Mean rank	Aspect	Mean rank
“Top quality guaranteed”	2.40	“Top quality guaranteed”	2.04
“Aged”	2.03	“Aged”	2.00
“Halal”	1.57	“Halal”	1.97
Test statistics		Test statistics	
N	307	N	307
Kendall’s W ^a	.300	Kendall’s W ^a	.004
Chi-square	184.157	Chi-square	2.250
df	2	df	2
Asymp. Sig.	.000	Asymp. Sig.	.325

a. Kendall’s coefficient of concordance

The results from Kendall’s W test for after-slaughter practices labelling that were tested against one another to determine the preferences for the individual aspects are shown in Table 4.41. In both analyses, the aspects were ranked in the same order. Thus, the participants paid attention to after-slaughter practices labelling in a similar manner to which they reported ranking these labels. “Top quality guaranteed” labelling showed the highest preference and also enjoyed the largest level of attention from the participants, followed by “Aged” beef labelling and lastly “Halal” labelling. The high rank that the “Top quality guaranteed” labelling scored in both tests suggests that the participants attached high value to the assurance of buying high-quality meat. This could be an option for retailers to pursue when attempting to increase the value of their red meat products in the eyes of their consumers.

The three forms of traceability labels used in the test were analysed and the results are presented in Table 4.42.

Table 4.42: Kendall’s W test results for traceability labelling

Questionnaire ranks		Eye-track ranks	
Aspect	Mean rank	Aspect	Mean rank
“Proudly made in SA”	2.28	Origin certification	2.32
Origin certification	1.98	“Proudly made in SA”	1.89
QR code	1.74	QR code	1.79
Test statistics		Test statistics	
N	307	N	307
Kendall’s W ^a	.164	Kendall’s W ^a	.122
Chi-square	100.974	Chi-square	75.113
df	2	df	2
Asymp. Sig.	.000	Asymp. Sig.	.000

a. Kendall’s coefficient of concordance

In terms of the questionnaire data, the form of traceability labelling (see Table 4.42) that was ranked the most important by the participants was the “Proudly made in SA” labelling, followed by origin

certification, which in this test represented the province the meat originated from, and the least important was the QR code. The eye-tracking results from Kendall's W test showed that more attention was paid to origin certification labelling than to the "Proudly made in SA" and QR code labelling. From the results, it could be deduced that while the participants ranked "Proudly made in SA" products higher than provincial origin certification products, they actually paid more attention to the provincial origin certification labelling than the "Proudly made in SA" labelling. This could be due to one of two reasons. Firstly, the "Proudly made in SA" label used in the test is a familiar label and most consumers should be familiar with it and they thus did not pay as much attention to the label in the eye-tracking test as their intentions indicated from the post-test questionnaire. The second reason could be that consumers want to associate themselves with a more selective group of consumers by purchasing a more elite product than just verified at country level. They thus prefer to buy red meat from a more selective area, for instance a specific province.⁶ This can be used as evidence for producers that some consumers regard the origin of their red meat as important, as these results showed that a more selective area of production enjoyed more attention. By making use of eye-tracking, a difference was identified between what the participants indicated they looked at and what they actually looked at.

The production practice labels that were used were all tested and ranked against one another. The results are presented in Table 4.43.

Table 4.43: Kendall's W test results for production practice labelling

Questionnaire ranks		Eye-tracking ranks	
Aspect	Mean rank	Aspect	Mean rank
"No antibiotics"	4.18	"Free range"	4.19
"Grass fed"	4.17	"No antibiotics"	4.06
"No added hormones"	4.04	"Grass fed"	4.05
"100% organic"	3.93	"100% organic"	4.04
"Grain fed"	3.93	"No added hormones"	3.95
"Certified humane"	3.93	"Grain fed"	3.91
"Free range"	3.82	"Certified humane"	3.80
Test statistics		Test statistics	
N	307	N	307
Kendall's W ^a	.008	Kendall's W ^a	.006
Chi-square	15.490	Chi-square	10.900
df	6	df	6
Asymp. Sig.	.017	Asymp. Sig.	.092

a. Kendall's coefficient of concordance

The results from the different production practice labelling that was used in the test are presented in Table 4.43. During the post-test questionnaire, the participants indicated their preferences regarding production practice labelling in descending order of preference. These included "No antibiotics", "Grass fed", "No added hormones", "100% organic", "Grain fed", "Certified humane", and "Free range". In the eye-tracking test, a slightly different picture emerged where "Free range" labelling enjoyed the highest

⁶ The origin certification used indicated the province of origin.

level of attention. Aspects enjoying attention in a descending order followed the same sequence in the eye-tracking test as the questionnaire-based ranking, with the exception of “Free range” labelling being ranked highest and not the lowest, as in the case of the questionnaire data. The general trend that these results from both the questionnaire and eye-tracker suggest is that the participants preferred a product that is closer to nature. It should also be noted how close the ranks were between the different forms of labelling in both the questionnaire and eye-tracker cases. This would emphasise the importance of identifying the correct label (production practice) for a targeted market.

All aspects tested on the pricing label of the meat products were grouped together and the results from Kendall's W test are shown in Table 4.44.

Table 4.44: Kendall's W test results for pricing label information

Questionnaire ranks		Eye-tracking ranks	
Aspect	Mean rank	Aspect	Mean rank
Price per kg	3.44	Price per pack	3.76
Price per pack	3.31	Weight of pack	3.20
Weight of pack	3.17	Classification	2.83
Classification	2.92	Price per kg	2.66
Freshness indicators	2.15	Freshness indicators	2.55
Test statistics		Test statistics	
N	307	N	307
Kendall's W ^a	.169	Kendall's W ^a	.131
Chi-square	187.071	Chi-square	161.064
df	4	df	4
Asymp. Sig.	.000	Asymp. Sig.	.000

a. Kendall's coefficient of concordance

Table 4.44 shows the ranks for pricing label aspects with regard to the questionnaire and eye-tracker data. In the questionnaire, the price per kg was ranked as the most important price label aspect, followed by the price and the weight of the pack. The classification of the meat and the freshness indicators were the lowest-ranked aspects. In light of the eye-tracker data, the price of the pack enjoyed the highest level of attention from the participants, followed by the weight of the pack and the classification. The price per kg and freshness indicators were the aspects that enjoyed the least amount of attention from the participants. Again, a difference was found between what the participants indicated that they looked at when buying red meat and what they actually paid attention to when looking at packs of red meat. While the participants said that price per kg was more important than price per pack, the results showed the opposite – that price per kg enjoyed less attention from the participants than the weight of the pack and the classification of the meat. It is surprising to note that the participants ranked (questionnaire) and showed (eye-tracking) that the freshness indicators were the least important aspect on the pricing label. The results from the price label information showed that the price of the pack enjoyed more attention than the price per kg and that consumers would buy the pack of meat that met their price per pack budget and not necessarily the pack that met their price per kg budget. Surprisingly, the participants indicated that the freshness indicators on the pack were the least important aspects on the price label and these also enjoyed the least amount of attention from the participants.

The last Kendall's *W* test (see Table 4.45) ranks and presents the different meat aspects.

Table 4.45: Kendall's *W* test results for meat aspects

Questionnaire ranks		Eye-tracking ranks	
Aspect	Mean rank	Aspect	Mean rank
Meat-only area	3.38	Meat-only area	4.18
Fat on the meat	3.05	Fat on the meat	3.47
Bone in the meat	2.98	Blood in the pack	2.74
Blood in the pack	2.81	Bone in the meat	2.59
Fat in the meat	2.78	Fat in the meat	2.02
Test statistics		Test statistics	
N	307	N	307
Kendall's <i>W</i> ^a	.055	Kendall's <i>W</i> ^a	.367
Chi-square	67.355	Chi-square	450.998
df	4	df	4
Asymp. Sig.	.000	Asymp. Sig.	.000

a. Kendall's coefficient of concordance

The different meat aspects that were ranked according to importance (questionnaire) and paid attention to (eye-tracker) are presented in Table 4.45. Questionnaire and eye-tracking results for the meat aspects mostly correlate between the two sets of data, with the only difference being that bone in the meat scored higher in the questionnaire data, while blood in the pack enjoyed slightly more attention than bone in the meat in the eye-tracker test than would be suggested by the questionnaire data. A general rank of importance between the two tests is the meat itself, fat on the meat, followed by either blood in the pack or bone in the meat, and lastly fat in the meat (marbling). These results confirm that while attention was paid to the amount of fat on the meat, the appearance of the meat itself was more important. Once the first two aspects are successfully managed, producers and retailers should pay attention to the bone in the meat and the blood in the pack, which proved to be less important. Lastly, fat in the meat (marbling) does not seem to be an aspect that will be worthwhile to pursue as a key strategy of differentiation. This aspect was neither ranked (questionnaire) nor measured (eye-tracker) highly by the participants.

This concludes the section where the different aspects were ranked between what the participants stated they looked at and what they actually looked at in the test. In the next part of the chapter, a summary of the scores for each aspect is presented.

4.5 TEST GROUP SUMMARY FOR QUESTIONNAIRE AND EYE-TRACKING DATA

The summary of the mean ranks obtained by the different tested aspects among all the tested population groups in both the questionnaire data and eye-tracker data are presented in Tables 4.46 and 4.47 respectively. These scores are presented per theme and category (vertically) and also per specific test group (income, age, etc. – horizontally). Subcategory results are also presented separately under the category themes in Tables 4.48 and 4.49.

Table 4.46: Summarised questionnaire results according to test themes

Questionnaire	Quality Indicators						Price label information					Meat aspects				
	Brand Certification	Breed Certification	Nutritional information on the pack	Production practices	After slaughter practices	Traceability measures	Classification	Price per kg	Price per pack	Freshness indicator	Weight of the pack	Fat on the meat	Fat in the meat	Meat itself	Blood in the pack	Bone on the meat
Income Group																
Low	3.54	2.71	2.96	2.79	2.90	3.15	3.33	4.21	4.27	2.34	4.00	3.90	3.74	4.45	3.71	4.01
Middle	3.42	2.72	2.90	2.69	2.95	3.22	3.87	4.46	4.25	2.23	3.97	4.21	3.95	4.68	3.76	4.19
High	3.28	2.31	3.17	2.80	2.78	2.79	3.76	4.24	3.97	1.64	3.54	4.60	4.22	4.50	4.26	4.28
Gender																
Female	3.39	2.67	2.99	2.82	2.85	3.12	3.45	4.48	4.43	2.45	3.88	4.38	4.27	4.63	3.95	4.38
Male	3.47	2.62	2.98	2.72	2.92	3.11	3.68	4.22	4.09	2.02	3.92	4.02	3.72	4.50	3.77	4.00
Age group																
18-30 years	3.66	2.54	2.98	2.53	2.81	3.04	3.23	4.25	4.23	2.20	3.75	4.13	3.93	4.34	3.71	4.23
31-40years	3.60	3.00	3.31	2.94	3.04	3.35	3.77	4.14	4.37	2.38	3.84	4.15	4.02	4.56	3.71	3.95
41-50 years	3.32	2.81	2.75	2.82	2.76	3.15	3.67	4.56	4.11	1.90	4.10	3.94	3.81	4.79	3.76	4.29
51-60 years	2.98	2.17	2.57	2.76	2.93	2.90	3.79	4.32	4.04	2.02	4.05	4.17	3.64	4.40	4.02	3.94
61-70 years	3.30	2.20	3.20	2.88	3.00	2.83	3.85	4.35	4.20	2.25	3.93	4.70	4.25	4.85	4.55	4.45
Level of education																
Grade 1-7	3.14	2.55	2.45	2.78	3.05	2.86	3.64	4.73	4.27	2.50	4.18	4.45	3.82	4.68	4.14	4.45
Grade 8-12	3.38	2.59	2.95	2.75	2.92	3.08	3.56	4.16	4.13	2.23	3.80	4.03	3.82	4.52	3.78	4.03
Tertiary	3.58	2.72	3.11	2.75	2.84	3.18	3.66	4.41	4.29	2.03	4.00	4.23	4.03	4.54	3.84	4.19
Race																
African	3.54	2.86	2.96	2.79	2.90	3.19	3.54	4.30	4.22	2.32	3.94	4.10	4.01	4.50	3.75	4.13
White	2.78	1.53	3.02	2.51	2.86	2.59	3.78	4.47	4.13	1.44	4.00	4.49	3.49	4.69	4.31	4.42
Coloured	4.00	1.91	3.09	2.88	2.85	3.21	4.27	3.73	4.18	1.36	2.80	3.55	3.18	4.73	3.91	2.82

Table 4.47: Summarised eye-tracking results according to test themes

Eye-tracker	Quality Indicators						Price label information					Meat aspects				
	Brand Certification	Breed Certification	Nutritional information on the pack	Production practices	After slaughter practices	Traceability measures	Classification	Price per kg	Price per pack	Freshness indicator	Weight of the pack	Fat on the meat	Fat in the meat	Meat itself	Blood in the pack	Bone on the meat
Income Group																
Low	55.40	53.96	54.68	38.49	36.93	40.77	27.10	25.18	44.84	21.94	33.33	63.55	23.74	84.89	48.92	38.13
Middle	73.18	64.55	65.68	47.16	45.45	49.49	29.09	25.76	50.91	23.18	37.27	76.97	16.36	91.59	52.27	35.45
High	65.52	51.72	55.17	42.78	37.36	44.64	24.14	21.26	43.10	22.41	33.33	64.94	18.97	87.50	31.90	50.00
Gender																
Female	63.46	58.17	61.30	45.61	45.19	47.76	26.92	25.96	45.83	19.87	38.78	70.83	22.12	91.59	48.08	42.31
Male	63.79	56.90	57.39	40.76	37.44	43.02	27.42	23.97	47.13	23.81	32.68	67.49	19.21	85.84	46.31	37.93
Age group																
18-30 years	67.58	62.64	70.05	47.73	44.32	48.96	28.21	25.27	49.45	28.94	37.73	74.36	25.27	91.76	53.30	36.26
31-40years	67.86	61.90	61.01	49.70	53.17	49.60	28.57	28.97	49.60	21.03	35.32	76.59	19.05	91.37	54.17	47.62
41-50 years	57.14	59.52	54.37	38.69	31.75	42.15	30.16	24.34	50.79	21.16	38.62	66.14	15.87	86.90	38.10	30.16
51-60 years	63.83	45.74	43.62	32.98	26.95	36.88	24.11	19.86	39.01	17.02	28.37	56.74	25.53	81.91	39.36	46.81
61-70 years	50.00	37.50	50.00	24.69	26.67	33.89	16.67	15.00	26.67	16.67	25.00	48.33	0.00	75.00	35.00	30.00
Level of education																
Grade 1-7	52.27	47.73	45.45	33.52	34.85	31.31	24.24	22.73	34.85	11.36	21.21	56.06	4.55	78.41	45.45	36.36
Grade 8-12	60.83	54.14	56.37	38.38	36.31	42.75	28.87	25.27	43.10	23.99	35.24	67.30	17.83	88.38	47.45	34.39
Tertiary	69.14	62.89	63.87	48.88	45.57	49.22	25.78	24.22	53.13	22.53	36.46	72.40	25.78	88.67	46.48	46.09
Race																
African	62.00	58.20	59.40	42.03	39.60	44.76	28.00	24.93	46.93	22.07	34.13	68.93	20.80	87.90	48.80	37.60
White	66.67	50.00	52.22	41.11	37.78	40.74	22.96	18.52	42.96	22.22	31.85	62.96	20.00	83.89	35.56	48.89
Coloured	86.36	63.64	70.45	58.52	63.64	57.58	30.30	42.42	57.58	31.82	60.61	84.85	9.09	100.00	50.00	36.36

Table 4.48: Summarised questionnaire results for subcategories

Questionnaire	Production practices								After slaughter practices				Traceability measures			
	Production practices	Grass-fed	No antibiotics	Hormone free	Grain-fed	Humane	Free range	Organic	After slaughter practices	Halal	Quality guarantee	Aged beef	Traceability measures	Proudly SA	Origin verification	QR-code
Low	2.79	3.06	2.88	2.68	2.91	2.57	2.66	2.77	2.90	1.76	3.98	2.95	3.15	3.76	3.18	2.52
Middle	2.69	2.75	2.82	2.77	2.56	2.87	2.46	2.58	2.95	2.05	3.83	2.98	3.22	3.75	3.37	2.55
High	2.80	2.88	3.09	2.93	2.69	2.71	2.56	2.72	2.78	1.67	3.67	3.00	2.79	3.74	2.40	2.24
Gender																
Female	2.82	3.18	3.00	2.93	2.77	2.69	2.53	2.64	2.85	1.81	3.87	2.88	3.12	3.81	2.99	2.55
Male	2.72	2.77	2.84	2.67	2.73	2.71	2.59	2.72	2.92	1.87	3.87	3.02	3.11	3.72	3.16	2.44
Age group																
18-30 years	2.53	2.48	2.81	2.45	2.46	2.51	2.47	2.51	2.81	1.80	3.85	2.79	3.04	3.56	3.05	2.52
31-40years	2.94	3.12	2.98	3.04	2.90	3.04	2.54	2.95	3.04	2.25	3.89	2.98	3.35	3.79	3.51	2.76
41-50 years	2.82	2.79	3.10	3.05	2.73	2.89	2.49	2.68	2.76	1.67	3.87	2.73	3.15	3.84	3.16	2.46
51-60 years	2.76	3.36	2.64	2.57	3.11	2.36	2.66	2.60	2.93	1.64	3.81	3.34	2.90	3.83	2.74	2.13
61-70 years	2.88	3.40	2.90	2.70	2.70	2.40	3.15	2.90	3.00	1.40	3.95	3.65	2.83	4.10	2.35	2.05
Level of education																
Grade 1-7	2.78	3.73	2.41	2.41	3.18	2.23	3.32	2.18	3.05	1.86	4.09	3.18	2.86	3.73	2.64	2.23
Grade 8-12	2.75	2.87	2.88	2.71	2.78	2.72	2.57	2.74	2.92	1.96	3.95	2.85	3.08	3.63	3.16	2.46
Tertiary	2.75	2.82	3.00	2.88	2.63	2.77	2.44	2.73	2.84	1.70	3.73	3.09	3.18	3.91	3.11	2.54
Race																
African	2.79	3.07	2.87	2.67	2.95	2.64	2.54	2.75	2.90	1.89	3.88	2.93	3.19	3.78	3.27	2.53
White	2.51	2.16	2.93	2.91	1.89	2.69	2.76	2.27	2.86	1.49	3.60	3.49	2.59	3.47	2.09	2.22
Coloured	2.88	2.27	3.09	3.91	1.73	3.91	2.27	3.00	2.85	2.09	4.55	1.91	3.21	4.27	3.27	2.09

Table 4.49: Summarised eye-tracking results for subcategories

Eye-tracker	Production practices								After slaughter practices				Traceability measures			
	Production practices	Grass-fed	No antibiotics	Hormone free	Grain-fed	Humane	Free range	Organic	After slaughter practices	Halal	Quality guarantee	Aged beef	Traceability measures	Proudly SA	Origin verification	QR-code
Low	38.49	38.85	40.29	40.29	38.13	33.09	39.57	38.85	36.93	37.41	35.97	37.41	40.77	36.69	51.80	33.81
Middle	47.16	50.00	45.45	48.18	40.00	45.45	53.64	47.27	45.45	41.82	49.09	45.45	49.49	40.91	72.73	34.55
High	42.78	46.55	50.00	31.03	46.55	34.48	47.41	43.10	37.36	31.03	46.55	34.48	44.64	36.21	68.97	28.74
Gender																
Female	45.61	47.12	50.96	49.04	44.23	39.42	45.67	44.23	45.19	44.23	43.27	48.08	47.76	40.38	65.38	37.50
Male	40.76	42.86	40.39	37.44	38.42	36.95	46.31	41.87	37.44	34.48	42.36	35.47	43.02	36.95	61.08	30.87
Age group																
18-30 years	47.73	52.75	51.65	49.45	48.35	43.96	52.20	41.76	44.32	40.66	49.45	42.86	48.96	47.25	60.44	39.19
31-40years	49.70	50.00	50.00	55.95	50.00	44.05	50.00	48.81	53.17	54.76	54.76	50.00	49.60	46.43	66.67	35.32
41-50 years	38.69	42.86	41.27	26.98	31.75	34.92	46.03	42.86	31.75	28.57	34.92	31.75	42.15	30.16	65.08	31.22
51-60 years	32.98	25.53	31.91	29.79	29.79	31.91	34.04	40.43	26.95	23.40	25.53	31.91	36.88	23.40	65.96	21.28
61-70 years	24.69	35.00	25.00	20.00	15.00	10.00	32.50	30.00	26.67	20.00	30.00	30.00	33.89	25.00	45.00	31.67
Level of education																
Grade 1-7	33.52	31.82	36.36	36.36	13.64	36.36	45.45	34.09	34.85	36.36	31.82	36.36	31.31	27.27	40.91	25.76
Grade 8-12	38.38	38.85	41.40	38.22	38.22	32.48	41.40	38.22	36.31	36.31	37.58	35.03	42.75	37.58	57.96	32.48
Tertiary	48.88	53.13	48.44	46.09	47.66	44.53	51.95	49.61	45.57	39.84	50.78	46.09	49.22	40.63	71.88	35.16
Race																
African	42.03	44.00	42.80	42.40	39.20	37.20	45.40	42.60	39.60	38.00	40.80	40.00	44.76	38.80	60.40	34.93
White	41.11	42.22	48.89	31.11	46.67	37.78	42.22	40.00	37.78	31.11	46.67	35.56	40.74	33.33	66.67	22.22
Coloured	58.52	63.64	54.55	63.64	45.45	54.55	77.27	54.55	63.64	63.64	72.73	54.55	57.58	45.45	90.91	36.36

The summarised results (see Tables 4.46, 4.47, 4.48, and 4.49) provide a simplified format of identifying preference scores (questionnaire) and attention scores (eye-tracking) for the different test groups (income, age, etc.) per tested aspect. These tables could be used by producers and meat outlets to identify the important meat aspects that their target market prefers. Some of the findings identified among the test groups include the following:

4.5.1 Quality indicators

Brand certification was rated higher by lower-income groups, while the middle- and high-income groups paid more attention to these labels. Younger participants ranked and measured brand certification more important than older groups. A higher level of education led to higher ranks and scores for brand certification. In terms of race, coloured participants ranked and measured brand certification the highest among the races. While black participants ranked brands more important than white participants, the level of attention paid by white participants to brands was slightly higher than that of black participants. It is interesting to see how close the level of attention paid towards brands were between black and white participants, while coloured participants measured an almost 20% higher level of attention. The majority of the quality indicators were ranked higher by higher-educated participants and the level of attention paid increased as the level of education increased. In the different age groups, participants in some of the older age groups ranked the nutritional information as more important, while this form of labelling enjoyed the highest level of attention from the youngest age group, with a tendency of lower levels of attention paid by the older groups.

4.5.2 Price label information

Price label information showed that low-income groups ranked the price of the pack the highest and the price per kg the lowest between the three income groups. Both the middle- and high-income groups rated the price per kg of more importance than the price of the pack, with the high-income participants showing the lowest importance for the price of the pack between the three groups. The levels of attention paid did not agree with these ranks, and the middle-income group paid the most attention to both the price per kg and the price of the pack between the different income groups. The low-income group did, however, pay more attention to these aspects than the high-income group. The classification of the meat scored a relatively high preference rating, while the attention paid to the classification labelling was relatively low.

4.5.3 Meat aspects

While high-income participants were less sensitive to price (rank) than the other income groups, the meat aspects results showed that in general the high-income groups rated most aspects of the meat more important than the other income groups. However, this trend cannot be seen in the attention levels where in all aspects, except bone in the meat, the two other groups paid more attention than the high-income group.

Among all the meat aspects, the appearance of the meat itself proved to be crucial; both the preference and attention levels confirm this. The middle-income group rated and paid the most attention to the meat itself. Bone in the meat scored a high value on the ratings but received lower amounts of attention than would be expected from the preference scores. Fat on and in the meat scored relatively similar preference scores, with fat on the meat scoring slightly higher ratings. Attention paid (fixation percentage) sketched a very different picture, with fat on the meat measuring much higher levels of attention than the fat in the meat. The test group that paid the most attention to the fat on the meat was the middle-income group, who in turn paid the least amount of attention to the fat in the meat, with the low-income groups paying the most attention to the fat in the meat. This could be due to the lower-income participants making use of the physical appearance of the meat to a larger extent than the higher-income groups. This trend was not found in the level of education, where higher-educated participants tended to pay more attention to the physical aspects of the meat.

4.5.4 Subcategories

The different production practices received relatively similar preference ratings, with the range between the different scores in the groups being low. From the results, it seemed that low-income groups indicated that the different production practices were of similar importance to them as for the middle- and high-income groups, while the attention that they paid to these labels was in most cases lower than that of the two higher-income groups. Women gave higher ratings for and paid more attention to most of the production practice labelling. Exceptions here were “Certified humane”, “100% organic”, and “Free range” labeling, for which men scored higher preferences. Attention levels showed that while men allocated higher ratings, they paid less attention to specifically “Certified humane” and “100% organic” labelling, with “Free range” labelling being the only form of labelling that was rated more important by men and enjoyed higher levels of attention.

Among all the different test groups, “Proudly made in SA” was rated higher than origin certification in the questionnaires. From the eye-tracker data, the opposite was true in terms of attention paid, where the origin certification labelling enjoyed higher levels of attention than “Proudly made in SA” labelling in all the test groups. QR codes were ranked lower and enjoyed lower levels of attention than the two other traceability measures. This concludes the summary of the different ranks given to the tested aspects by the different categories of participants. In the next part, some special cases are discussed by making use of of heat maps.

4.6 SPECIAL CASES

In this section of the results, selected heat maps are presented and discussed. While the tables used in the first section of this chapter provided accurate data regarding the fixation percentages and times on aspects, heat maps can be used to identify a more general trend in the tested images. Image 4.35 presents the heat map results for a pack of meat containing only a price label. Note

how the largest (redder) share of participants' attention was fixated on the price label, specifically on the price of the pack.

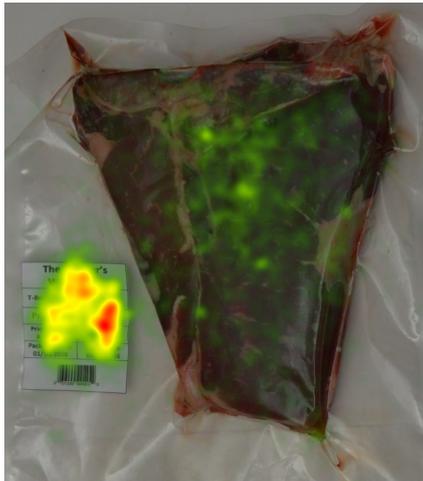


Image 4.35: Heat map for beef steak with a pricing label

Following the pack of meat with only a pricing label, Image 4.36 presents the heat map of a pack of beef that had a quality indicator as well as a price label. In comparison to the previous image, it can now clearly be seen how the attention paid to the pricing labels and the meat itself has decreased on the pack where the quality indicator was added. This illustrates the results that quality indicators led to less attention being paid to the pricing label. This was also the case generally experienced with all the quality labels.

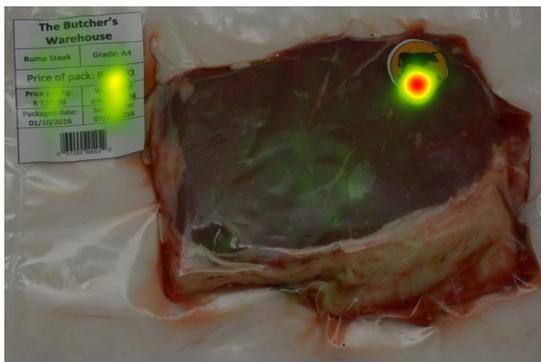


Image 4.36: Heat map for beef steak with a Bonsmara breed label

The effect of the colour of the meat is illustrated in Image 4.37, where two packs of beef were shown next to each other during the test. While the results showed that slightly fewer participants fixated on the dark-red meat than the bright-red meat (75% vs. 79%), the aspects on the pricing label of the dark-red meat enjoyed much higher levels of attention than the bright-red cut. This could indicate the importance of providing freshness information of the meat in the pack, especially if the meat does not appear cherry red.

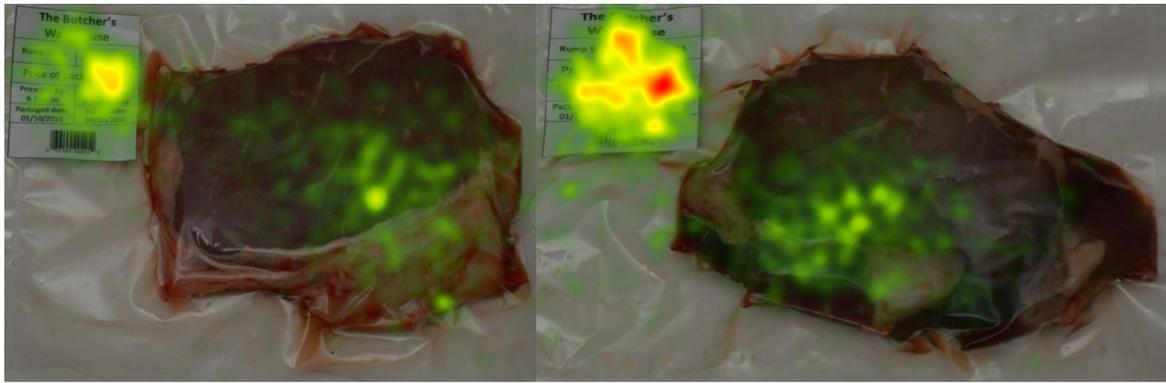


Image 4.37: Heat map for bright-red and dark-red meat combo

In Image 4.38, two rolls of beef sausage were tested next to each other and the heat map results for the image are presented. The difference between the two packs was the packaging that was used, while the sausages placed in the packs were of similar appearance to ensure that the results were not influenced. The sausage on the left was placed on a polystyrene plate before being vacuum-packed, while the roll on the right was only vacuum-packed. The earliest results proved that the vacuum-packed-only sausage enjoyed higher levels of attention (91% vs. 88%) but the heat map shows how the areas that enjoyed attention between the two packs differed. The lower time to first fixation and longer total fixation duration that the vacuum-packed-only sausage had suggest that vacuum-packed-only meat is more successful in capturing the attention of potential buyers, as well as keeping their attention.

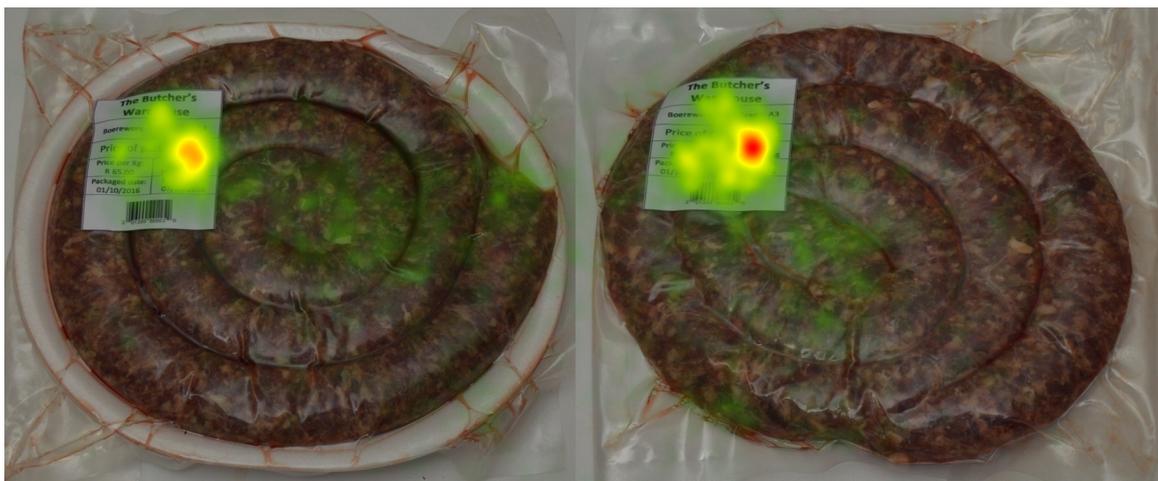


Image 4.38: Heat map for beef sausage in different packaging

To demonstrate how the participants paid attention to a pack of red meat that did not contain any form of labelling, Image 4.39 is shown, which is the heat map result for a beef steak placed on a polystyrene plate and vacuum-packed without any labelling.

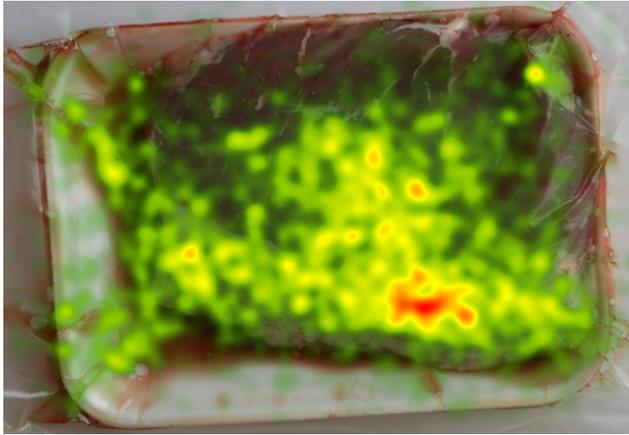


Image 4.39: Eye-tracking results for beef steak with no labelling

The heat map (see Image 4.39) shows how participants paid attention to a pack of meat that did not have any labelling. The heat map shows how the attention duration of the participants was focused on the red area at the bottom right of the image. Also, there are smaller red areas on the meat itself and green areas on the blood shown on the left side of the image. If this heat map is compared to Image 4.36, where a price label was added to the pack, it could be suggested that labelling, in this case specifically the price label, serves as an aid to consumers when looking at red meat products. Labelling allows that consumers' attention is less scattered across the meat in the pack and mainly focused on the labelling of the pack. When no labelling is provided on packets of red meat, consumers seem to fixate their attention on the fat on the meat and the meaty areas of the packets.

4.7 CONCLUSION

The results presented in this chapter consisted of red meat consumers' demographic statistics, their red meat consumption trends, purchasing behaviour, and aspects that were deemed as important when buying red meat products. Following these results from the self-reported data, the eye-tracking data results were presented, which showed the percentage of participants focusing on the different red meat aspects that were tested. The results from these two datasets were then statistically ranked and compared to identify differences between what red meat consumers said was important to them when purchasing their red meat products and what they actually paid attention to when shown images of red meat. In some instances, it was found that the participants' self-reported preferences agreed with their eye-tracking results but also that in certain instances their actions (eye-tracking data) differed from their reported preferences. Lastly, some special cases were presented, where heat maps were used to derive conclusions.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Red meat consumers in the Mangaung Metropolitan Municipality were investigated in this study with the assistance of eye-tracking technology. These consumers proved to have specific preferences with regard to aspects of the red meat products that they buy. These preferences were identified through self-reporting results from the post-test questionnaire completed by the participants after undergoing the eye-tracking test. An eye-tracking test was used to verify whether the aspects that the participants stated were important to them also received attention from the participants when these products were shown to them. Data from both the eye-tracker and the post-test questionnaire were ranked in Kendall's W test to determine whether the tested aspects had the same rank between the two sources of collected data. This study contributes to the use of eye-tracking technology in red meat consumer research and is a one-of-a-kind study in the South African context. This study shows the possibility of using this technology to improve research in the field of red meat studies and opens this field for future research. Presented in this chapter are some key findings that were made in the study and conclusions that are drawn from them. This is followed by recommendations, and suggestions for further research in the field.

5.2 MEETING THE OBJECTIVES OF THE STUDY

The primary objective of this study was to use eye-tracking technology in conjunction with self-reporting techniques to analyse and determine red meat consumers' preferences in the Mangaung Metropolitan Municipality of South Africa. The sub-objectives included in the study were to provide a qualitative review of the beef and mutton market in South Africa and to determine red meat consumers' preferences from eye-tracking and self-reporting data-collection processes. Once these preferences were determined, they were analysed and compared between the two forms of data collection. Another sub-objective was to highlight the advantages of eye-tracking while understanding the use of this technology in the process of investigating red meat consumers' preferences. Lastly, the study also aimed to ensure that the marketing strategies for red meat can be built on the preferential aspects of different consumers in the process of buying red meat.

5.2.1 To provide a qualitative review of the beef and mutton market in South Africa

From the literature review it was clear that the South African red meat industry is an important role player in the economy and is responsible for generating roughly R33.4 billion (2015) annually.

This sector represents, among others, extensive livestock farms, which 68.8% of the total land area in South Africa is mainly suitable for. Growth in the middle- and high-income groups of South African consumers has been seen in recent years, with a decrease in the share of low-income consumers in the country. The middle- and high-income groups are responsible for the majority of red meat purchases and the enrichment of the population has led to an increase in the demand for beef and mutton, which can be seen in the steady increase in the per capita consumption of the two types of meat. Meat was the most popular commodity for 2015, when it contributed 8.1% of the total retail sales in South Africa. Pieces of legislation that affect the meat industry include the Meat Safety Act (No. 40 of 2000) and the Agricultural Product Standards Act (No. 119 of 1990), among others. The classification system used for beef and mutton is highly regulated, with authorities in place to ensure that the classification is applied correctly. Legislation applied to red meat also regulates the marks and quality indicators that may be added to the carcass, the container of the meat, etc. Quality indicators may not lead to misinterpretation, either directly or indirectly. Before a quality indicator or mark can be used, it must be registered with the executive officer and will appear on the list of approved quality indicators. In terms of quality indicators, the red meat industry does not stand back for other meats, with a number of quality indicators already registered that now cater for niche markets and obtain premium prices for their products. While the classification system used for classifying beef and mutton was set out with great intent and performs the role of influencing the price at which live animals are bought, it does not seem as if it is applied transparently as very few red meat retailers indicate the classification of the meat that is sold according to what they bought the animals or carcasses for. The need for consumer education regarding the classification also became clear. Not only has other researchers (Vermeulen *et al.*, 2015) shed light on the matter but it was also identified in this study. Red meat consumers should be educated regarding the classification system used and what it tells them about the product. While chicken is chicken, and no further mention is made of the classification of the chicken meat on the packs, beef and mutton have a classification system that can be used to provide more information regarding the product. Besides educating consumers on the classification system, the registered quality indicators should also be explained to them in a simple and understandable manner. This will ensure that consumers know what they can expect from the products labelled with such quality indicators. It will also allow consumers to determine whether the premium that is to be paid for such a product is worthwhile in their opinion.

The mostly one-sided use of the classification system could be one aspect that is causing sub-optimal marketing of red meat in South Africa. Organisations such as the Red Meat Producers Organization (RPO) can play an important part in ensuring better transparency in the red meat value chain, as well as in the education of consumers. The classification system has in recent years

experienced much criticism and some feel that a meat-grading system should be developed to provide consumers with more information when selecting their red meat products. Consumer research on the matter will assist in developing what type of information consumers would want to see regarding this grading system and how it should be presented on red meat products to ensure greater understanding among consumers.

5.2.2 To determine red meat consumers' preferences in the buying process via eye-tracking, combined with self-reporting data-collection processes

Consumers' self-reported preferences were identified by means of the data collected during the post-test questionnaire. Preferences were identified from the test data generated during the eye-tracker test. The preferences identified from the post-test questionnaire include the following:

5.2.2.1 Labelling of red meat: Self-reported results

The most important labelling aspects that were identified from the self-reported data were price, expiry date, freshness, and quality. The participants indicated that they paid more attention to the price per kg of the pack than the price of the pack. According to these results, retailers will be able to convince red meat consumers of their purchases based on the price per kg that they offer on the red meat products. A recommendation based on this result is that red meat retailers should use price per kg special promotions to attract consumers. Freshness indicators were also reported as important by the participants, indicating the importance of applying these indicators on the packs of meat.

From the recall testing it was found that the participants were more likely to recall a meat brand that was shown to them during the eye-tracking test that was familiar to the area. This is an indication of the success that these brands have achieved through their marketing campaigns in the Mangaung area. It is recommended that red meat retailers place emphasis on their marketing campaigns in order to increase their market share. Retailers must ensure that their brand is known among local consumers to ensure their future.

The quality indicators that were ranked as important during the interviews were "Top quality guaranteed", "Proudly made in SA", brand certification, and origin certification. This shows the need that red meat consumers indicated for a verification method of sorts that will be able to guarantee the quality of the red meat that they purchase. Consumers are positive towards South African products, and the high level of importance suggests that consumers will support such a product.

5.2.2.2 Red meat characteristics: Self-reported results

Meat aspects that the majority of the participants regarded as most important in the self-reported data were fat and the colour of the meat. It was clearly found that cherry-red meat (63%) was the

preferred choice of the participants when buying red meat, with dark-red meat (25%) being preferred by a smaller share of the market. Fat on the meat was scored at medium (3/5) by more than half of the participants, with an additional share of the participants indicating that they mostly preferred lower amounts of fat on their red meat. The importance of the colour of the meat and the neatness of the cut were ranked the most important physical aspects of red meat when the participants were asked to rank the tested aspects, followed by fat on the meat, fat in the meat, and blood in the pack.

The preferred red meat colour of choice in this study was bright-red or cherry-red meat. Retailers in the Mangaung area are recommended to always attempt to provide meat of this colour to consumers. Besides the colour of the meat, attention should be paid to the fat on the red meat product. Retailers should provide red meat products with a medium amount of fat to meet the preference of the general population in the Mangaung area.

The preferred method of red meat packaging was vacuum-packed-only meat, with vacuum-packed meat on polystyrene plates being the second favourite.

5.2.2.3 Labelling of red meat: Eye-tracking results

In the eye-tracking results for the tested labelling aspects it was found that consumers on average pay the most attention to the price of the pack and the butchery's name. This was the case where no other form of labelling, except the price label, was added to a pack of red meat. The packaging and sell-by date received less attention than the aforementioned aspects. Price per kg was also fixated on by a fairly smaller share of the participants. From these results it can be seen that the most important labelling aspects, according to the attention the participants paid to the packs of meat shown, were the price of the pack and the butchery's name. This indicates the sensitivity that consumers in the Mangaung area have to the price of the pack of red meat that they want to purchase. The importance of a trustworthy butchery name was also emphasised. This suggests that consumers want to buy red meat from a reliable supplier but the large amount of attention paid to the price of the pack suggests that the price of the pack should still fall within their budget.

Packs of meat where quality indicator labels (all forms of additional labelling) were added along with the price label enjoyed large fixation percentages from the participants and caused a reduction in the attention paid to the butchery's name and the classification of the meat. The price of the pack was still fixated on by a large share of the participants but slightly less than on packs without the quality indicator labelling. While this was a trend with most of the quality labelling, it should be noted that the brand of meat, breed certification labelling, and origin-verifying labelling (excluding "Proudly made in SA") were fixated on by a larger share of the participants than those paying attention to the price of the pack. In general, this was not the case for the other forms of quality indicator labelling, where the labelling and the price of the packs received similar levels of attention. This shows that consumers are more aware of the brand, breed, and origin-verifying labelling than other

labelling types. Retailers who are able to provide red meat products with the correct quality indicators for their consumers might be able to charge a premium on these products. The high level of interest in the brand, breed, and origin-certifying labelling shows consumers' interest in these matters.

Nutritional information labelling was also able to attract a large share of participants' attention, with both NITs and MTL labelling being fixated on by a larger share of the participants than the price of the pack in both images. These results shed some light on the need that red meat consumers have of being informed of the nutritional value of the red meat products that they buy.

5.2.2.4 Red meat characteristics: Eye-tracking results

The results from the eye-tracker on the physical aspects of red meat showed that the meat-only areas (excluding the fat, etc.) of meat that contained high amounts of external fat were fixated on by the same percentage of participants than the same area of meat that contained low amounts of external fat (this was for two packs of meat tested next to each other). This shows that the meat-only area was equally attractive to the participants between the low- and high-fat red meat products. However, when the whole areas of high- and lower-fat meats products were compared, it was found that the lower-fat meat enjoyed higher levels of attention from the participants. This indicates that while the meaty area of the product was of equal attractiveness to the participants, other aspects such as the high amount of fat on the presented cut of meat caused the participants to rather pay attention to the lower-fat product. The level of attention paid to fat on the high-fat cut of meat was less than in the case of the lower-fat cut of meat.

The colour of the meat also influenced the manner in which the participants paid attention to the pack of meat. While the bright-red meat (meat-only area) enjoyed higher levels of attention than the dark-red meat, the labelling of the dark-red pack was fixated on by a larger number of participants. All the price labelling aspects were fixated on by a larger share of participants than was the case for the bright-red meat. It seems that consumers make use of labelling information when attempting to determine why some meat is darker than others.

The results from the different forms of packaging showed that the participants were more likely to pay attention to meat that was only vacuum-packed. In the tested images, these packs were fixated on by a larger share of participants than, for instance, the meat that was placed on a polystyrene plate before being vacuum-packed. The labelling aspect on the vacuum-packed-only meat was more likely to be fixated on by the participants than on their polystyrene-plated vacuum-packed counterparts. In images where the products were placed on a white polystyrene plate before being vacuum-packed, the attention paid to the blood in the pack was higher. This could be due to the white background that makes the blood more prominent.

5.2.3 To analyse any differences in consumers' preferences identified from the self-reported data to preferences identified from the eye-tracking data

In reaching this sub-objective, the preferences identified in the previous sub-objective were statistically ranked by means of Kendall's *W* tests. These tests were conducted separately between labelling and product aspect themes and categories and were also separately conducted between questionnaire and eye-tracking data in order to be compared against one another.

From the results it was clear that consumers attach a high value to a certified brand of red meat by scoring (post-test questionnaire) and showing (eye-tracker) that it is important.

The eye-tracking results showed that nutritional information, breed certification, and production practice labels were more important than indicated in the post-test questionnaire, while the opposite was found for traceability and after-slaughter practice labelling. These findings show that while the participants said traceability and after-slaughter practices were important to them, their attention was fixated on the nutritional information, breed, and production practice labelling to a larger extent.

Among the traceability labelling, a difference was found between what the participants rated as important and what they paid attention to. While "Proudly made in SA" labelling was rated more important than other origin certification labelling, the eye-tracking results showed that the other origin certifying labelling, in this case province of origin, received more attention from red meat consumers in the eye-tracking test.

Interestingly, the after-slaughter practice labels were ranked in the same sequence of importance in both the questionnaire and eye-tracking, where "Top quality guaranteed" labels were ranked of greater importance to the participants than "Aged" meat and "Halal" labels.

Production practice labels, with the exception of "Free range" labelling, were ranked in the same order of importance in both Kendall's *W* test on the questionnaire data and Kendall's *W* test on the eye-tracking data. From the higher ratings, as well as the higher levels of attention paid to these labels, a trend was seen where the participants tended to prefer and pay more attention to labels that certified that the meat was produced more naturally or greener.

Investigation of the price label information identified a difference between the questionnaire and eye-tracking data. While the price per kg was ranked as the most important according to the questionnaire data, the eye-tracking data did not agree with this. In the eye-tracking test, the price of the pack was ranked as the most important according to attention paid by the participants, with the weight of the pack and the classification of the meat in second and third place respectively. Price per kg received less attention than the first three mentioned aspects but more attention than what was given to the freshness indicators. The freshness indicators were ranked the lowest and also received the least amount of attention from the participants of all the price label information

aspects. This emphasises the importance of ensuring that the price of the packs of meat that retailers display on their shelves agree with the consumers' budget. Here it can be concluded that the price of the pack was the most important aspect that consumers consulted when evaluating red meat products. Once the pack price agrees with the market-required pack price, retailers can focus on other important price label information, such as the weight of the pack and classification. Again, the use of an eye-tracking device was able to assist in improving consumer research by detecting a difference between what the participants said was important and what they actually focused on when shown packs of meat.

The meat aspect results showed that fat on the meat and the meat-only area were both rated of high importance and also received attention from a large share of the participants. Fat on the meat proved to be slightly less important than the meat-only area in both the questionnaire and eye-tracking data. In the rank of importance between the questionnaire and eye-tracking data, bone in the meat and blood in the pack were ranked third and fourth respectively in the questionnaire, while swapping positions in the eye-tracking test. Fat in the meat (marbling) enjoyed the least amount of attention and was also ranked the lowest of all the meat aspects in terms of importance. In terms of the red meat aspects, the study can conclude that the appearance of the meat-only area of meat is the most important aspect consumers will consider when selecting their product, followed by the fat on the meat. It can also be concluded that in the tested population, fat in the meat is not an important aspect that will influence consumers' decisions.

5.2.4 To identify the advantages of eye-tracking technology on red meat consumers' preferences

In the process of identifying and ranking red meat consumers' preferences in the Mangaung Metropolitan Municipality, some benefits of using eye-tracking came to light. Using eye-tracking identified instances in which red meat consumers said certain aspects were important but these aspects did not receive the expected level of attention from the research participants. In this regard, the price per kg versus price per pack results can be mentioned. Here a clear difference between how participants ranked the price per kg and the amount of attention paid to the price per kg was found. This sheds some light on the ability of eye-tracking when used in conjunction with a post-test questionnaire to identify differences between what consumers say is important when selecting red meat products and what they actually show is important to them. These findings should serve as proof to researchers that eye-tracking should be used in future research to improve the captured data and to increase the accuracy of the results.

Besides identifying the differences, similarities were also identified between the two forms of data and this could serve as proof of how eye-tracking technology can not only be used to identify differences between what consumers say they look at and what they actually look at, but also the similarities between the two. This technology could serve as a manner of verifying consumers'

preferences with regard to the aspects of red meat products that they prefer. If this mindset is followed and the after-slaughter practice labels, which were ranked in the same sequence in both the questionnaire and eye-tracking test, are evaluated, it can be concluded that “Top quality guaranteed” labels are of greater importance to consumers than “Aged” meat and “Halal” labels. The low rank of importance and level of attention paid to freshness indicators can also be used to conclude that red meat consumers do not see this aspect of labelling as having great value when selecting their red meat products.

Combining the use of eye-tracking with questionnaires will assist researchers in instances where the interaction of two different aspects is investigated. For instance, how did adding a quality indicator influence the manner in which consumers paid attention to the price label, or which form of labelling was fixated on first and which form of labelling received attention for the longest duration of time in these scenarios?

Some guidelines from this study that can be suggested for future red meat studies that aim to make use of eye-tracking include the following:

- **Keep the study focused**

The aims of red meat studies that want to make use of eye-tracking should be kept focused. If many aims are set and a wide range of aspects must be investigated, it will either mean that a large number of test images will be used or that multiple aspects will have to be investigated on the images. This will either lead to participants becoming impatient and/or bored when being tested with a large number of images, or that the deductions made from images where multiple aspects are tested could be incorrect due to the interaction of these aspects with one another. Researchers should rather conduct a larger number of surveys where a smaller number of red meat aspects are investigated per survey.

- **Images**

Care should be given to which images will be used in a study. Researchers should pay attention to aspects that fall outside the scope of the study but that can influence the results. For instance, if different brands of meat are tested but different packs of meat are used and the colour of the meat in each pack is different, it might lead to consumers paying attention differently to some of the labels due to the colour of the meat and not just due to the label itself.

- **Test area**

In studies where the eye-tracking device is transported to different test locations, it is important to ensure that a test area will be available at each of the locations. This area should at least provide a somewhat isolated area where participants will be allowed to view the images on the eye-tracker without being distracted by, for instance, people moving past the test area. A background should

be used in front of which the eye-tracker can be placed to ensure that the attention of participants is not distracted by activities behind the eye-tracker screen.

- **Interviewers**

The interviewers should have a good knowledge of the aspects that are to be tested. If these individuals do not have the required knowledge, they should be trained before conducting the surveys. This will allow them to answer participants if they have questions regarding the meaning of some of aspects, which will also assist in gathering useable answers from the participants.

- **Time of testing**

The participants in this study were tested with greater ease on Fridays and Saturdays than the other days of the week. The participants seemed to be more relaxed when visiting the respective red meat outlets on these days and were more willing to sacrifice some of their time to participate in the data-collection process.

5.2.5 To recommend some main strategy adaptations to red meat marketing according to the eye-tracker data findings

Consumers in the Mangaung area indicated that they spent 65% of their monthly meat budget on beef and mutton/lamb products. This serves as a sign of a healthy market in which red meat retailers can conduct business. Butcheries are a clear leader as the preferred location for buying red meat (65.5%), followed by supermarkets (28%). In contrast to the preference of consumers to buy red meat at butcheries, supermarkets are visited slightly more often than butcheries. This is probably due to general shopping requirements at supermarkets compared to buying only red meat from butcheries.

From this it could be suggested that butcheries should compile value packs or month-end specials on their red meat products in an attempt to sell larger quantities of red meat to consumers during their fewer visits per month. Supermarkets, on the other hand, could focus on selling smaller packs that can be prepared as a single serving for a household and that could be bought on a more regular basis.

The high level of attention that was paid by the participants to the tested brand labels and the reduction in the attention paid to the butchery's name in images suggest that consumers are aware of the brand of red meat they buy. If no brand certification is made available, the consumers revert to the butchery's name during their evaluation of the product. When brand certification labelling is provided, consumers pay more attention to the brand labelling and use the butchery's name to a lesser extent. Here it can be concluded that red meat consumers search for some form of reassurance of the meat they buy. This could serve as a suggestion that a small or new butchery (retailer) who does not have a good name among consumers yet should buy their meat from a red

meat producer with a known brand and place this brand's labelling on the packs of meat to gain the trust of red meat consumers.

The high recall rate of well-known red meat brands in the test area suggests that the marketing campaigns that these brands are using are paying off and that value is linked to the brand by consumers. It is recommended that red meat retailers who want to increase their market share should emphasise their marketing campaigns.

From a comparison between the eye-tracking and post-test questionnaire results, production practices were fixated on more than the questionnaire ranks would suggest. In turn, the production practice labelling that enjoyed the highest levels of attention were "Free range", "No antibiotics", and "Grass fed" labelling. Retailers in the Mungaung area are advised to investigate the possibility of providing greener or more naturally produced meat products since consumers pay attention to these aspects. It could be of value to identify correct production practice labelling for a target market and supply them with this form of labelling. The willingness of the target market to pay for this form of labelling should, however, be tested before it is pursued. Traceability labelling in this study was found to be less important than, for instance, brand and nutritional information. In terms of traceability measures, it was found that the province of origin was more likely to be paid attention to than country of origin certification. Consumers seem to prefer red meat products from a more selective area of origin than country of origin. Retailers should attempt to put measurements in place that can guarantee the origin of their meat, and this origin should be specified at provincial level rather than national level. "Top quality guaranteed" was the after-slaughter practice labelling that proved to have the highest preference and attention level for the participants in the tests. If such a form of labelling is pursued, consumers should be made aware of what this guarantee stands for. For instance, will the consumers be guaranteed of a tender piece of meat, one that is rich in flavour, etc.? The production side of this label will have to be regulated to ensure that the taste, among others, continuously stays the same regardless of, for example, the season of production. Retailers should attempt to provide consumers with the nutritional information of the red meat product, which might allow them to lure consumers away from other red meat retailers who do not provide nutritional information on their red meat products.

Price per pack was the most important aspect shown on the price labels. Based on the attention paid by red meat consumers, the weight of the pack and the classification of the meat were also more important than price per kg. This shows that while consumers might be lured to butcheries or meat outlets that offer a good price on their meat per kg, they will still make use of the price of the pack to base their final purchase decision on. This is proof that butcheries might be more successful when using price per kg to attract consumers; however, the price per pack of displayed red meat products will play a more important role in influencing consumers' purchasing decisions. It is therefore recommended that retailers should ensure that the price of the pack of meat is clearly presented to consumers. Retailers who attempt to increase their sales in the pre-packed red meat

segment are advised to determine what the price per pack budget is for their target market and to provide packs of meat that are in line with this budget.

Freshness indicators were found not to be very important to consumers. However, it should be kept in mind that these findings were made from bright-red packs of meat. In instances where darker cuts of meat were presented to the participants, a clear increase was seen in the attention paid to the labelling aspects, which included freshness indicators (packaging and sell-by date). This proves that red meat consumers in the Mangaung Metropolitan Municipality do not regard freshness indicators as an influential aspect when the presented meat seems fresh. This suggests that while the freshness indicators shown on the pack are of little importance when the meat presented in the pack is bright red, conversely, if the meat appears paler or darker, consumers will rely on the freshness indicators to assist with their purchasing decisions. Labelling is thus then used to determine why meat is paler or darker and freshness labelling will be more important in shops that do not sell bright-red meat. Retailers are advised to ensure that the meat on the shelves contain valid freshness indicator dates to avoid losses of sales. The opposite can be said for retailers that do not make use of sell-by or packaging dates. These retailers should ensure that the meat they present to their consumers is of such a colour that they will not require the freshness labelling to base their decision on. Retailers who sell meat that is paler in colour due to the preparation of the meat, such as ageing, should provide sufficient consumer education to reassure consumers of the colour of their product.

The largest share of consumers in the Mangaung area prefer to buy bright-red (cherry-red) meat. Dark red was rated the second highest score but was less than half of bright-red meat. In the case of mutton, many participants indicated that they preferred both bright- and dark-red meat. This would suggest that a larger share of the mutton market would be happy to buy dark-red meat than was the case for the beef market. It could be due to lamb meat usually appearing bright red while mutton appears somewhat darker. Retailers in the Mangaung area are thus advised to always supply their market with bright-red beef and mutton, while dark-red mutton is also accepted. The presentation of pale meat should, however, be avoided as far as possible, or retailers should present the different colours of meat ranging from cherry red to the least red to ensure that consumers can choose according to their preferences.

The largest share of participants indicated a preference for medium-fat meat, followed by lean and very lean. Therefore, red meat retailers in the test area should aim to provide medium-fat red meat products to their clients. It is recommended that retailers should pay attention to the amount of fat on the red meat products that are presented to consumers, especially if cuts of different levels of fat are placed on shelves alongside one another. It seems that the lower-fat products will be sold first and this might lead to a situation where higher-fat meat packs stay on the shelf past their sell-by date and will have to be removed from the shelves, causing a loss to the retailer's income.

Packaging recommendations that can be made to red meat retailers include that red meat products should be vacuum-packed without adding a polystyrene plate under the meat. This form of packaging will enhance the levels of attention consumers pay to the labelling aspects. Retailers can thus make use of this form of packaging if they want to ensure that consumers pay more attention to the labelling aspects on the pack. For instance, if it is desired that consumers' attention is directed to a new cut of meat that is being sold or the price per kg is of such a nature that it would convince prospective consumers of their purchase once they have paid attention to the aspect, this form of packaging is advised. This form of packaging also scored the highest rating for acceptance from the self-reported results. Many of the red meat retailers represented at the test locations already made use of vacuum-packaging (without adding a polystyrene plate to the pack), indicating that they are on the right track. Still, this can serve as a recommendation to other retailers of one possibility of how a product can be provided that has a higher acceptance rate among consumers in general.

Additional items in the pack, such as the blood pad, were fixated on by 65% of the participants. This was higher than the share of participants who paid attention to the blood shown in other images. Here caution should be taken to not cause more distractions (blood pad) to the consumers with an attempt that was aimed at lowering the original distraction (blood in the pack). It must be considered that in the test image the blood pad was added, while the rest of the labelling aspects remained the same. This could also have led to the high rate of fixation the "new aspect" received. A recommendation would be that red meat outlets should place items such as blood pads under the meat to ensure that no attention is distracted from the important aspects of the product.

The findings of this study can be used by red meat retailers to enhance the sale of their red meat products by providing products that are closer to the preferences of their target market and to improve the marketing of these products. The tables in Chapter 4, especially Tables 4.46 to 4.49, can be consulted by red meat retailers in the Mangaung Metropolitan Municipality who know their target market's characteristics and want to enhance the red meat products offered to this market. For instance, low-income groups tended to make use of the appearance of the meat to a larger extent by fixating on the meat aspects than would be suggested from their self-reporting scores. Here it can be concluded that low-income participants were not able to accurately express the importance they attached to the appearance of their red meat products, while they actually did pay attention to these aspects. This could be used to advise suppliers catering to lower-income groups on the importance that their consumers showed that they attached to the appearance of red meat products, even though they were not able to accurately express these preferences during self-reporting research techniques.

Male consumers in general paid more attention to labelling aspects such as brand, price per pack, classification, and freshness indicators than female consumers. Retailers who have identified a target market that consists predominantly of male consumers should focus on providing red meat

products of the correct brand, preferred price per pack, valid freshness indicators, and classification of the meat. Female consumers paid more attention to breed, nutritional information, production practice labelling, traceability labelling, price per kg, and the weight of the pack than any of the other meat aspects (fat in and on the meat, and blood and bone in the pack). The increased attention seen with the different labelling and meat aspects for female consumers suggests that they are more health conscious and take these aspects into account when buying red meat. The high percentage fixated on the weight of the pack suggests that women use the weight to determine their purchase and it might be that the pack of meat must meet the requirements for a meal in weight terms or that a recipe requires a certain weight. Care should be taken in a market that is equally divided between men and women and these aspects will then have to be presented creatively to ensure the support of all consumers.

5.3 GENERAL RECOMMENDATIONS

Besides the recommendations mentioned above, a number of general recommendations can also be made. The first and most important recommendation is regarding the fact that there is a lack of and need for consumer education regarding red meat aspects, which became clear during this study, especially during data collection in the field. Consumers across racial, income, and educational boundaries mentioned their need to understand not only the red meat classification system better but also to understand what the different forms of quality indicator labelling stand for. This serves not only as a sign that consumers' understanding of quality indicators should be investigated but also that more should be done to educate consumers regarding the red meat products that they purchase. There is thus room to improve meat sales if these products could be backed by a quality indicator of some sort, which is also understood by consumers. These quality indicators need to be customer friendly to be understood by all LSM levels. It is recommended that red meat researchers further investigate this matter. Other parties such as the Red Meat Research and Development SA (RMRD SA) and the RPO can assist in the matter since it will be to the benefit of the market that they serve.

Educating consumers will also create value, and consumers should be willing to pay a premium for products with the preferred certification. Educating consumers on the aspects of red meat could be done by creating a competition with cash or other significant prizes that will ensure greater involvement from consumers. Platforms used for such a competition should not necessarily be agriculturally based, since these users are already more familiar with red meat matters. It would rather be suggested that popular magazines (*Huisgenoot*, *You*, etc.) and social media be used to reach the larger South African community. Consumer education might also prevent consumers from substituting their red meat products in favour of other protein sources due to health concerns, etc. A small percentage (1%) of the participants indicated that they specifically searched for the classification stamp on the meat, while slightly more consumers (4%) indicated that they took the classification into account when they purchased meat. This shows that a low percentage of consumers are aware of the classification system and how it works, given that all of the animals

bought for the beef and mutton/lamb markets are classed according to this system. Very few retailers show their meat's classification on the packs and more effort should be made to not only purchase animals according to the classification system, which is already being done, but also to sell their meat accordingly. This will allow red meat consumers to make more informed decisions regarding the type of red meat product they want to buy. Retailers should market the characteristics (tender, tasty, lower in fat, etc.) of the different classification classes among consumers to improve their ability to choose the correct product. Supplying red meat that indicates the correct classification class of the meat should follow once consumers are educated. Appropriate authorities, such as the RPO, should review the current classification system to determine whether it is still applicable to current market requirements. A classification or grading system should be put in place that is more user friendly. This must be done either to the current system, if it is found to still be applicable, or a new system should be created with this in mind.

General aspects that can be added by red meat retailers in the Mangaung Metropolitan Municipality to increase the acceptance of their products are as follows:

- Ensure that the price of the pack is visible.
- Add the brand of the meat to the pack.
- If no brand is available, at least add the name of the butchery.
- Origin certification should be added, preferably at provincial level or lower.
- A quality guarantee should be added if some aspect of the meat can be guaranteed.
- Nutritional information of the meat should be added if it is known.
- Meat should be of medium fat for the general tested area.
- Meat should be bright red in colour; if not, a freshness indicator must be placed on the pack.
- Meat should be vacuum-packed only.

The findings from this study should be used by red meat retailers to increase the acceptability of their products among consumers. This can be done by identifying the target market of red meat outlets and then matching this group's characteristics to the preferences that were identified. Once these preferences are identified, retailers should communicate these preferences to red meat producers, who will be responsible for aspects such as the production practice aspects, which are determined at their level in the value chain.

Target markets will likely differ between red meat retailers due to their location and the population of consumers situated the closest to them. Determining the characteristics of these target markets will serve as an advantage to the retailers so that products that comply with consumers' needs can be provided. It is also recommended that eye-tracking research be used in future red meat studies to assist in the accuracy of the results and recommendations that will be made. Using eye-tracking in red meat consumer research allows for the removal or at least a reduction in the bias of tested

consumers and allows for a deeper insight into the consumers' purchase of red meat products. It is further recommended that eye-tracking should be used when testing consumers' preferences for other meats, such as poultry and pork, in future studies.

From a business point of view, new brands or labels can be tested through the use of eye-tracking to determine which ones enjoy the most attention from consumers or which labels are able to capture the attention of consumers for the longest period of time.

5.4 SUGGESTIONS FOR FUTURE RESEARCH

While this study was able to show the value that eye-tracking technology contributes to red meat preference research, it is suggested that consumers' willingness to pay for these identified preferences is determined before being provided by red meat outlets. With regard to production practices, all the practices were ranked relatively high, with consumers seemingly placing value on and paying attention to production practice labelling that was closer to nature or greener. "No antibiotics", "Grass fed", "No added hormones", and "100% organic" labelling were all ranked highly in both the questionnaire and eye-tracker data. This suggests that consumers prefer to buy these types of products, but would they be willing to pay for these products and, specifically, would they be willing to pay a premium for these forms of certification?

The study was not able to determine consumers' understanding of the different forms of labelling. Although this was not part of the study's aims, it would have helped to know why a label was preferred based on consumers' understanding of the label when interpreting the results. The study could not fully investigate the aspects regarding red meat's fat. For instance, preferences regarding the colour of fat (yellow or white) and the degree of marbling that is preferred, were not fully determined.

It is suggested that consumers' preferences that were identified in the study should be further investigated to determine to which extent they are willing to pay for certain labelling forms that guarantee how the meat was produced, etc. If such a study can be combined with an eye-tracking test that is followed up with a post-test questionnaire, it will be able to determine what consumers say they look at (questionnaire) and what they actually look at (eye-tracker) when shown images of meat and also to which extent they would be willing to pay for these preferences. It should also be worthwhile to conduct a study where the attention of consumers is tested when shown images of meat before they are educated on the meaning of the labelling, and then retested on the eye-tracker to see how their attention towards these labels might be influenced once educated on the matter. "Top quality guaranteed" labelling proved to be important to consumers; the question that remains is what is the quality that should be reinforced with the label that is placed on the pack. In other words, what do red meat consumers see as quality aspects of red meat?

Eye-tracking can be used in future studies to research the link between placing brand certification in the shop as opposed to on the pack, as in this study. In this case it might be more appropriate to use an eye-tracker that is in the form of glasses. This technology can also be used in future research to investigate the influence that different aspects have on the attention received from consumers. Other studies have investigated the effect of placing labelling on different areas of products and the effect this has on consumers' attention; a similar study could be conducted on red meat. The colours that are used on quality labels could also be investigated in future studies. This will assist researchers to determine the association that consumers have with different colours of labelling. The ability of different colours to attract consumers' attention should also be investigated. While the current study identified the preference of quality indicators, these types of studies should be conducted to determine the colour that the labels should be and where they should be placed on the product.

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APPENDIX A

Post-test questionnaire

Test no.

Location no.

1. Monthly income of household (includes all forms of income, salaries, wages, pension, etc.)

< R 2 956	R2 957 – R 3 296	R3 297 – R 4 468	R4 469 – R 5 372	R5 374 – R 8 141
R8 142 – R13 216	R13 217 – R16 090	R18 652 – R20 585	R25 776 – R30 326	R40 540 – R49 796

2. Size of household? (One or more persons who live under the same roof and also share meals or living accommodation)

3. What is your household's monthly budget for meat? (beef, mutton, lamb, goat, pork, fish, and chicken)

4. What amount of your household's monthly budget is spent on beef?

5. What amount of your household's monthly budget is spent on mutton/lamb?

6. How often does your household eat red meat?

Three times a day	
Twice a day	
Once a day	
Number of days per month if not every day (1-30)	
Other (specify).....	

7. Where do you prefer to buy your red meat? (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Very often)

Supermarket	
Butcher	
Convenience store	
Wholesale store	
Directly from farmer	
Other (specify).....	

8. How often do you go to the following retailers to buy meat?

	Number of times per month (specify)
Supermarket	
Butcher	
Convenience store	
Wholesale store	
Directly from farmer	
Other (specify).....	

9. Which cuts of beef do you buy most often?

-
-
-
-

10. Which cuts of mutton/lamb do you buy most often?

-
-
-
-

11. List the five most important aspects when buying beef.

-
-
-
-
-

12. List the five most important aspects when buying mutton/lamb.

-
-
-
-
-

13. Can you recall the classification (class) of meat shown? If yes, please name them:

-
-
-
-

14. What labelling can you recall from the images?

Free range			Top quality guaranteed	
Grass fed			Sernick	
Grain fed			Free State Meat	
Aged			Sparta	
100% organic			Bonsmara	
Proudly made in SA			Angus	
Certified humane			Sustainable product	
No added hormones			QR traceability code	
No antibiotics			Nutritional table	
Halal			Multiple traffic light label	

15. Can you recall the brand names that were shown? If yes, please name them:

-
-
-
-
-

16. Do you prefer red meat from a certain producer/brand? If yes, which brands do you prefer and why?

-
-
-

17. Can you recall the breeds of animals that were shown? If yes, please name them:

-
-

18. Do you prefer red meat from a certain breed of cattle? If yes, which breed?

-

19. Do you prefer red meat from a certain breed of sheep? If yes, which breed?

-

20. Do you prefer red meat from a certain origin (area in the country)? If yes, which area and why?

-

21. Can you recall labels indicating the nutritional value of the packs of red meat? If yes, what labelling can you recall?

Nutritional table	
Multiple traffic light label	

22. How important is it to you that red meat has the following labelling? (1 = Not important to 5 = Very important)

	Rating		Rating
Free range		Halal	
Grass fed		Top quality guaranteed	
Grain fed		Brand certification	
Aged		Origin certification	
100% organic		Breed certification	
Proudly made in SA		Sustainable product	
Certified humane		QR traceability code	
No added hormones		Nutritional information on the pack	
No antibiotics			

23. What size of red meat packs do you prefer to buy for one meal (either weight, rand value, or number of cuts) and how important is it to you? (1 = Not important – 5 = Very important)

	Specify	Rating
Weight of pack in kilogram	
Number of cuts in the pack	
Rand value of the pack (price in rand)	

24. How do you prefer to prepare your red meat? (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Very often)

Method	Beef	Mutton/Lamb
Barbeque		
Stew/boil		
Pan fry		
Roast		
Other (specify).....		

25. What colour do you prefer for red meat?

	Beef	Mutton/Lamb
Bright red / Cherry red		
Dark red		
Brown		
Pale		
Other (specify).....		

26. How important are the following aspects when you are buying red meat? (1 = Not important – 5 = Very important)

	Rating
Colour of the meat	
Classification (class) of meat (Class A3, etc.)	
Appearance of the meat	
Amount of visible fat on the meat	
Amount of visible fat in the meat (distribution)	
Neatness of the cut	
Blood in the packaging	
Bone to meat ratio	

27. Please describe the fat content that you prefer in your meat.

Very lean – 1	Lean – 2	Medium – 3	Fat – 4	High fat – 5

28. To what extent do you prefer the following packaging for your red meat? (1 = Dislikes a lot, 2 = Dislikes, 3 = Neutral preference, 4 = Likes, 5 = Preferred choice)

	Rating
Vacuum-packed-only meat	
Vacuum-packed meat on a polystyrene plate	
Wrapped in cling film on a polystyrene plate	
Plastic container	
Other (specify).....	

29. How often do you look at the price per kilogram and price per pack when buying red meat? (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always)

	Rating
Price per kilogram	
Price per pack	

30. Gender

Male	
Female	

31. Age (years)

18-30	31-40	41-50	51-60	61-70	71-80	81+

32. Education

Primary (up to Grade 7)	Secondary (up to Grade 12)	Tertiary (degree or diploma)

33. Race

Black	
White	
Coloured	
Asian	
Other (please specify)	