A balanced food basket approach to monitor food affordability in South Africa

by

Hester Vermeulen

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"*I can do all things through Christ who strengthens me*"

Philippians 4:13 (New King James Version)

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Hester Vermeulen

Degree: PhD Nutrition
Department: Department of Animal and Wildlife Sciences, Faculty of Natural and Agricultural Sciences, University of Pretoria
Supervisor: Prof. Hettie C. Schönfeldt
Co-supervisor: Prof. Ferdi Meyer

ABSTRACT

The public health landscape in South Africa today is characterised by a double-burden of nutritional challenges. Under-nutrition is prevalent, as is evident from the high levels of childhood stunting that are reported. Deficiencies of micro-nutrients such as vitamin A and iron continue to be prevalent in children, females and vulnerable groups. Simultaneously overweight and obesity among adults and children together with an associated increase in the occurrence of non-communicable diseases (NCDs) such as diabetes and cardiovascular disease are increasing steadily to epidemic levels.

With approximately 40% of the population living under the International Poverty Line and approximately a quarter of the population not able to obtain enough food to fulfil their daily energy needs, poverty and food insecurity are harsh realities in many South African households. The ability of a household to make healthy food choices is, among other factors, affected by food affordability. Food affordability is determined by household income relative to the cost of purchased food items. In recent years, food affordability in South Africa has been under increased pressure due to the following factors: household income-growth barely keeping track with inflation, rising unemployment, as well as high and ever increasing food prices. The pressure on lower income households is particularly profound, forcing such households to use about a third of total expenditure for food purchases.

In this study, a multi-disciplinary approach was used (including principles of nutrition, economics and consumer behaviour sciences) to develop models to measure the cost and affordability of healthy eating in South Africa at a national level and on a socio-economically disaggregated basis. The healthy food basket model was primarily based on the South African Food-based Dietary Guidelines, typical food consumption patterns, household demographics and official urban retail food prices monitored by Statistics South Africa.

Food affordability is a major challenge, with 60% of the population unable to afford the Moderate-cost Food Basket which provides greater nutritional diversity. The more economical Thrifty Healthy Food Basket (approximately 30% less expensive) is only

affordable to approximately half of the South African population. A four member household earning two minimum wages has to spend a third of total expenditure on food to be able to afford this basket, while the typical food expenditure share of such households is usually lower (approximately 24%), thus confirming the pressure on households to afford healthy eating. In future the models of healthy eating also present possibilities for further expansion (e.g. these models can be refined to study different geographical areas or different household structure typologies).

Compared to national nutritional recommendations, the study found that the intakes of whole-grain starch-rich foods, lean meat, fish, eggs, dairy, fruit, vegetables and legumes were low. Inadequate intake was generally more severe among lower income households. Less-affluent households spend a large proportion of their food budget on starch-rich staples, fats / oils and sugar-rich foods, but allocate insufficient resources to animal-source foods, legumes, fruit and vegetables. This study also identified that excessive intakes of refined and processed starch-rich food options, sugar-rich foods and fats / oils were common across all income groups and increased with socio-economic status. These findings confirm the reality of the nutrition transition in South Africa.

The contribution of this research to estimate the socio-economically disaggregated consumption of animal-source foods (meat, fish and eggs) and starch-rich foods (maize meal, bread, rice and potatoes), provides valuable insights into differences in food intake across the socio-economic spectrum of South Africa.

A complex combination of interventions is required to promote healthy eating patterns in South Africa. In addition to legislative measures (e.g. salt and sugar reduction legislation), consumer education (across the socio-economic spectrum) should focus on science-based practical solutions and provide advice on making healthy and budget-conscious food choices. In addition, it is also important to design and implement policy actions to improve the affordability and availability of healthy food options for the various socio-economic groups, in diverse geographic locations in South Africa.

The improvement of food affordability is a key component in moving closer to achieve the Sustainable Development Goal of the United Nations “to end hunger, achieve food security, improve nutrition and promote sustainable agriculture”. Furthermore, improving household food and nutrition security (including addressing issues pertaining to healthy food consumption and affordability), through public and private sector actions, is one of the enabling milestones in the National Development Plan 2030.

The monthly costing of the food basket models which were developed in this study and analyses thereof should be used as policy analysis tools to act as a practical, scientific basis for the food security debate in South Africa. These tools are, in fact, already published on a quarterly basis in the public domain. In future the models of healthy eating also present possibilities for further expansion (e.g. these models can be refined to study different geographical areas or different household structure typologies).

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LIST OF ACRONYMS

AFSUN	African Food Security Urban Network
AI	Avian Influenza
AMPS	All Media and Products Survey
ANOVA	Analysis of variance
BER	Bureau for Economic Research
BFAP	Bureau for Food and Agricultural Policy
BRC	Broadcast Research Council of South Africa
CCI	Consumer Confidence Index
CoE	Centre of Excellence
COICOP	Classification of Individual Consumption by Purpose
CPI	Consumer Price Index
CRIBSA	Cardiovacular Risk in Black South Africans
DDS	Dietary diversity score
DoH	Department of Health
DST	Department of Science and Technology
EC	Eastern Cape (Province in South Africa)
ED	Expenditure decile
EER	Estimated energy requirements
ERS	Economic Research Service
ES	Establishment Survey
EuroFIR	European Food Information Resource
FACS	Food Advisory Consumer Service
FAO	Food and Agricultural Organisation of the United Nations
FAOSTAT	Food and Agriculture Organisation Corporate Statistical Database
FBDG	Food-based dietary guidelines
FNB	First National Bank
FPL	Food Poverty Line
GDP	Gross domestic product
GHS	General Household Survey
GI	Glycaemic index
GP	Gauteng (Province in South Africa)
HIV	Human immunodeficiency virus
IARC	International Agency for Research on Cancer
IES	Income and expenditure survey
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IPL	International Poverty Line
KZN	KwaZulu-Natal (Province in South Africa)
LBPL	Lower-bound poverty Line
LCS	Living conditions survey

LP	Limpopo (Province in South Africa)
LSM	Living standards measure
MHFB	Moderate-cost healthy food basket
NAB	Non-alcoholic beverages
NAMC	National Agricultural Marketing Council
NCDs	Non-communicable diseases
NDA	National Department of Agriculture
NFCS	National food consumption survey
NFPL	National Food Poverty Line
NRF	National Research Foundation
OECD	Organisation for Economic Co-operation and Development
PACSA	Pietermaritzburg Agency for Community Social Action
RDA	Recommended daily allowances
RMAA	Red Meat Abattoir Association
RMRD SA	Red Meat Research and Development South Africa
RPO	South African Red Meat Producers Organisation
Q	Quarter
SA	South African
SAARF	South African Audience Research Foundation
SADC	Southern African Development Community
SADHS	South African Demographic and Health Survey
SAFOODS	South African Food Data System
SAGIS	South African Grain Information Service
SAMIC	South African Meat Industry Company
SANHANES	South African National Health and Nutrition Examination Survey
SAPA	South African Poultry Association
SAPPO	Pork Producers Organisation
SARChI	South African Research Chairs Initiative
SASAS	South African Social Attitudes Survey
SASSA	South African Social Security Agency
SDGs	Sustainable Development Goals
SEM	Socio-economic measurement
SPSS	Statistical Package for the Social Sciences
SSU	Single Serving Unit
Stats SA	Statistics South Africa
THFB	Thrifty healthy food basket
UBPL	Upper-bound poverty Line / National poverty Line
UK	United Kingdom
UNDP	United Nations Development Program
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America

USDA	United States Department of Agriculture
WC	Western Cape (Province in South Africa)
WFP	World Food Programme
WHO	World Health Organisation
WWF	World Wildlife Foundation

CHAPTER 1: INTRODUCTION

Improving household food and nutrition security (involving elements such as hunger, malnutrition and micronutrient deficiencies), through public and private sector actions, is one of the enabling milestones in the National Development Plan 2030 proposed in the objective of broader social security coverage (National Planning Commission, 2012). Food intake also relates in particular to two of the seventeen Sustainable Development Goals (SDGs), targeting the window 2016 to 2030, specifically the second goal (to "end hunger, achieve food security, improved nutrition and promote sustainable agriculture") and the third goal (to "ensure healthy lives and promote well-being for all at all ages") (United Nations Development Program (UNDP), 2018). Even though the third SDG is largely focused on disease eradication, food intake also plays a significant role in improving the health status of individuals by satisfying the nutritional requirements of individuals, to enhance general health and prevent chronic diseases (FAO (Food and Agricultural Organisation of the UN), 2018).

1.1 JUSTIFICATION OF THE STUDY

Food affordability can be defined as "the cost of the diet of a household relative to the household's income" (Lee et al., 2013), where the cost of the diet is strongly affected by food prices and the quantity of food purchased. According to the Statistics South Africa (Stats SA) Community Survey 2016 (Stats SA, 2017a) own food production is not a common practice in South Africa with only approximately 6% of all households obtaining the majority of their food from their own agricultural activities. Several sources confirm the increasing importance of purchased food from supermarkets as the dominant source of food for households (D'Haese & Van Huylenbroeck, 2005; Hendriks, 2005; Baipheti & Jacobs, 2009; Schönfeldt et al., 2010; Pereira, 2013; Peyton et al., 2015; Crush & Frayne, 2011)[1].

Food prices and food affordability affect consumer food choices[2], with subsequent influences on dietary patterns, nutrition, health and food security status (Lee et al., 2013; James et al., 1997; Beydoun & Wang, 2008). The World Health Organisation (WHO) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). Numerous factors affect health status, including the social and economic environment (e.g. income level and social status), the physical environment (e.g. safe water, clean air, safe housing, healthy workplaces and infrastructure), individual characteristics and behaviour (e.g. lifestyle, culture, education level, genetics, gender, involvement in social support networks) and the access and usage of health services (WHO, 2018).

The intake of a healthy diet[3] (in terms of dietary patterns and diversity) is an integral part of the concept of health, contributing to the prevention of malnutrition and non-communicable diseases (NCDs) (WHO, 2015; WHO, 2018). Unhealthy diets and inadequate

[1] Refer to Section 1.3.2 for more detail on the importance of purchased food in South Africa.
[2] Refer to Section 1.3.1 for more detail on the conceptual role of food affordability in consumers' food choices.
[3] Refer to Section 1.3.5 for background information on the definition of healthy eating in South Africa.

physical activity are widely acknowledged as prominent global risks to health. Dissimilarities in the cost of healthy and less healthy food items and diets have been linked to public health issues such as obesity and NCDs (Drewnowski & Darmon, 2005). An increasing global policy focus on promoting the intake of healthier food options is fuelling a need for data on the comparative prices and affordability of healthy foods versus less healthy alternatives (Lee et al., 2013).

In South Africa the need to measure the affordability of healthy eating has become increasingly critical in recent years, when we consider pressure factors such as food inflation, household income pressure, the prevalence of food insecurity and the nutrition transition (more detailed discussion to follow).

Over the last ten years (from January 2009 to January 2019) the average annual monthly inflation rate on food and non-alcoholic beverages (NAB) was 6.5% with three major periods of above average inflation (mid-2011 to April 2012, March 2014 to December 2014 and January 2016 to mid-2017[4] (Stats SA, 2019)[5]). With a perspective on the five year period from 2014 to 2018, the FAO (2020) reported increased food inflation in Africa, in contrast to relatively stable food prices in Europe and declining food inflation rates in certain regions (e.g. Latin America, Asia and Oceania). From 2014 to 2018 the food inflation rate (average annualised monthly food inflation) in South Africa decreased from 8.0% to 3.1%, followed by an increase in 2019 to 3.6% (Stats SA, 2020).

According to the Stats SA Income and Expenditure Survey (IES) 2010/2011 and the more recent Living Conditions Survey (LCS) 2014/2015 the percentage of total household expenditure spent on food and NAB ranged from approximately a third of total expenditure for the poorest 40% of the population to just over 5% for the wealthiest 10% of households (Stats SA, 2012; Stats SA, 2017b). The negative impact of rising food prices (and rising staple food prices in particular) on poverty levels, food insecurity and under-nutrition is well established in the scientific literature, with impacts particularly evident among low-income households spending a large portion of their income on food (World Bank, 2011a; Dorward, 2012; Evans, 2009; McLachlan & Landman, 2013).

Household level income pressure is a reality in the South African context[6]. Over the last 10 years, despite an increase of 7.7% in real terms (after accounting for the effect of inflation), household disposable income has been under pressure with real growth rates varying between positive growth of +1.8% and negative growth of -0.9% - thus struggling to keep up with inflation. A high inequality rate (income-based Gini coefficient of 0.68 in 2015 (World Bank, 2018a)) further emphasises household-level income pressure in South Africa. A comparison of household income across the socio-economic spectrum (Stats SA, 2017b), with the International Poverty Line (IPL) of the World Bank (US$1.90 per person per day)

[4] Attributed to the 2015/2016 drought in South Africa, according to the Bureau for Food and Agricultural Policy (BFAP) (2017).

[5] Refer to Section 1.2.3 and Figure 1.1 for a more detail on food inflation dynamics in South African over time.

[6] Refer to Section 2.2.4 in Chapter 2 for a more detailed discussion on household-level income dynamics over time in South Africa.

(World Bank, 2015) revealed that an estimated 40% of the South African population lived under the International Poverty Line in 2014/2015[7].

Even though the total available food supply in South Africa, which is obtained food production and food imports, provides food security from a total energy perspective (FAOSTAT, 2019), food security involves more than just the intake of an adequate amount of energy. Dietary diversity and dietary quality are of critical importance to ensure that individuals obtain the optimal quantity and quality of macronutrients and micronutrients (World Food Summit, 1996)[8]. Poverty and food insecurity are realities faced by too many South Africans. In 2015, 55.5% of people were not able to afford sufficient quantities of food and non-food items, while 25.2% of people were incapable of procuring or consuming adequate food for daily energy needs (Stats SA, 2017c). According to the SANHANES-1 (South African National Health and Nutrition Examination Survey) of 2012, 28.3% of the population was at risk of hunger and 26.0% were food insecure (i.e. experiencing hunger) (Shisana et al., 2014)[9]. The complex nutritional landscape in South Africa is characterised by high levels of child stunting in contrast with a high prevalence of overweight and obesity amongst adults. The latter is associated with the increased role of NCDs in mortality (Shisana et al., 2014).

The complexity of the nutritional landscape in South Africa is further evident in the nutritional transition process taking place (Shisana et al., 2014; Ronquest-Ross et al., 2015; Tathiah et al., 2013; Nnyepi et al., 2015). The nutrition transition refers to the shifts in dietary patterns towards more Western-orientated diets characterised by the intake of more animal protein, fat, sugar and refined foods, while the intake of fresh produce and fibre-rich foods tend to decline (Steyn, 2006; Shisana et al., 2014; Bourne et al., 2002; Kruger et al., 2005; Delgado, 2003; Du et al., 2004; Popkin & Du, 2003; Ghattas, 2014). The nutrition transition is linked to adverse health outcomes such as overweight, obesity and resulting NCDs. Driving factors of the nutrition transition include rapid demographic, social and economic changes (due to economic growth and rising per capita income), increased urbanisation and changes in food systems (including technological advances making low-cost, energy-dense and nutrient-poor foods more available) (Ghattas, 2014; Delgado et al., 1999; Pica-Ciamarra & Otte, 2009).

In the South African context selected elements of the affordability of healthy eating have been researched. In relation to the cost of healthy food at food stores in an urban setting (Cape Town) Temple and Steyn (2009) found that even though healthier food options were available, the cost of food pressured low-income consumers to eat “energy-dense, nutritionally inferior diets”. In rural food stores in the Western Cape, Temple and coworkers (2011) observed general price premiums on healthier food options compared to commonly consumed food options, having a negative impact on lower-income household’s ability to afford healthy diets. In the Pietermaritzburg area of KwaZulu-Natal PACSA (The

[7] Refer to Section 1.3.4 for a discussion on poverty dynamics in South Africa.
[8] Refer to Section 1.3.6 for a conceptual view of the food affordability in food and nutrition security.
[9] Refer to Section 1.3.7 for a discussion on food and nutrition security dynamics in South Africa over time.

Pietermaritzburg Agency for Community Social Action) monitored the cost of the PACSA Minimum Nutritious Food Basket based on retail prices observed in a selection of local retailers in the particular area (PACSA, 2018). Even though the Stats SA Consumer Price Index (CPI) of food is an indication of the effects that inflation has on a typical basket of food items[10], no previous research was found that addresses the measurement of the cost of basic healthy eating in the South African context over time at a national level. Consequently the need was identified to fill this significant research gap by applying a scientifically sound multidisciplinary approach (involving the study fields of nutrition, consumer science and economics) to develop models to measure the cost of healthy eating in South Africa. In the context of the country's limited fiscal resources, limiting the generation of additional primary data, the development of the healthy food basket model had to utilise existing data sources – particularly in the context of food price data, socio-demographic household characteristics and typical food preferences of consumers in the country.

An improved understanding of the cost of basic healthy eating in South Africa can contribute to more comprehensive insights into the complex food and nutrition security landscape in South Africa and can be a useful tool for policy analysis involving elements of consumer food choices and food affordability – ultimately helping the nation to achieve the goals of the National Development Plan 2030 and the UN SDGs pertaining to food and nutrition security.

1.2 BACKGROUND TO THE STUDY JUSTIFICATION

In this section, key elements flowing from the study justification are discussed in more detail. Following a discussion of the conceptual role of food affordability in consumer food choices (Section 1.2.1), the importance of purchased food for South African consumers is explored (Section 1.2.2). Food prices are the first component of food affordability to be discussed, including a historical overview of food inflation in the South African context (Section 1.2.3). The focus then shifts to the second main component of food affordability with a discussion of household income distribution and the prevalence of poverty in South Africa (Section 1.2.4). In view of the link between food affordability and consumer health, Section 1.2.5 then deals with a discussion on healthy eating in South Africa based on official food-based dietary guidelines. Finally the concepts of food affordability and health are integrated by presenting a conceptual view of the role of food affordability in food and nutrition security (Section 1.2.6) and a discussion of food and nutrition security dynamics in South Africa over time (Section 1.2.7).

1.2.1 The conceptual role of food affordability in consumer food choices

The food choices of consumers are affected by a complex range of interrelated factors as shown by several food choice models developed over time (Pilgrim, 1957; Khan, 1981; Randall & Sanjur, 1981; Shepherd, 1985; Shepherd, 1989).

[10] Refer to Section 1.3.3 for a discussion on the methodology applied by Stats SA to calculate the CPI in South Africa.

According to Randall and Sanjur (1981) the factors affecting food choices are related to:

- Individual characteristics (e.g. age, gender, education level, income level, nutrition knowledge, food preparation skills and health attitudes);
- Food characteristics (e.g. taste, visual characteristics, texture, price, type of food, method of preparation, foods eaten together);
- Environmental characteristics (e.g. season, mobility, urbanisation and household size).

Shepherd (1985) described the factors influencing food choice and consumption in terms of:

- Factors related to the person (e.g. perceptions, sensory attributes such as appearance, aroma, taste and texture, as well as psychological factors such as personality, experience, mood and beliefs);
- Factors related to the food (e.g. physical characteristics, chemical composition, nutritional profile, as well as physiological effects like satiety, hunger and thirst);
- Economic and social factors (e.g. price, availability, brand, social and cultural factors which influence the attitudes of the individual related to the sensory properties of the food, health, nutrition, price and value).

Von Alvensleben (1997) proposed a model of the variables influencing food demand where consumer motives of food demand (such as nutrition, health, enjoyment, convenience, safety, social acceptance, prestige, environmental and political motives), their perceptions, attitudes and ultimately food choices are influenced by two categories of variables:

- Product related variables such as price, quality, packaging, service and availability;
- Consumer-related variables related to cultural norms and values in the society and in the family or reference group, as well as consumer-related variables related to the socio-economic situation of the consumer (e.g. stage in the life cycle, age, education, profession, leisure time, household size, urban/rural location and income.

Thus, the models proposed by Von Alvensleben (1997), Shepherd (1985), as well as by Randall and Sanjur (1981) overlapped in terms of two of the three factor categories, i.e. factors related to the food and factors related to the consumer. As mentioned earlier in this chapter, food affordability can be defined as the total cost of the food intake of a household compared to their income (Lee et al., 2013). In the food choice models discussed in this section the price of food items, as well as the income of the consumer, were included as influencing factors in all the models. The role of food prices in food choice has been widely studied over a long period of time (Glanz et al., 1998; Turrell et al., 2002; Pula et al., 2014; Aschemann-Witzel et al., 2018). Income (combined with food prices, thus implying food affordability) can impact on consumer food demand by restricting demand (i.e. the type, quality and quantity of food that can be afforded) and by affecting consumer attitudes, motives and other consumer-related variables (Von Alvensleben, 1997).

1.2.2 How important is purchased food as a food source for households in South Africa?

When we consider the role of food affordability in consumer food choices, the next critical question is to consider the dependence of households on purchased food in the South African context. The South African Community Survey 2016 (Stats SA, 2017a) indicated that

13.8% (or 2.33 million) of all households engage in farming, with farming location dominated by backyard farming (83.8%) followed by farming on farm land (8.7%), communal land (5.0%), organisational land (e.g. school or church) (0.9%) and other options (1.6%). From 2011 to 2016 the percentage of households involved in agriculture decreased from 19.9% (or 2.88 million) in to 13.8% – with the decrease mainly attributed to the severe drought that occurred in South Africa in 2014/2015. Table 1.1 illustrates the main purpose of household involvement in agriculture in 2016, showing that 81.2% of agricultural households or 11.2% of all households in South Africa viewed their agricultural involvement as a source of food (main or additional source of food for the household). Agriculture was indicated as the dominant source of food for 6.0% of all the households in South Africa (Table 1.1).

In relation to the data described in Table 1.1, at least 94% of the total households in South Africa did not engage in agriculture to supply their main source of food (according to the Community Survey 2016). Consequently these households had to obtain food from alternative sources. Household-level research with a food security focus among poorer communities in nine Southern African Development Community (SADC) countries was conducted by the African Food Security Urban Network (AFSUN) in 2008 to 2009 (n=6 453). The study revealed that the most prominent sources normally used by households to obtain food were supermarkets (79% of households), informal markets or street food (70% of households) and small shops or restaurants or take-away outlets (68% of households) (Crush & Frayne, 2011). In terms of supermarket patronage 75% of consumers bought items at supermarkets at least once a month or more often. The increasing dependence of South African consumers on market purchases to obtain food has been reported in numerous studies (D'Haese & Van Huylenbroeck, 2005; Hendriks, 2005; Baipheti & Jacobs, 2009; Schönfeldt et al., 2010; Pereira, 2013; Peyton et al., 2015; Crush & Frayne, 2011).

Table 1.1: The main reasons for involvement in agriculture according to the Community Survey 2016 (Stats SA, 2017a)

Purpose:	**% of agricultural households (n=2.329 million)**	**%of total households (n=16.923 million)**
Main source of food for household	43.7%	6.0%
Additional source of food for household	37.5%	5.2%
For leisure, hobby	6.8%	0.9%
Main source of household income	5.7%	0.8%
Additional source of household income	4.7%	0.6%
Other	1.6%	0.2%

1.2.3 Historical food inflation in South Africa over the last decade

Stats SA (Stats SA, 2017d) defines the CPI as a "current social and economic indicator constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use, or pay for". The index measures the variation in consumer prices over time by monitoring the cost of purchasing a pre-defined basket of consumer goods and services based on the Classification of Individual Consumption by Purpose (COICOP) for goods and services. The purpose of the CPI index is to measure

inflation, measure the cost of living and provide a deflator of consumer expenditure – thus supporting policy formulation. The weights obtained to calculate the current CPI are based on household-level expenditure data obtained from Stats SA LCS 2014/2015 (Stats SA, 2017e) according to the following main groups: food and NAB; alcoholic beverages and tobacco; clothing and footwear; housing and utilities, household contents, equipment and maintenance; health; transport; communication; recreation and culture; education; restaurants and hotels; and miscellaneous products and services (Stats SA, 2017e). The CPI is calculated for the country as a whole, individual provinces, rural / urban areas and different socio-economic groups. These groups are specified in terms of the ten expenditure deciles (EDs) – each representing 10% of the households in South Africa. CPI food price data rely on field-based collection where field workers visit sampled retail outlets to survey monthly prices at a retail level. See Table 1.2 for a list of all food items included in the calculation of the CPI.

Table 1.2: Food items included in the South African CPI for food and NAB (Stats SA, 2017e)

Food category specified by Stats SA:	**Food items:**
Bread and cereals	Rice, white bread, brown bread, bread rolls, sweet biscuits, savoury biscuits, rusks, pasta, cakes / tarts, frozen pastry products, cake flour, bread flour, cold cereal, maize meal (super and special), hot cereals / porridge, ready-mix flour.
Meat	Beef, pork, lamb, poultry, dried / salted/ smoked meat and other preserved or processed meat.
Fish	Fresh / chilled / frozen / preserved or processed fish and seafood.
Milk, cheese and eggs	Whole milk, low fat milk, preserved milk, yoghurt, cheese, other milk products, eggs.
Oils and fats	Margarine and other vegetable fats, edible oils.
Fruit	Bananas, apples, seasonal fruit, dried fruit.
Vegetables	Leaf / stem vegetables, cabbages, vegetables cultivated for their fruit, root crops / non-starchy bulbs / mushrooms, dried vegetables, other preserved or processed vegetables, potatoes, other tubers and products of tubers.
Sugar, sweets, desserts	Sugar, chocolate, confectionery products, ice cream.
Other food	Sauces, condiments, salt, spices, herbs and baby food.
NAB	Hot beverages (coffee, tea, cocoa and powdered chocolate) Cold beverages (mineral water, soft drinks, fruit juice).

Figure 1.1 presents data from Stats SA on the CPI aggregate (headline) index, as well as the food and NAB index for all urban areas[11], for the ten year period from January 2009 to January 2019 (Stats SA, 2019). From January 2009 to January 2019 the CPI index for food and NAB increased by 76.2%, even though the rate of inflation varied with several upward- and downward cycles as illustrated in Figure 1.1. During this period CPI headline inflation was lower than CPI inflation on food and NAB for approximately two thirds of the months considered. From January 2009 to April 2018 the average inflation rate on food and NAB

[11] The CPI figures for 'all urban areas' is the main focus of the inflation figures reported by Stats SA (Stats SA, 2019).

was 6.5%, with the most recent high value of 11.8% in October 2016 – mainly attributed to the 2015/2016 drought in South Africa (BFAP, 2018). Over the last year (January 2018 to January 2019) the average monthly year-on-year inflation rate on food and NAB was lower than the 10-year average, at 3.5%.

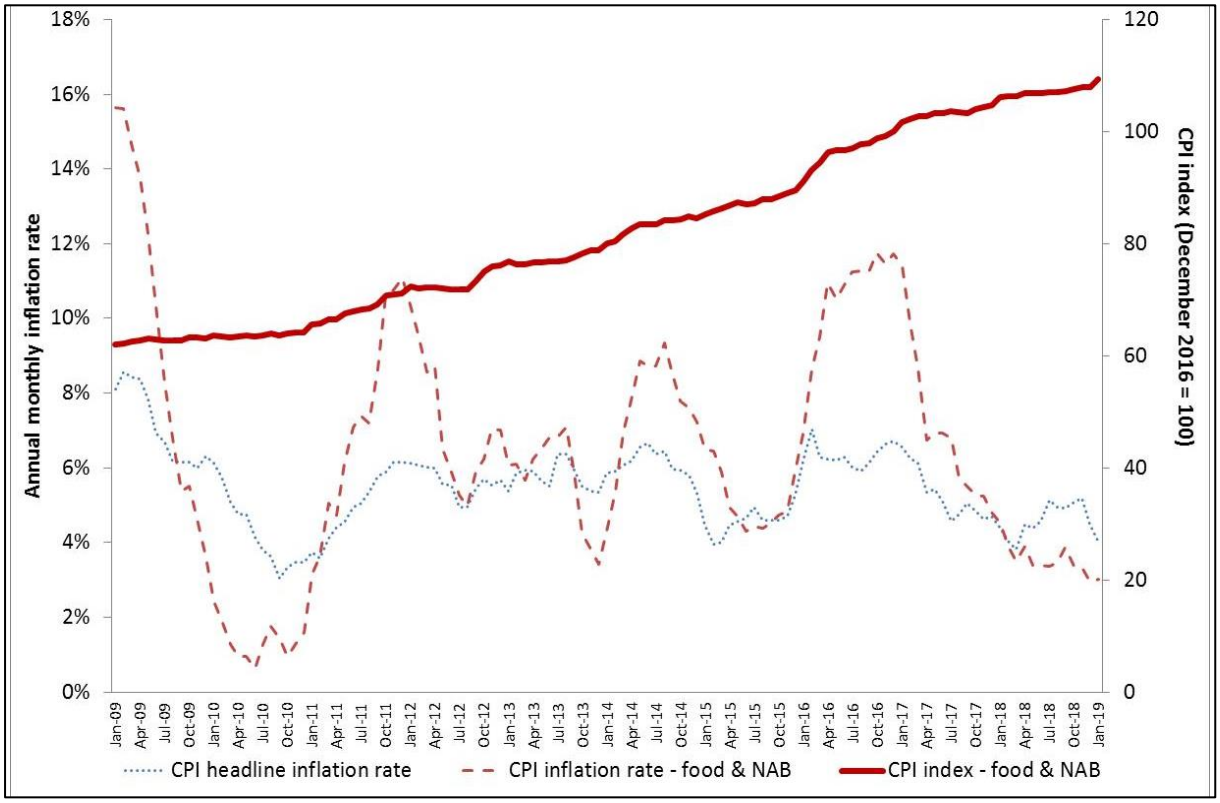

Figure 1.1: Headline inflation versus inflation on food and NAB in South Africa from January 2009 to January 2019 (Stats SA, 2019)

Upward cycles in the CPI food inflation rate were generally driven by factors such as higher international commodity prices, higher input costs (e.g. electricity, labour[12]), higher oil prices and exchange rate weakening (which increased the attractiveness of export opportunities) (BFAP, 2017; BFAP, 2018). The most recent upward cycle in food inflation (from mid-2015 to the end of 2016) was mainly driven by the impact of the severe 2015/2016 drought in the summer rainfall areas in South Africa, combined with additional factors such as a significantly depreciated exchange rate.

From an international perspective the FAO (2020) reported decreased food inflation at a global level from 2014 to 2018, with the following regional observations:

- Increased food inflation in Africa;
- Relatively stable food prices in Europe;
- Declining food inflation rates in regions such as Latin America, Asia and Oceania

Figure 1.2 presents a comparison of food price inflation in South Africa compared to select other countries within the various world regions.

[12] Input costs such as fuel and electricity are administered prices.

From an international perspective (based on data reported by the Organisation for Economic Co-operation and Development (OECD)), Figure 1.2 presents annual average monthly CPI food inflation for the period January 2014 to December 2018 was the lowest for the United States[13], the United Kingdom, the European Union and China[14] (OECD, 2019). South Africa and Brazil[15] had the highest food inflation rates over this period. In 2014, 2016, 2017 and 2018 the food inflation rate in South Africa was the highest among the considered countries and regions (OECD, 2019). In 2019 (based on OECD data), compared to South Africa food inflation rates were higher for countries such as China, Russia, Brazil, Columbia and Mexico, with comparative lower food inflation rates observed for countries such as China, Indian, United Kingdom, European Union and Australia[16].

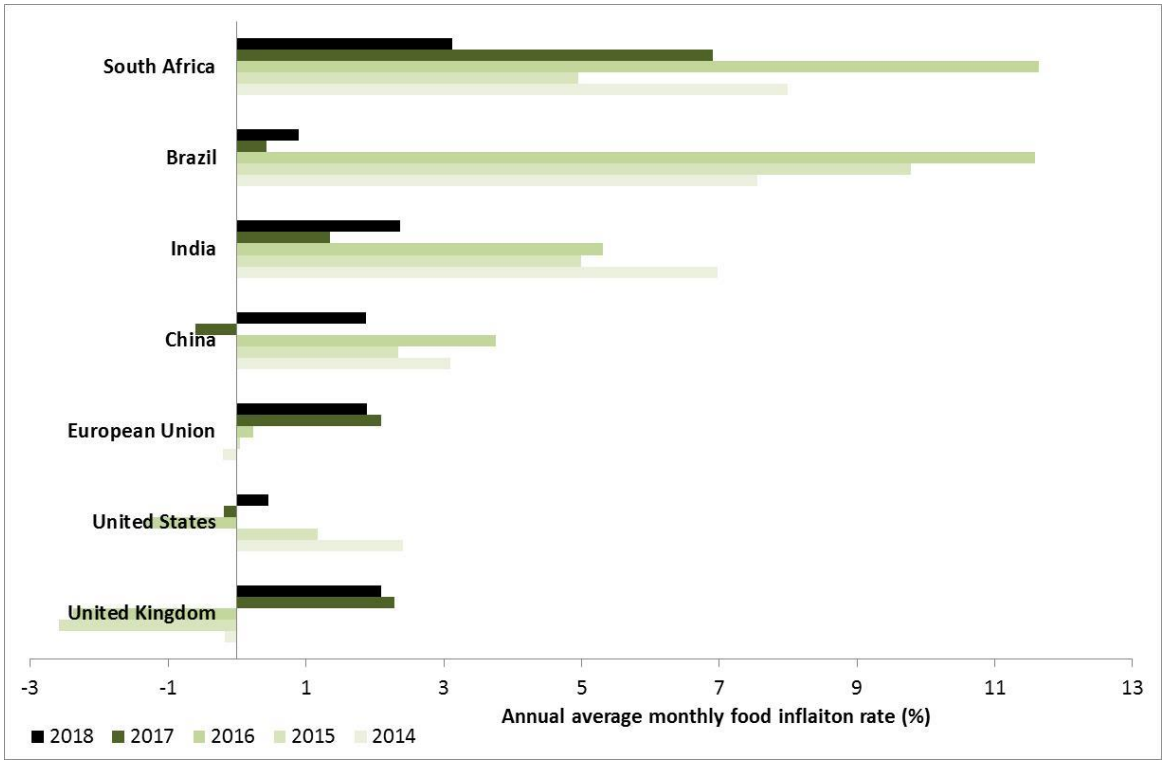

Figure 1.2: Food inflation in South Africa compared to selected other regions and countries – 2013 to 2018 (OECD, 2019)

When focussing on inflation for specific food categories Table 1.3 presents an overview of average monthly year-on-year inflation rates for specific food categories (as defined by Stats SA in official CPI data) for the period 2009 to 2018 (Stats SA, 2019). Sugar-rich foods (sugar, sweets and desserts), followed by animal-source foods (meat, fish, milk, cheese and eggs) and vegetables generally had the highest CPI inflation rates over the ten year period, while the lowest inflation rates were observed for fats / oils and fruit. In the staples (bread and cereals) category, the most significant inflation was observed during the 2015/2015 drought impact period. The varying impact of food inflation across the socio-economic spectrum is

[13] Representing a major role-player in North America.
[14] Representing a major role-player in Asia.
[15] Representing a major role-player in South America.
[16] The OECD database on food inflation rates is lacking of data on other African countries.

influenced by the more specific expenditure on food categories and food items. For example, according to the Stats SA LCS 2014/2015, the bread and cereals category represented 11.4% of the total expenditure of households in ED 1, remaining around 10% up to ED4 and decreasing to 0.8% for ED 10 (Stats SA, 2017b). Thus, significant staple food inflation can have a more severe impact on the lower income households with a large portion of their food budget allocated to staple foods (Dorward, 2012). Significant inflation of food categories such as animal-source foods, fruit and vegetables can have a negative impact on consumer ability to achieve adequate dietary diversity.

Table 1.3: Overview of the average monthly year-on-year inflation rates for specific food categories (Stats SA in official CPI data) for the period 2009 to 2018 (Stats SA, 2019)

Food category: *(as defined by Stats SA)*	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Sugar-rich foods	12.2%	**5.8%**	9.7%	**9.9%**	6.8%	7.1%	**8.5%**	15.7%	**12.8%**	-0.4%
Fish	12.4%	2.7%	2.8%	8.9%	6.5%	7.8%	7.4%	8.3%	6.5%	5.7%
Vegetables	**15.7%**	1.2%	4.1%	4.1%	**10.8%**	**10.0%**	0.8%	16.5%	-0.3%	5.6%
Meat	7.0%	0.6%	10.8%	7.6%	3.3%	7.4%	5.9%	5.8%	**12.8%**	**6.9%**
Milk, eggs and cheese	11.2%	2.1%	0.7%	7.9%	7.6%	**10.3%**	6.2%	7.4%	5.6%	3.8%
Bread and cereals	8.3%	-1.6%	6.9%	8.4%	6.2%	7.5%	5.1%	14.6%	2.9%	-2.5%
Fruit	11.4%	4.2%	5.9%	4.7%	3.6%	4.3%	2.0%	**18.1%**	1.1%	-4.4%
Oils and fats	-1.4%	-5.0%	**20.9%**	6.7%	4.4%	1.7%	4.0%	16.7%	-0.5%	-0.7%

*NOTES: The highest monthly year-on-year inflation rate in a particular year is indicated in **bold**, while other food categories with high inflation rates in the particular year are indicated by grey shading.*

1.2.4 Poverty dynamics in South Africa

Household-level income pressure in South Africa can be better understood when we consider household-level food expenditure per ED in 2014/2015[17,18] (Stats SA, 2017b), combined with the International Poverty Line (IPL) of the World Bank (US$1.90 per person per day[19]) (World Bank, 2015) (see Figure 1.3). According to the data illustrated in Figure 1.3, 40% of all households in South Africa (i.e. EDs 1 to 4) lived below the International Poverty Line in 2014/2015, with ED 5 in line with the IPL and ED6 just above the line.

Having explored the reality faced by South African consumers in terms of rising food prices and income pressure, it is consequently important to consider the incidence of poverty, as well as food and nutrition security over time in the South African context. According to the

[17] The Stats SA LCS 2014/2015 represents the most recent nationally representative household-level expenditure survey for South Africa.

[18] The average household size observed in the Stats SA LCS 2014/2015 was 3.3 and consequently the International Poverty Line was calculated for a family consisting of four individuals (thus rounded up).

[19] The World Bank International Poverty Line of US$1.90 per person per day was converted to Rand equivalents by applying the average Rand/US$ exchange rate for the period October 2014 to October 2015 (i.e. the data gathering period of LCS 2014/2015) as sourced from the South African Reserve Bank.

most recent Stats SA publication on poverty trends in South Africa, poverty has declined from 2006 to 2011 (Stats SA, 2017c). The percentage of the population operating under the upper-bound poverty line (UBPL) or national poverty line (thus not being able to afford enough food and non-food items) decreased from 66.6% to 53.2% in 2011, but increased to 55.5% in 2015 (representing 30.4 million people in 2015).

The food poverty line (FPL) is used as an indication of people living in extreme poverty, i.e. individuals who cannot buy or consume adequate food quantities for daily energy and health needs.

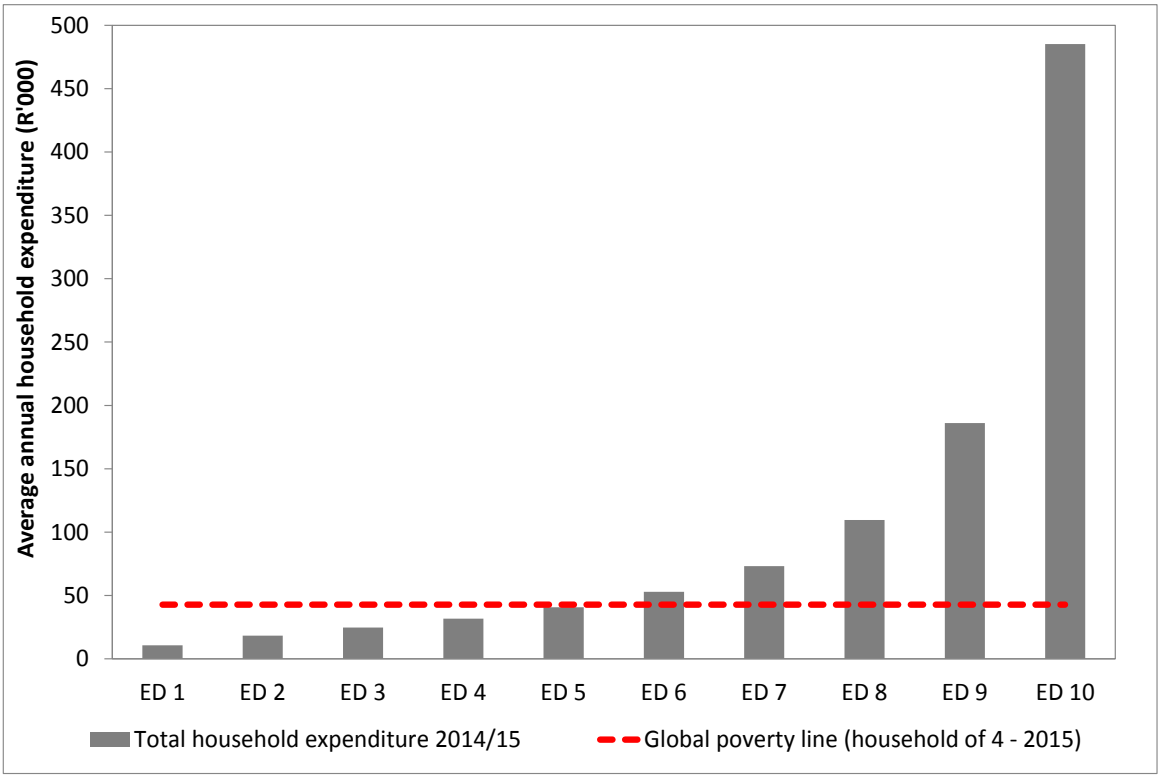

Figure 1.3: Comparing socio-economically disaggregated household expenditure with the World Bank International Poverty Line (World Bank, 2015; Stats SA, 2017b)

The proportion of the population living in extreme poverty increased from 28.4% in 2006 (13.4 million people) to 33.5% in 2009 (16.7 million people), linked to the impact of the 2008 global financial crisis. In 2011 the portion of the population under the FPL decreased to 21.4% (11.0 million people), followed by an increase to 25.2% in 2015 (13.8 million people) (see Table 1.4).

Table 1.4: Poverty measurements for South Africa – 2006 to 2015 (Stats SA, 2017c)

Poverty measure:		2006	2009	2011	2015
Poverty based on the UBPL[1]	**% of population**	66.6%	62.1%	53.2%	55.5%
	Number of people (millions)	31.6	30.9	27.3	30.4
Poverty based on the Lower-bound poverty line (LBPL)[2]	**% of population**	51.0%	47.6%	36.4%	40.0%
	Number of people (millions)	24.2	23.7	18.7	21.9
Poverty based on the FPL[3]	**% of population**	28.4%	33.5%	21.4%	25.2%
	Number of people (millions)	13.4	16.7	11.0	13.8

[1] *Upper-bound Poverty Line (UBPL) / National Poverty Line: Purchasing power required for both adequate levels of food and non-food items. UBPL in April 2017: R1 138 per person per month.*

[2] *Lower-bound Poverty Line (LBPL): Individuals operating below the LBPL do not have adequate resources to purchase or consume both adequate food and non-food items and thus have to forfeit some food to obtain essential non-food items. LBPL in April 2017: R758 per person per month.*

[3] *Food Poverty Line (FPL): "Rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for adequate health"* (Stats SA, 2017c). *FPL in April 2017: R531 per person per month.*

1.2.5 Defining healthy eating in the South African context

In relation to the focus of the thesis on specifically healthy eating, it is important to provide background on the definition of healthy eating in the South African context. Since 1948 the WHO has defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). Consuming a healthy diet through all life stages contributes to the prevention of malnutrition and NCDs such as diabetes, heart disease, stroke and cancer (WHO, 2015), while unhealthy diets and inadequate physical activity are classified as prominent global risks to health. The composition of a diversified, balanced and healthy diet can be affected by a wide range of factors such as cultural context, the availability of foods, dietary customs and the needs of individuals – which relate to variables such as age, gender, lifestyle and the physical activity level of the individual (WHO, 2015).To help individuals to make healthy food choices, food-based dietary guidelines (FBDG) can be developed. FBDG consist of recommendations (both on the levels of principles and specific advice) pertaining to healthy diets (e.g. the consumption of foods, food groups and dietary patterns) and healthy lifestyles, to ensure adequate nutrient intake, enhance general health and avoid chronic diseases (FAO, 2018). FBDG have to be based on sound scientific evidence, and take into consideration factors such as the public health and nutrition priorities of a country, social influences, cultural influences, food production, typical food consumption, food composition data and the accessibility of food (FAO, 2018), but can also involve a more holistic approach where food safety, sustainability and food combinations (i.e. meals) are considered.

The most recent South African (SA) FBDG for adults and children aged six years and older was released in 2012 (Vorster et al., 2013) and involves three types of guidelines:

- General guidelines:
    - Dietary diversity: "Enjoy a variety of foods";
    - Physical activity: "Be active";
    - Water intake: "Drink lots of clean, safe water".

- Guidelines pertaining to food groups to include in the diet:
    - "Make starchy foods part of most meals";
    - "Eat dry beans, split peas, lentils and soya regularly";
    - "Eat plenty of vegetables and fruit every day";
    - "Have milk, maas or yoghurt every day"[20];
    - "Fish, chicken, lean meat or eggs can be eaten daily";
    - "Use fats sparingly. Choose vegetable oils, rather than hard fats".
- Cautionary guidelines:
    - "Use salt and food high in salt sparingly";
    - "Use foods and drinks containing sugar sparingly, and not between meals".

The official South African Food Guide (Figure 1.4) visually presents the key messages contained in the SA FBDG focusing on the quantities and types of foods individuals should eat to obtain the nutrients required for good health (Deparment of Health, 2012a).

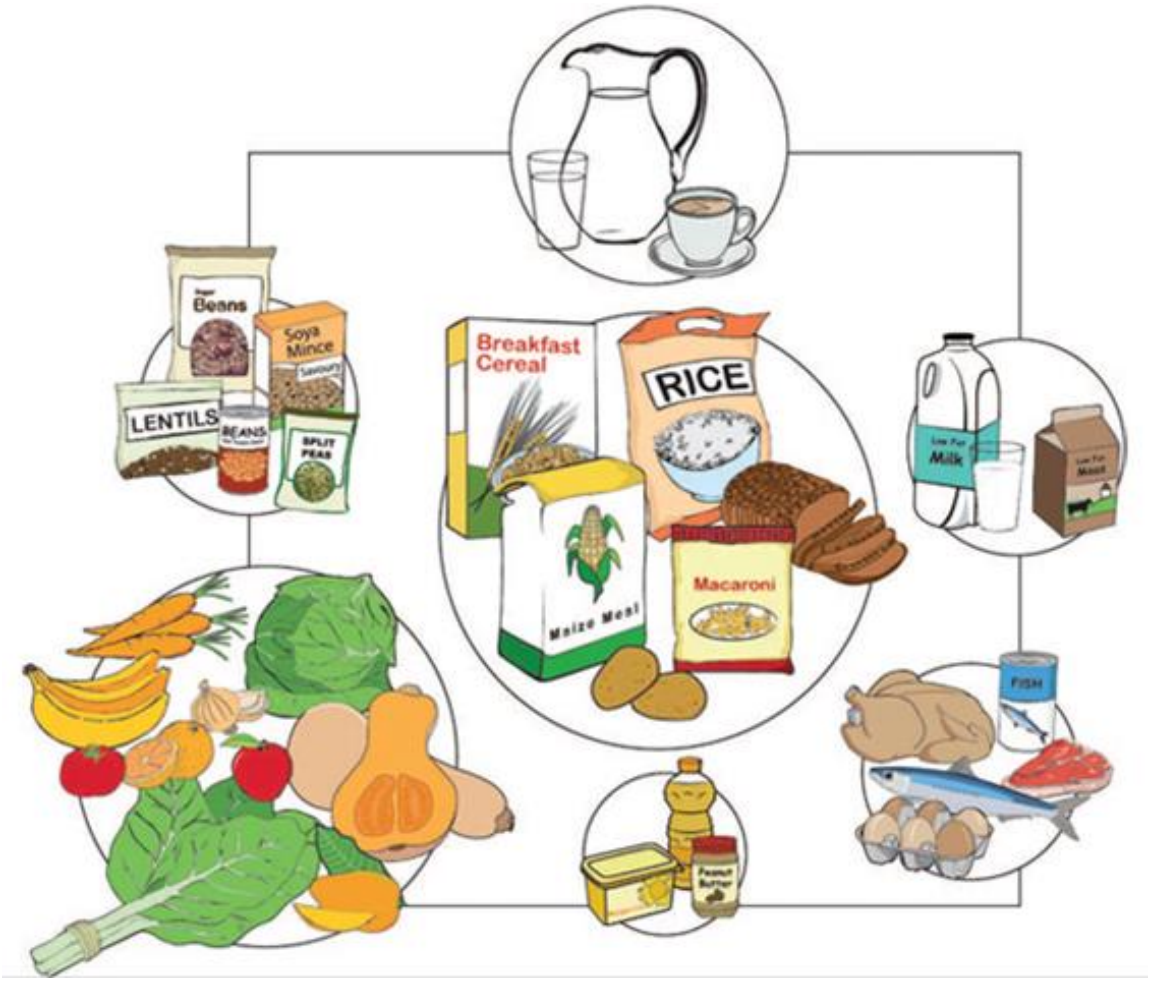

Figure 1.4: The 2012 South African Food Guide (Department of Health, 2012b)

[20] Maas is a fermented milk product.

The South African Food Guide displays pictures of seven food groupings forming part of healthy eating where the relative size of the food group circles serves as an indication of the relative contribution of food groups to daily food intake (Vorster et al., 2013):

- The starch-rich foods group has the largest circle and contains pictures of bread, breakfast cereals, maize meal, pasta, potatoes and rice;
- The vegetables and fruit group has the second largest circle and displays pictures of bananas, butternut, cabbage, carrots, onions, oranges, spinach, strawberries, sweet potatoes and tomatoes;
- The water group has the third largest circle and contains pictures of clean water in a jug and a glass, as well as a cup filled with a hot beverage (e.g. tea or coffee) prepared with water;
- In fourth position, the circles for fish, chicken, lean meat or eggs, milk, maas or yoghurt and legumes (dry beans, peas, lentils and soya) are of equal size and contain pictures of the following specific food items:
    - Chicken, fish (fresh and canned), red meat and eggs;
    - Milk and maas;
    - Canned beans, lentils, soya mince, split peas and sugar beans.
- In the fifth position~~,~~ the smallest circle for fats and oils displays pictures of peanut butter, plant oil and margarine.

Sugar (including foods high in sugar) and salt are not included in the South African Food Guide, but are discussed in the SA FBDG.

1.2.6 A conceptual view on the role of food affordability in food and nutrition security

Having discussed the concept of health, the role played by food prices in food choice from a conceptual perspective and the importance of purchased food for households in South Africa, the next step is to explore the link between food affordability and food security. Food security is achieved when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996). There are four main dimensions or pillars of food security (FAO, 2008; Wüstefeld, 2013): Availability, accessibility, utilisation and stability (Figure 1.5). The concurrent fulfilment of all four dimensions is required to reach food security objectives.

Food ***availability*** refers to a situation where "adequate food is ready to have at peoples' disposal" (Gross et al., 2000). Food availability is determined by factors such as domestic production, food stock levels, food aid, import capacity and net trade (FAO, 2008). However, household-level food security may still be lacking despite an adequate aggregate food supply if limitations exist in terms of economical and physical access to food.

From a supply chain perspective food ***access*** involves aspects such as market infrastructure, food distribution and transport. From a consumer perspective food access relates to household-level purchasing power and food affordability. Gross and co-workers (2000) stated that food access is achieved "when all households and all individuals within those

households have sufficient resources to obtain appropriate foods (through production, purchase or donation) for a nutritious diet".

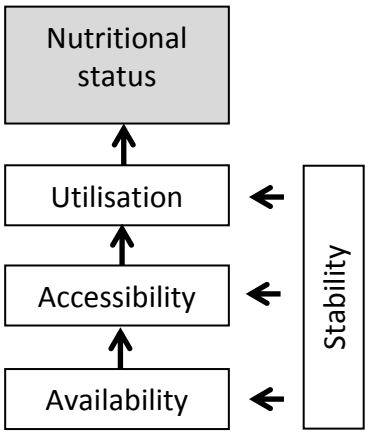

Figure 1.5: A conceptual model of food security (Gross et al., 2000)

Ingram (2011) stressed the importance of food affordability in alleviating food insecurity, in addition to the role of increased agricultural production. The food security impacts of food prices and food affordability have been widely studied. The World Bank estimates indicated that the 2005 to 2007 increase in food prices resulted in up to 105 million people moving into poverty (World Bank, 2008). The Committee on World Food Security (2011) reported that in the four year period leading up to 2011, food price volatility adversely affected the nutritional status and food security of millions of people globally and also had negative implications in terms of economic growth and poverty alleviation in developing countries.

Moving from a global perspective to a rural South African setting, it was found that female-headed rural households residing in the Limpopo province reduced food intake and dietary diversity when facing high and rising food prices (Mkhawani et al., 2016). The negative impact of rising food prices on food security in the South African context has been established by several studies (Naicker et al., 2015; Musemwa et al., 2015; Chakona & Shackleton, 2017; Temple et al., 2011). Temple and co-workers (2011) concluded that healthier food options carried a price premium compared to commonly consumed foods in South Africa and consequently that the majority of households in the country could not afford a healthy diet.

In the context of the link between food affordability and food security the effect of food price changes on demand for different types of food (i.e. the price elasticity of demand) should also be considered (Andreyeva et al., 2010). An in-depth understanding of consumer reaction to changes in food prices is critical to understand the potential impact of food price policy interventions.

Food ***utilisation*** is described as "the way the body makes the most of various nutrients in the food" (FAO, 2008) and is affected by aspects such as food safety, food quality, food preparation, dietary diversity, clean water, health, sanitation, care practices, feeding practices and the distribution of food among household members – ultimately affecting the nutritional status of individuals. Instability can result from factors such as weather

variability, political uncertainty and economic factors such as a high unemployment rate and increasing and fluctuating food prices. Food security requires ***stability*** in terms of availability, access and utilisation over time to avoid periodical food insecurity and ultimately the deterioration of the nutritional status of individuals.

Food insecurity, poverty and malnutrition are interrelated (FAO, 2008), with poverty defined as "different dimensions of deprivation that relate to human capabilities including consumption and food security, health, education, rights, voice, security and decent work" (OECD, 2001). Hunger or food deprivation can refer to "an uncomfortable or painful sensation caused by insufficient food energy consumption" (FAO, 2008). A two-way relationship exists between poverty and hunger, as hunger can be the result of poverty and inadequate nutrition can be an underlying cause of poverty affecting physical and cognitive development and productivity (FAO, 2008). Hungry or food deprived individuals are viewed as food insecure, but food insecurity can also exist in the absence of hunger and the presence of inadequate micronutrient intake (i.e. inadequate dietary quality). Malnutrition refers to "deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients" (WHO, 2016) and includes under-nutrition and over-nutrition. Malnutrition can result from food insecurity or non-food reasons such as insufficient child care, insufficient health services or an unhealthy environment (FAO, 2008) and malnutrition can be both an outcome of poverty, as well as a cause of poverty.

The UN Children's Fund (UNICEF) conceptual framework of malnutrition (UNICEF, 1990) has been applied to both under- and over-nutrition and states that malnutrition has two immediate causes: inadequate dietary intake and inadequate health (Figure 1.6).

At the next level the underlying causes of malnutrition include insufficient access to food (affecting dietary intake), insufficient care for household members which is aggravated by inadequate education (affecting both dietary intake and diseases), sub-standard health services and an unhealthy environment (e.g. water, sanitation) (affecting diseases). The underlying causes are affected by basic causes which include human resources, environmental resources, economic systems, political factors and ideological factors. Thus, in this conceptual framework, food affordability impacts nutritional status mainly in the context of the economic resources of the household (i.e. household income) and how food prices affect the access that households and individuals have to adequate food.

The complexity of factors affecting the nutritional status of individuals and households is emphasised when we consider the nutrition transition phenomenon. The global nutrition transition involves shifts in dietary patterns characterised by the increased consumption of saturated fats, sugars and refined foods, as well as reduced intakes of fibre-rich foods (e.g. fruits, vegetables, whole grains). Driving factors of the nutrition transition include swift demographic, social and economic changes, increased urbanisation and changes in food systems (Ghattas, 2014). The negative nutritional outcomes of the nutrition transition include overweight, obesity and associated NCDs (e.g. diabetes, heart diseases) (Popkin et al., 2001; Albala et al., 2002; Rivera et al., 2004; Popkin et al., 2012; Ghattas, 2014; Cohen et al., 2017).

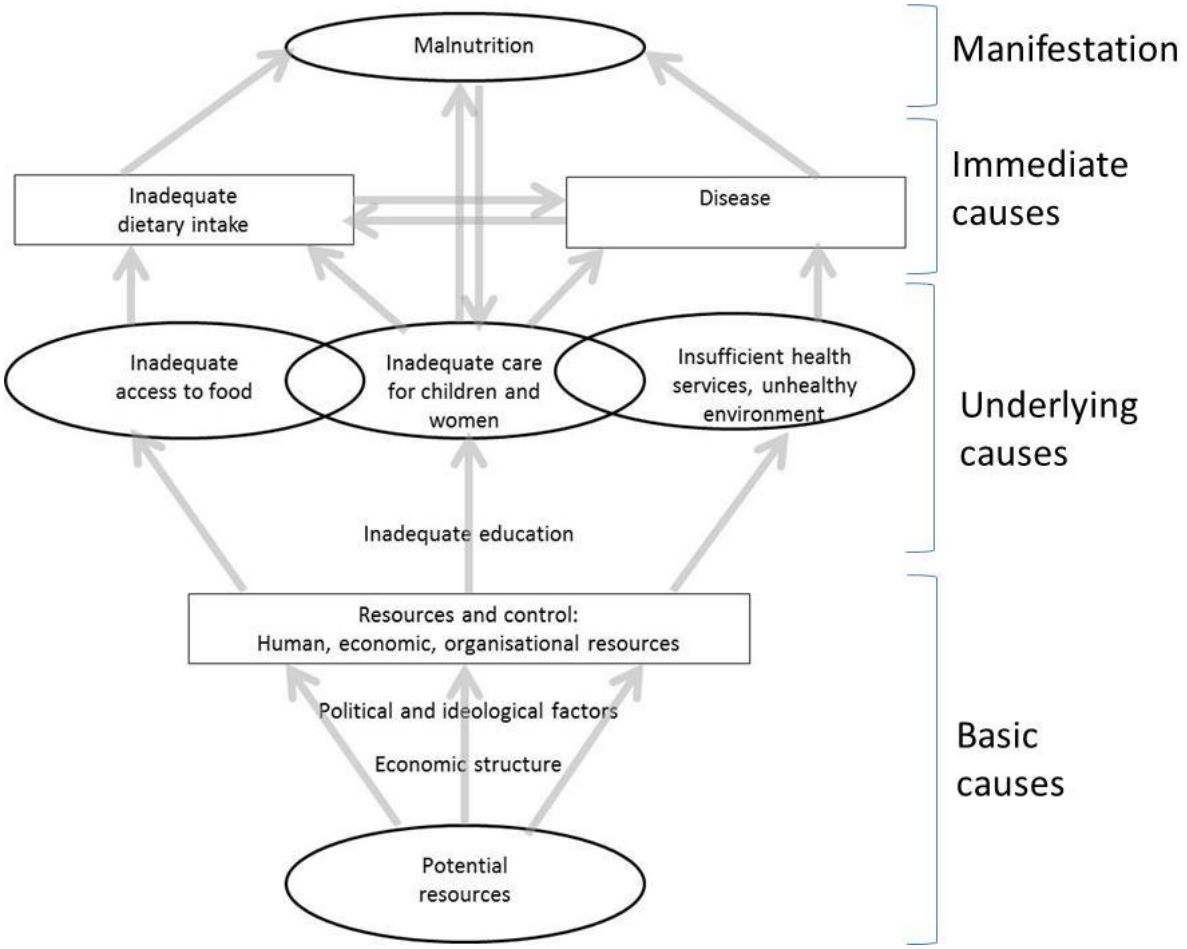

Figure 1.6: Conceptual framework of malnutrition (UNICEF, 1990)

1.2.7 Food- and nutrition security dynamics in South Africa over time

In relation to the access component of food security in terms of hunger measurements, the most recent nationally representative SANHANES-1 (Shisana et al., 2014) revealed that 45.6% of the population was food secure in 2012, improving from a level of 19.8% observed in the National Food Consumption Survey (NFCS) 2005 (Labadarios et al., 2007). In 2012 (based on SANHANES-1) food insecurity was most prominent among individuals residing in rural formal areas (37.0%) and urban informal areas (32.4%), while at a provincial level food insecurity was the highest in the Eastern Cape and Limpopo provinces (36.2%% and 30.8% respectively) and the lowest in Gauteng (19.2%) and the Western Cape (16.4%) (Shisana et al., 2014). The portion of the population which was ***at risk of hunger*** in 2012 (SANHANES-1, 2012), constituted 28.3% with a similar level (27.9%) observed in the NFCS 2005. ***Food insecurity*** (in other words, people experiencing hunger) applied to 26.0% of the population, which improved from 48.0% in 2005 (NFCS 2005 data). A comparison of the estimated levels of severe food insecurity in South Africa to other countries and regions for the period 2014

to 2016 (FAO, IFAD, UNICEF, WFP and WHO, 2017)[21] reveals higher levels for South Africa (23%) and Africa (26%) compared to Asia (7%), Latin America (5%), Australia / New Zealand (3%), Europe (2%) and North America (1%).

The access component of food security can also be measured in terms of dietary diversity, to measure the nutritional quality of the diets (Kennedy, 2009). Low dietary diversity is linked to nutritional vulnerability (Kennedy, 2009). According to SANHANES-1 2012 (Shisana et al., 2014) the mean national ***dietary diversity score (DDS)*** at a nation level was 4.2, with 39.7% of the population experiencing ***dietary inadequacy*** (i.e. a DDS of less than 4). These values show a slight improvement from data obtained in the 2009 South African Social Attitudes Survey (SASAS) (Labadarios et al., 2011) which reported a national mean DDS of 4.02 with 38% of the population having a DDS score below 4. SAHANES-1, 2012 DDS results did not differ significantly across age categories, even though dietary inadequacy was significantly more prominent among participants in rural areas (up to 59.7%) as well as participants in the Limpopo and North-West provinces (65.6% and 61.3%, respectively).

The utilisation component of food security can be measured by means of the anthropometric status of children and includes both under- and over-nutrition. Stunting (height-for-age), which is an indication of chronic undernourishment and chronic inadequate energy intake, is the most prominent under-nutrition condition in South Africa. In 2012, stunting affected 26.5% of children aged 1 to 3 years and 11.9% of children aged 4 to 6 years (medium and low severity level ranges respectively, as defined by the WHO (De Onis & Blössner, 1997)) (Shisana et al., 2014). From 2005 (NFCS 2005) to 2012 (Shisana et al., 2014) stunting did not improve among younger children, even though some improvement was observed for children aged 4 to 6 years compared to data obtained in 2005 (Table 1.5). According to the most recent 2015 South African Demographic and Health Survey, 27.4% of children below 5 years of age were stunted and 9.8% severely stunted (Stats SA, 2017f). For children aged 1 to 3 years wasting and underweight have improved from 2005 to 2012, with observations in the low severity category of public health importance according to the WHO definition. From 2005 to 2012 wasting and underweight improved among children aged 4 to 6 years. According to the 2015 South African Demographic and Health Survey, 2.5% of children under 5 years of age were stunted and 1.1% underweight (Stats SA, 2017f).

Micronutrient deficiencies are also used to measure under-nutrition, with vitamin A and iron often of particular importance due to the role these micronutrients in early childhood development. In South Africa, the prevalence of anaemia (linked to iron deficiency) was 10.7% in 2012 (SANHANES-1) with a decreasing trend observed over time. Even though the prevalence of vitamin A deficiency has decreased over time to a level of 43.6%, it remains a significant public health concern (Shisana et al., 2014).

[21] FAO: Food and Agriculture Organisation of the UN; IFAD: International Fund for Agricultural Development; UNICEF: UN International Children's Emergency Fund; WFP: World Food Programme.

Table 1.5: Anthropometric data for children aged 1-6 years – comparing the results from the NFCS 2005 (Labadarios et al., 2007) and SANHANES-1 2012 (Shisana et al., 2014)

Age group:	Stunting (Height-for-age):			
	Stunting:		Severe stunting:	
	2005	2012	2005	2012
1-3	23.4%	26.5%	6.4%	9.5%
4-6	16.4%	11.9%	5.1%	2.2%
Age group:	**Wasting (Weight-for-height):**			
	Wasting:		**Severe wasting:**	
	2005	**2012**	**2005**	**2012**
1-3	5.1%	2.2%	0.9%	1.1%
4-6	5.0%	2.0%	1.5%	0.8%
Age group:	**Underweight (Weight-for-age):**			
	Underweight:		**Severe underweight:**	
	2005	**2012**	**2005**	**2012**
1-3	11.0%	6.1%	1.2%	1.7%
4-6	8.6%	4.5%	0.8%	0.6%

In relation to the utilisation component of food security in terms of the anthropometric status of children measuring over-nutrition, from 2005 to 2012, the combined prevalence of overweight and obesity in children aged 1 to 9 years increased by 5.9 percentage points to 19.9% (according to NFCS 2005 and SANHANES-1, 2012). Overweight and obesity were more prominent among girls of all ages (than boys), as well as children residing in urban formal and informal areas (compared to rural formal and informal areas). According to the 2015 South African Demographic and Health Survey, 13% of children were overweight (Stats SA, 2017f), more than 50% higher than the global average of 6.1% (International Food Policy Research Institute (IFPRI), 2016).

The food availability component of food security can be measured using the household inventory approach, even though no recent data are available in this regard. According to the 1999 NFCS, households residing in formal urban areas and those with a higher income level (more than R12 000 per annum in 1999), had a more comprehensive household inventory (on average 15.7 different items), compared to rural households and those with lower income levels (on average 7.4 different food items) (Labadarios et al., 2005).

The contrasting complexity of the nutritional challenges faced in South Africa is highlighted when we consider that in addition to unacceptably high stunting levels among children (which are indicative of chronic undernourishment), 67.6% of women and 31.3% of men were overweight or obese in 2016 according the most recent Stats SA South African Demographic and Health Survey (SADHS) (Stats SA, 2017f) – which is indicative of excessive energy intake. In 2014, the global prevalence of adult overweight and obesity was 52% (IFPRI, 2016). Obesity is one of the risk factors associated with NCDs (e.g. cancer, diabetes, heart disease and asthma), in addition to factors such as hypertension, dyslipidaemia, hyperglycaemia, inactivity, smoking and alcohol consumption (Vorster et al., 2013). From 2006 to 2016 the percentage of deaths in South African attributed to NCDs increased from 43.6% to 57.4% (Stats SA, 2018a). In 2016 the top 10 dominant underlying natural causes of mortality in South Africa were tuberculosis (6.5%), diabetes mellitus (5.5%), other forms of

heart disease (5.1%), cerebrovascular diseases (5.1%), human immunodeficiency virus (HIV) disease (4.8%), hypertensive diseases (4.4%), influenza / pneumonia (4.3%), other viral diseases (3.6%), ischemic heart diseases (2.8%) and chronic lower respiratory diseases (2.8%).

1.3 THESIS AIM AND OBJECTIVES

The aim of the thesis is to investigate the affordability of basic healthy (nutritionally balanced) eating in South Africa over time. The objectives are:

1. To describe the dynamic South African consumer landscape from a socio-demographic perspective, in order to establish the context for food intake across the socio-economic spectrum.
2. To investigate the food expenditure patterns of South African consumers across the socio-economic spectrum with a particular focus on the various food groups.
3. To develop a model of basic healthy (nutritionally balanced) eating in the South African context, focusing on a thrifty basket option and a more elaborate moderate-cost basket option.
4. Starch-rich staple foods and animal-source foods (meat, fish, chicken and eggs) represent the dominant portion of household-level food expenditure in the South African context. These two food groups were, therefore, selected to develop application case studies where the principles of the model of basic healthy (nutritionally balanced) eating were applied to determine whether the intake of these food groups adhere to the recommendations set out in the SA FBDG and to explore the discrepancies between actual intake and more ideal intake.

1.4 OUTLINE OF THE STUDY

This thesis is divided into seven chapters. Following the introductory chapter, the second chapter presents a literature overview of the dynamic and diverse South African consumer landscape. Chapter 2 provides the socio-economic consumer context for the thesis and includes an introductory exploration of the food expenditure patterns of South African consumers across the socio-economic spectrum.

The development and application of the model that was used in this study to measure the cost of basic healthy (nutritionally balanced) eating in South Africa is presented in Chapter 3. Following a review of literature on healthy food baskets and a description of the methodology employed to develop the healthy food basket models, the chapter reports on key empirical results generated through the application of the healthy food basket models. Detail is discussed on the cost of basic healthy eating over time, a comparison of general CPI food inflation with the inflation rate of the basic healthy food baskets, an analysis of the affordability of the healthy food baskets, as well as the magnitude and nutritional implications of the expenditure gap between actual food expenditure and basic healthy food expenditure.

To further illustrate the potential application of the developed basic healthy food basket model, Chapters 4, 5 and 6 report on two case studies to explore whether the starch-rich

food intake (Chapter 4) and the intake of animal-source foods (meat, chicken meat, fish and eggs) (Chapter 5) in South Africa adhere to the principles set out in the SA FBDG. These two food groups were selected as case studies, in view of the dominance of starch-based staple foods and animal-source foods in the food expenditure patterns of South African consumers (as described in Chapter 2). Chapter 6 supplements the content of Chapter 5 by focusing on a consumer perspective of the South African red meat classification system, in view of the association between red meat classification and red meat prices (explained in more detail in the introduction section of Chapter 6). Chapter 6 of this thesis was published in a peer-reviewed journal in 2015 (Vermeulen et al., 2015). A summary of the study, as well as recommendations and concluding remarks are discussed in Chapter 7.

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CHAPTER 2: FOOD INTAKE AND THE DIVERSE SOCIO-DEMOGRAPHIC CONSUMER LANDSCAPE IN SOUTH AFRICA

Before presenting the balanced food basket approach to monitor food affordability in South Africa (Chapter 3), this chapter introduces the socio-economically diverse South African consumer landscape. The purpose of this chapter is to present a socio-economically disaggregated view of the South African consumer landscape, including typical socio-demographic characteristics of consumer sub-segments and an introduction to the food expenditure patterns of major consumer sub-segments in South Africa.

2.1 THE DYNAMIC SOUTH AFRICAN CONSUMER LANDSCAPE

In this section, the socio-demographic dynamics of the South African consumer landscape is discussed, with a specific focus on population size and growth, cultural diversity, income inequality, household income and factors indicating pressure on consumer ability to cope financially.

2.1.1 Population size, age structure and geographical distribution

Over the 15-year period from 2003 to 2018, the South African population increased by approximately 25% to 57.7 million people (based on Statistics South Africa (Stats SA) population estimates), with the year-on-year growth rate increasing from 1.1% for 2003/2004 to 1.56% for 2017/2018 (Stats SA, 2018a; Stats SA, 2018b).

South Africa has a young age structure. In 2018, it was estimated that 46.4% of the population was younger than 25 years (Figure 2.1). In 2018, approximately 48.0% of the population was part of the active working-age population (25 to 64 years old). Over the last decade, this group had grown by 6.89 million individuals (or about 33%) – compared to the 18.6% overall population growth for the ten year period. In 2018, people of retirement-age (65 years and older) represented 5.6% of the population (Stats SA, 2018a; Stats SA, 2008). In December 2018, the South African Social Security Agency (SASSA) reported that old age grant recipients amounted to 3.5 million elderly people (SASSA, 2018), thus including approximately 77% of the South African population aged 64 years and older – once again implying a significant fiscal commitment for the government (as in the case of child grant payments).

In South Africa, the relatively young population age structure contributes to pressure on household income, as younger individuals below working-age[22] have to be cared for within household structures. It also puts additional pressure on government resources, i.e. if child support grants are used as an example: From February 2013 to February 2018 the number of child support grant beneficiaries increased by 8.3% to 12.3 million (SASSA, 2013; SASSA, 2018). Thus, in 2018 approximately two thirds of the population younger than 18 years received child grants in 2018, indicating significant pressure on the country's fiscal resources.

[22] Stats SA defines the 'working-age population' as individuals aged from 15 years to 64 years (Stats SA, 2019).

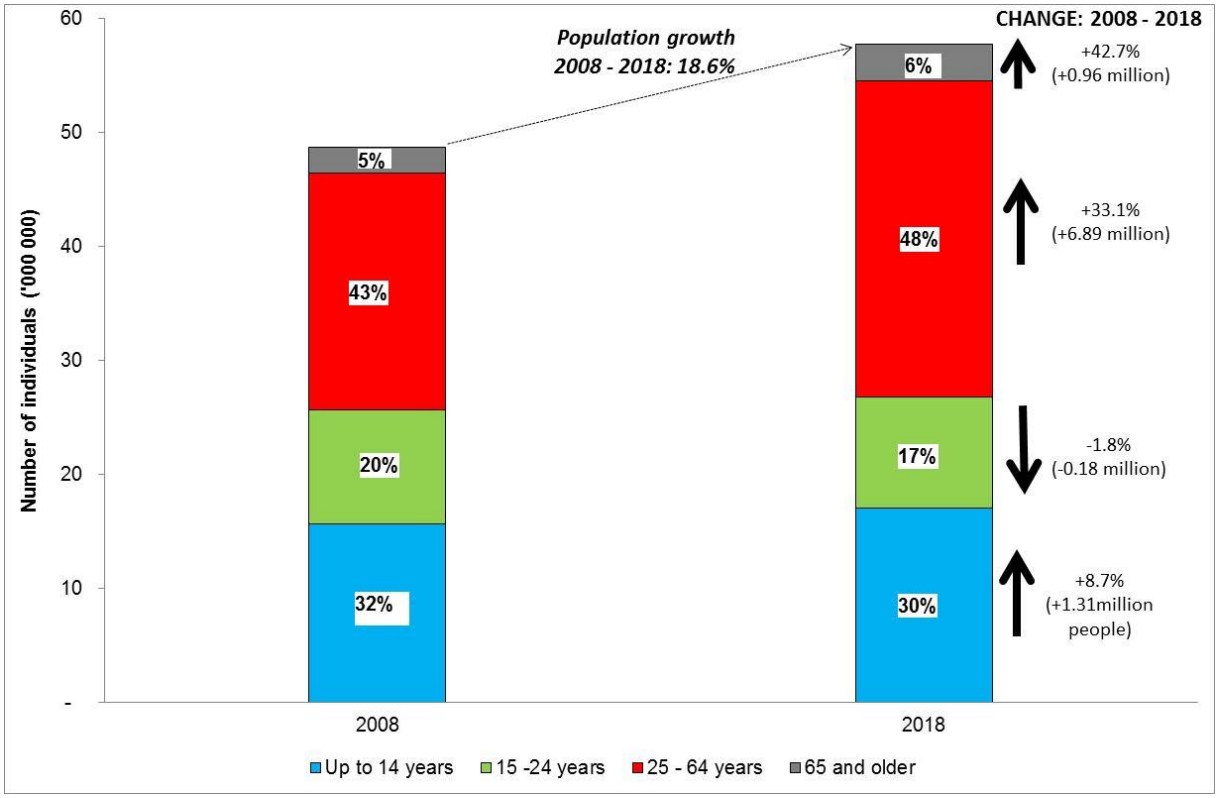

Figure 2.1: Comparing the population age structure in South Africa in 2008 and 2018 using Stats SA Mid-year Population Estimates, 2008 and 2018 (Stats SA 2008, 2018)

The young age structure causes pressure on the country's educational resources – of critical importance to ensure a well-educated future generation. According to the Stats SA General Household Survey (GHS) 2018 the proportion of school attending children aged 5 years and older who did not pay tuition fees, increased significantly from 22% in 2007 to 66% in 2017, which emphasises the impact of a young age structure on the fiscal resources of the country. Unemployment can potentially be negatively affected when the large youth population reaches working-age with limited job opportunities available in the economy.

The South African population is gradually getting older despite the young population structure, with the median population age increasing from 23 years in 2001 to 25 years in 2011 (Stats SA Census 2001 and 2011 (Stats SA, 2015)), and to between 25 and 26 years in 2017 (Stats SA GHS 2017 (Stats SA, 2018c)). The 2018 Stats SA mid-year population estimates also confirm that the population is gradually ageing, with the percentage of the total population aged 25 years and older increasing from 47.4% in 2008 to 53.6% in 2018.

In 2018 the Limpopo and Eastern Cape provinces had the largest proportions of individuals in the age bracket up to 14 years (i.e. approximately a third of the population in these provinces was younger than 15 years of age), while the largest proportion of individuals aged 60 years and older resided in the Eastern Cape and the Northern Cape (Stats SA,

2018a) - causing pressure on the social support resources needed in these particular provinces in terms of child support grants and old age pensions[23].

From a provincial perspective in 2018, the largest proportions of the South African population resided in Gauteng (approximately 25.5%), KwaZulu-Natal (19.7%) and the Western Cape (11.5%), while the Northern Cape was home to the smallest proportion of the population (2.1%) (Stats SA, 2018a). Over the last 15 years Gauteng and the Western Cape (with the largest urban centres (Stats SA Census 2011)), had the most significant population growth (Stats SA, 2018a). Migration between provinces, as well as international migration, affects the provincial numbers and structure in the country (Stats SA, 2018a).

The urban proportion of the South African population has increased from 58% in 2001 (Stats SA Census 2001) to about 70% in 2018, according to the Establishment Survey (ES) March 2018 release published by the Broadcast Research Council of South Africa (BRC) (BRC, 2018). Household income in South Africa varies according to the living location of households (i.e. rural or urban), as is evident from the Stats SA Living Conditions Survey (LCS) 2014/2015 (Stats SA, 2017a) indicating that households residing in urban formal areas had the highest income per household member, while the income per household was 49% lower for households in rural formal areas and 70% to 77% lower for households residing in urban informal and traditional areas, respectively.

Globally, urbanisation has been documented as an important driver of the nutrition transition, often characterised by the increased consumption of saturated fats, sugars, refined foods and energy-dense high-fat take-away foods, as well as reduced intakes of fibre-rich foods (Ghattas, 2014). In 2014/2014, the out-of-home food expenditure in urban formal areas was about four times higher and even approximately 60% higher in urban informal areas compared to traditional rural areas (Stats SA, 2017a).

2.1.2 Household size

Over the last two decades, from 1996 (Census 1996) to 2016 / 2017 (Stats SA GHS), the average household size in South Africa has declined by approximately 1 person from 4.5 to 3.5 persons in 2016 / 2017 (Stats SA GHS). Wittenberg and co-workers (2017) confirmed the reduction in the average household size in South Africa and attributed it to rapid household formation and shifts in location.

2.1.3 Cultural diversity

The South African population is characterised by cultural diversity. Stats SA distinguishes between four main population groups: 'Black Africans' (approximately 80.9% in 2018), 'Coloureds' (8.8%), 'Whites' (7.8%) and 'Indians/Asians' (2.5%) (Stats SA, 2018a). The dominant ethnic groups in South Africa are Zulu, Xhosa, Basotho (South Sotho), Bapedi (North Sotho), Venda, Tswana, Tsonga, Swazi and Ndebele. The main languages spoken at home (according to the ES October 2017 release, published by the BRC), were Zulu (31%),

[23] An individual qualifies for an old-age pension if the following requirements are met: South African citizen, permanent resident or refugee; a permanent resident of South Africa; aged 60 years or older; not living in a state institution; and not receiving payments from another social grant (Western Cape Government, 2018b).

English (29%), Xhosa (18%), Afrikaans (18%), Sesotho (14%), Sepedi (13%), Setswana (12%), Tsonga (5%), Swati (3%), Ndebele (2%) and Venda (2%) (BRC, 2017a).

2.1.4 Income inequality

Socio-economic diversity is another prominent feature of the South African population. The country is classified as an upper middle income country by the World Bank (The World Bank, 2018a), with a Gross National Income per capita of US$5 480 in 2016, falling in the defined range for upper middle income countries of between US$3,956 and US$12,235 (The World Bank, 2018b). The South African economy is characterised by a high inequality rate as evident from the Gini coefficient of 0.64 (from an expenditure perspective) and 0.68 (from a total income perspective) (The World Bank, 2018c). Since 2006, the Gini coefficient for South Africa has been improving with a coefficient of 0.67 for per capita expenditure and 0.72 for per capita income calculated for 2015 (Stats SA, 2017c). The severe inequality in South Africa is further emphasised by household-level expenditure data from the most recent Stats SA LCS 2014/2015 (Stats SA, 2017a) indicating that the poorest fifth of the South African population is responsible for only about 3% of total expenditure and 7% of total food expenditure, while the wealthiest fifth of the population is responsible for 65% of total expenditure and 36% of total food expenditure in South Africa (Figure 2.2).

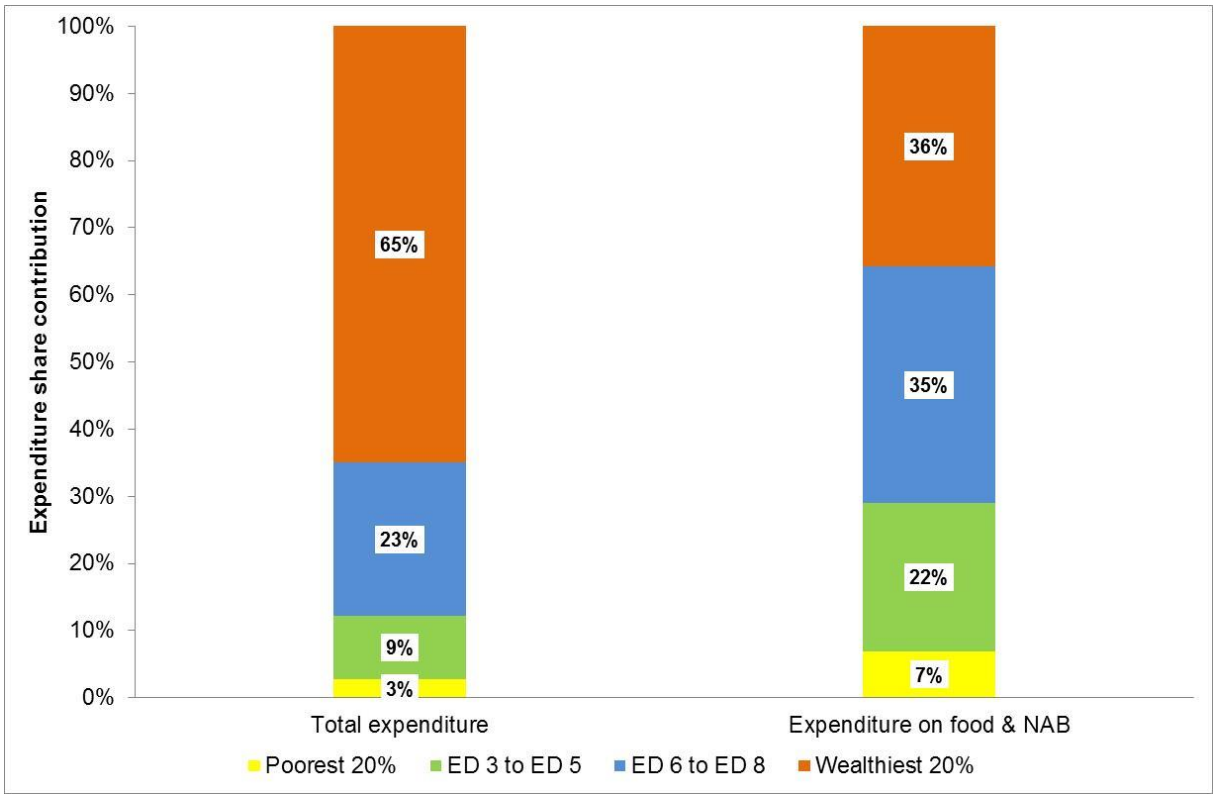

Figure 2.2: Estimated contribution of selected socio-economic sub-groups to total household expenditure and total expenditure on food and non-alcoholic beverages according to the Stats SA LCS 2014/2015 (Stats SA, 2017a)

Combined with income inequality, food security is also a concern in the South African context, with approximately 26% of the population suffering from severe food insecurity in 2012 (Steyn et al., 2015) (improving from 62% in 1999 (National Food Consumption Survey

1999)). A detailed discussion on food security in South Africa was discussed in Chapter 1 of the thesis.

2.1.5 Household income dynamics over time

According to the South African Reserve Bank (2019) the disposable income of households per capita (where disposable income refers to the amount of money available to a household after accounting for income taxes), increased by 82.9% in nominal terms and 7.7% in real terms (after accounting for inflation) over the last 10 years (from 2008 to 2018) (see Figure 2.3). The general real increase in household income is supported by data from the two most recent household-level expenditure studies conducted by Stats SA LCS 2014/2015 (Stats SA, 2017a) and the 2010/2011 Income and Expenditure Survey (IES) (Stats SA, 2012)) indicating a positive real growth rate in terms of total household expenditure from 2010/2011 to 2014/2015.

Following real increases of 2.5% in 2009/2010 and 3.4% in 2010/2011, household disposable income has been under pressure in recent years with real growth rates varying between +1.8% and negative growth of 0.9% (see Figure 2.3). Most recently, from 2017 to 2018, the per capita disposable income of households increased by 4.2% in nominal terms, implying an increase of only 0.1% in real terms - thus barely keeping up with inflation.

Establishment Survey data for 2016 and 2018 indicate that the average household income in South Africa increased nominally by approximately 13.4% (BRC, 2019) (thus a 4.5% real increase) - compared to a slightly lower nominal increase of 10.8% (1.9% real increase) observed in the Reserve Bank personal disposable income per capita data between 2016 and 2018.

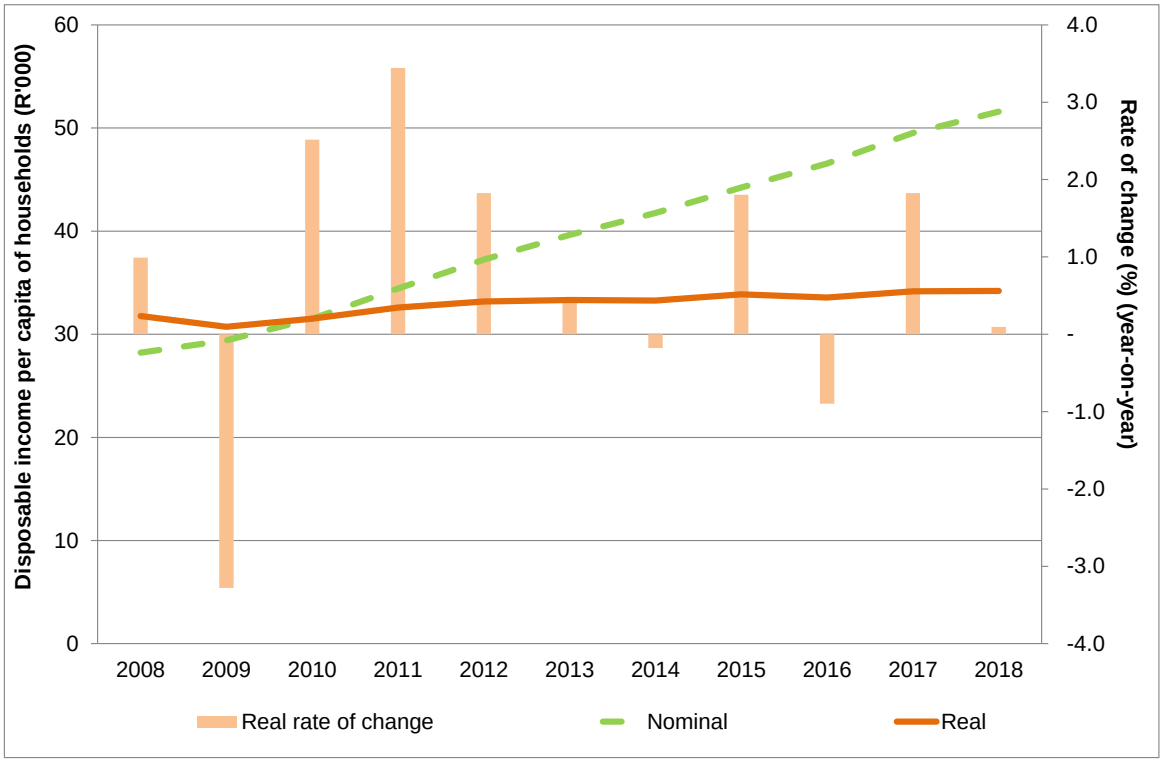

Figure 2.3: Disposable income per capita of household in South Africa from 2008 to 2018 (South African Reserve Bank, 2019)

2.1.6 Further indications of pressure on household income in South Africa

Despite the observed positive growth in real household income as discussed above, several factors revealed the financial pressure experienced by South African consumers in recent years, such as low consumer confidence reported by the First National Bank / Bureau for Economic Research (FNB BER) (BER, 2018), rising unemployment (Stats SA, 2019) and increasing consumer debt (National Credit Regulator, 2018).

The FNB BER Consumer Confidence Index (CCI) gauges consumer confidence in South Africa based on the expected performance of the economy, the expected financial position of households and the perceived appropriateness of purchasing durable goods at the time of the survey (BER, 2018). When the period from the first quarter of 2015 to the first quarter of 2017, was considered, the FNB/BER CCI had negative values for 2015 to 2017 (with an average negative index value of 8.5 over the three years), but recovered to an index value of +26 in the first quarter of 2018 – with consumer optimist linked to recent political developments (the recent change in the country's leadership) (Figure 2.4).

At the end of 2018, the FNB/BER CCI was at a level of +7 for the third and fourth quarters of 2018. Thus, in the latter part of 2018 consumers were "fairly optimistic with respect to the outlook for the South African economy and their own household finances" (BER, 2018), but the BER stated that "household income and credit growth also need to accelerate". The question remains whether consumer confidence in the economy will continue at the positive levels observed for 2018, or once again decrease to lower positive or negative levels in the near future.

Unemployment trends in this country also suggest that some South African consumers potentially experience financial pressure. After increasing from a low point of 21.5% in the fourth quarter of 2008 to a high point of 27.7% in the first three quarters of 2017, the official unemployment rate in South Africa (as reported by Stats SA in the Quarterly Labour Force Survey) (Stats SA, 2019) (Figure 2.5), decreased slightly to 27.1% in the last quarter of 2018 (while the number of unemployed persons increased by 259 000 individuals from the last quarter of 2017 to the last quarter of 2018).

In the last quarter of 2018, from a provincial perspective, unemployment was the lowest in the Western Cape (19.3% unemployment rate), Northern Cape (25.0%) and KwaZulu-Natal (25.6%). Eastern Cape (36.1%), Free State (32.9%) and Mpumalanga (32.0%) had the highest unemployment rates (Stats SA, 2019). The low unemployment rate reported for the Limpopo province (16.5% in the fourth quarter of 2018) seems unlikely, as the Limpopo province had the lowest average household expenditure levels among all the provinces in the Stats SA LCS 2014/2015. The migration of working-age population to cities, with the remaining people in the province mostly those younger than 16 and older than 65 years behind, could attribute to the low unemployment rate reported for the Limpopo province.

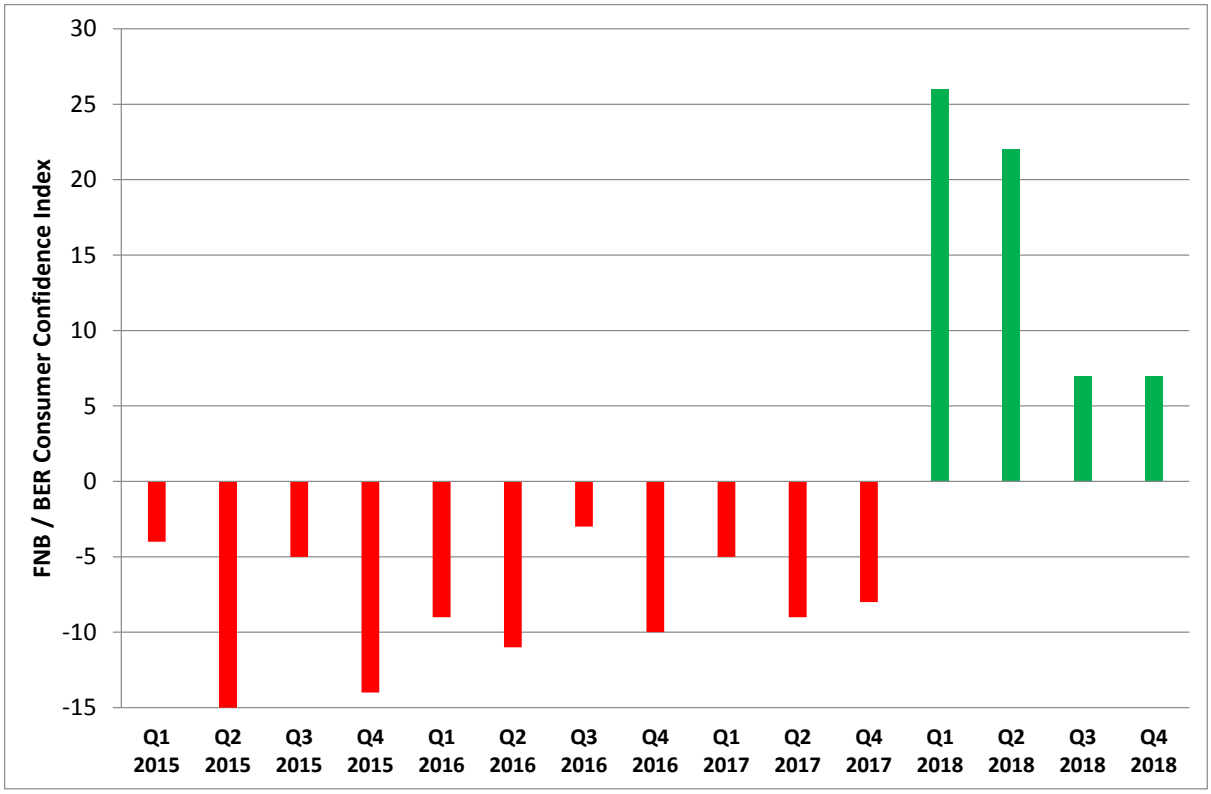

Figure 2.4: The FNB/BER Consumer Confidence Index from the first quarter of 2015 to the fourth quarter of 2018 *(Q=Quarter)* (BER, 2018)

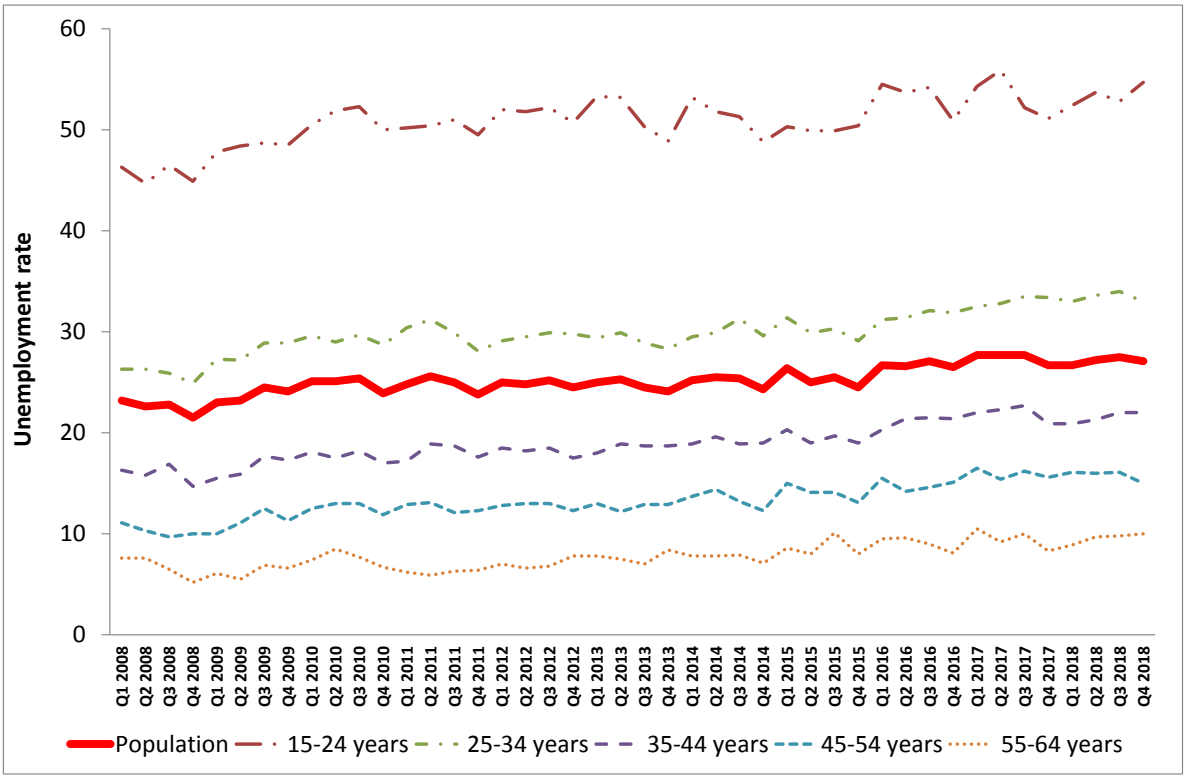

Figure 2.5: The unemployment rate in South Africa for the total population and different age groups from the first quarter of 2008 (Q1 2008) to the fourth quarter of 2018 (Stats SA, 2019)

Among different age categories the most significant unemployment rate was among individuals aged 15[24] to 24 years (54.7%) (Stats SA, 2019), followed by 25 to 34 years (33.0%), 35 to 44 years (22.0%) (Figure 2.5). Lower unemployment rates were observed among older age categories (45 to 54 years – 15.0% and 55 to 64 years – 10.0%).

Comparing the unemployment rates observed in the fourth quarter (Q4) of 2008 and Q4 of 2018, the most significant increases occurred in the age categories 55 to 64 years (+92.3%) and 35 to 54 years (increasing by approximately 50%). During this period the smallest increase in unemployment was observed for the 15 to 24 years age bracket.

Rising consumer debt is an additional indication of the financial pressure experienced by South African consumers. From early 2009, to the third quarter of 2018 (National Credit Regulator, 2018), the value of the gross debtor book enlarged by 59.4% to R1 818 billion. In the gross debtor book the total number of accounts increased by 8.2% during this period. In the fourth third of 2018, credit granted (mortgages, secured credit, credit facilities, unsecured credit, short-term credit and developmental credit) to consumers with income levels of less than R5500 per month represented approximately 4% of total credit granted in value terms, but 32% when we consider total number of credit facilities granted – with the most significant contributions originating from short-term credit and credit facilities.

In relation to the high level of inequality and consumer diversity in South Africa, as presented in this chapter, a disaggregated view of the South African consumer spectrum is critically important for understanding consumer food dynamics.

2.2 THE SOCIO-ECONOMIC SPECTRUM IN SOUTH AFRICA: SOCIO-DEMOGRAPHIC CHARACTERISTICS

The purpose of this section is to present background information on the socio-economically disaggregated South African consumer landscape. A combination of two segmentation approaches was used in this section. The 'expenditure decile' (ED) approach as used by Stats SA in household income and expenditure studies such as LCS 2014/2015 (Stats SA, 2017a), where every ED contains 10% of the total number of households in South Africa. The Stats SA data were supplemented with characteristics of the Socio-economic Measurement (SEM^{TM}) Scoring System yielding the SEM^{TM} segmentation tool[25] (BRC, 2017a). The latter

[24] Stats SA defines the working-age of the population by ages 15 to 64 years (Stats SA, 2019). Even though many children aged 15 to approximately18 years are still attending school, the South African Schools Act of 1996 states that school attendance is compulsory from the age of six to the age of 15 (or the completion of grade 9). Thus, some individuals can potentially enter the workforce at age 15.

[25] The SEM^{TM} segmentation tool is based on 14 variables obtained from the Establishment Survey (ES) (BRC, 2017a). The SEM continuum has ten groups from SEM 1 (low socio-economic living) to SEM 10 (high socio-economic living) and replaced the Living Standard Measure segmentation approach (South African Audience Research Foundation) which was terminated in 2015 (Langschmidt, 2017). The ES involves a nationally representative sample of people aged 15 years and older (n=25 000 per annum), which is targeted in the ES with two survey cycles (January to June and July to December). Interviewing is conducted in all area types and provinces over 49 weeks of the year. The ES is partly aimed at providing relevant data to construct the SEM socio-economic measure (TNS, 2017a). The 14 variables used to construct the SEM classification are: live near post office and police station, house characteristics (roof type, floor type, number of sleeping rooms, water source, toilet type, built-in kitchen sink), home security service, equipment in household (motor car, free standing deep freeze, microwave oven, floor polisher or vacuum cleaner and washing machine).

was the second segmentation approach that was used. Figure 2.6 and Table 2.1 present overview characteristics of four main lifestyle levels in the South African socio-economic spectrum, illustrating that rising socio-economic class is generally associated with higher household income levels, increasing urbanisation, higher education levels and lower unemployment.

In 2018, marginalised consumers (SEM^{TM} segments 1 to 3) represented approximately 30% of the adults (aged 15 years and older) (Establishment Survey (ES), 2018), which roughly overlapped with EDs 1 to 3 as defined by Stats SA in household-level income and expenditure studies (where each ED represents 10% of households in South Africa). These consumers typically have very limited access to amenities such as a built-in kitchen sink (14% or less), hot running water (1% or less) and a flush toilet (10% or less), but they do have a strong rural component (up to 75%) and a self-reported unemployment rate of approximately 30% (BRC, 2017b). This segment tends to reside in the KwaZulu-Natal, Eastern Cape, Limpopo and Gauteng provinces of South Africa.

In 2018, lower middle-income consumers (SEM^{TM} segments 3 to 5), represented approximately 30% of the adults (aged 15 years and older), which roughly overlapped with EDs 4 to 6 as defined by Stats SA. In 2018, upper middle-income consumers (SEM^{TM} segments 6 to 7), represented approximately 20% of the adults (aged 15 years and older), which roughly overlapped with EDs 7to 8 as defined by Stats SA. The middle-income segments typically have improved access to amenities (e.g. built-in kitchen sink (approximately 75%), hot running water (27%) and a flush toilet (69%)). They also have a strong urban component (85% on average). In 2016, the self-reported unemployment of these segments was in the range of 25% for lower middle-income consumers and 15% for upper middle-income consumers (BRC, 2017b). These segments tend to reside in the Gauteng, KwaZulu-Natal, Eastern Cape, Limpopo and Western Cape provinces of South Africa.

In 2018, affluent consumers (SEM^{TM} segments 8 to 10) represented the most affluent 20% of adults roughly overlapping with EDs 9 to 10 as defined by Stats SA. Most consumers in this group live in urban areas with access to the basic amenities mentioned above. In 2016, the self-reported unemployment rate for affluent consumers ranged between 9% and 3% in 2016 (BRC, 2017b). Consumers in this segment tend to reside in Gauteng, Western Cape and KwaZulu-Natal.

The household income levels reported for the SEM^{TM} segments differ from the Stats SA values, i.e. they are generally higher for lower income brackets, while they are lower for higher income brackets (see Table 2.1). Based on household income levels reported in the Stats SA LCS 2014/2015 adjusted by growth in disposable income of households over time) the three least affluent EDs in South Africa had an income of approximately R2 000, R3 000 and R3 900 per month respectively, increasing to approximately R61 100 for the most affluent 10% of households. It should be kept in mind that the primary objective of the SEM^{TM} segments is to present a predictor of media and purchasing behaviour in South Africa.

Upward social class mobility has been a key feature of the South African consumer landscape for many years. Social class mobility refers to the migration (in an upward or downward direction) of individuals or social groups (e.g. family units, households) between different social layers in a particular society (Simandan, 2018; Heckman & Mosso, 2014).

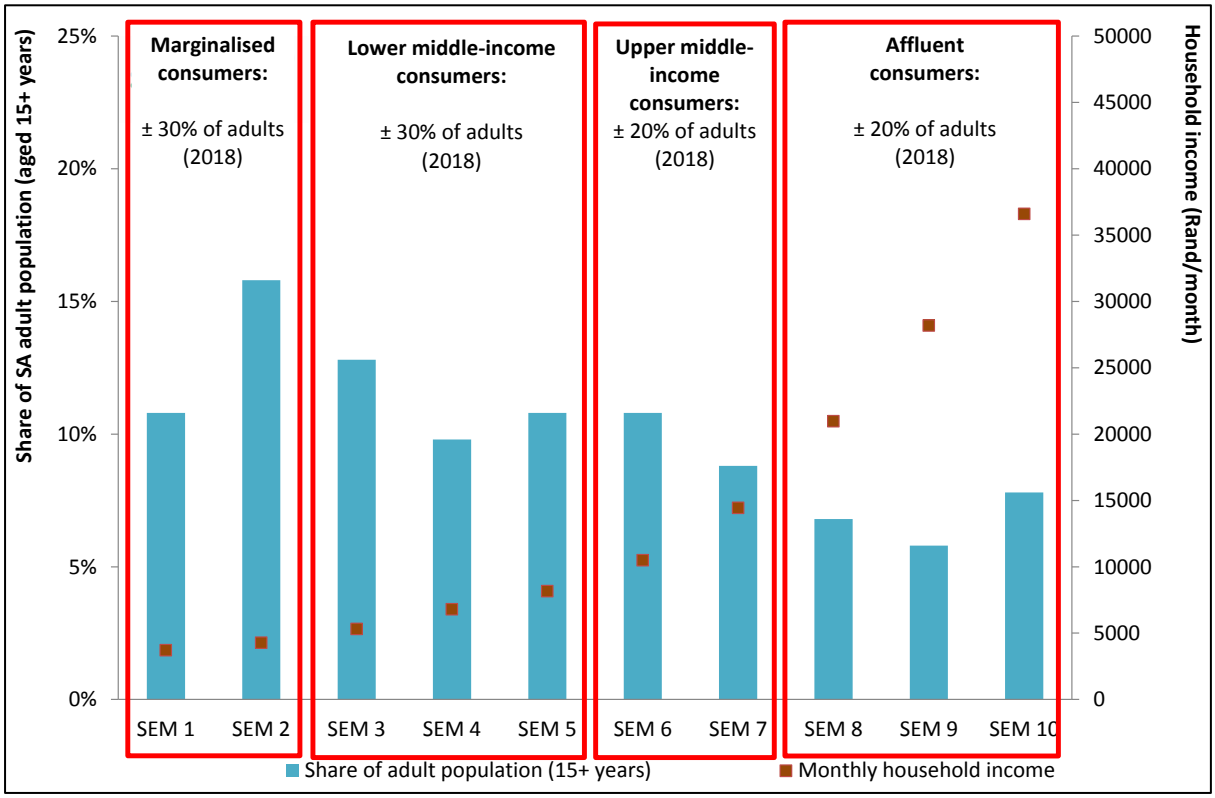

Figure 2.6: An overview of the four main socio-economic groups in South Africa based on the SEM™ segments in 2018 (ES 2018 (BRC, 2019))

It is evident from historical data for 2005 to 2015 found in the SAARF (South African Audience Research Foundation) LSM (Living Standards Measure) classification[26], that consumers tend to move to higher socio-economic groups[27] (see Figure 2.7)[28]:

- LSM segments 1 to 3 (lower end of the socio-economic spectrum) represented 32% of the adult population in 2005 and decreased by 91% to 10% in 2015;
- LSM segments 4 to 6 (lower-middle section of the socio-economic spectrum) represented 43% of the adult population in 2005 and increased by 22% to 52% in 2015;
- LSM segments 7 to 8 (upper-middle section of the socio-economic spectrum) represented 13% of the adult population in 2005 and increased by 57% to 22% in 2015;
- LSM segments 9 to 10 (upper end of the socio-economic spectrum) represented 12% of the adult population in 2005 and increased by 30% to 16% in 2015;

[26] The LSM socio-economic segments approach was developed by the South African Audience Research Foundation (SAARF), based on consumer access to amenities durable items, the location of the household and dwelling type (www.saarf.co.za).

[27] The lack of LSM data from 2016 onwards inhibits calculation of further class mobility rates.

[28] Future research could focus on the factors driving class mobility in the South African context, also investigating the potential role of unsustainable credit to low-income households.

- For the ten year period presented in Figure 2.7, the most significant upward class mobility occurred in the middle class segments, yielding a South African middle class of noteworthy size, recognised as a major source of purchasing power in the socio-economic spectrum. As is also evident from Figure 2.7, despite continuous upward class mobility for the particular ten year period, the rate of class mobility slowed down in the years before 2015.

In the next section of this chapter, it will be shown that the food expenditure patterns of households evolve across the socio-economic spectrum, thus emphasising the importance of class mobility as one of the factors affecting the dynamic food complex in South Africa.

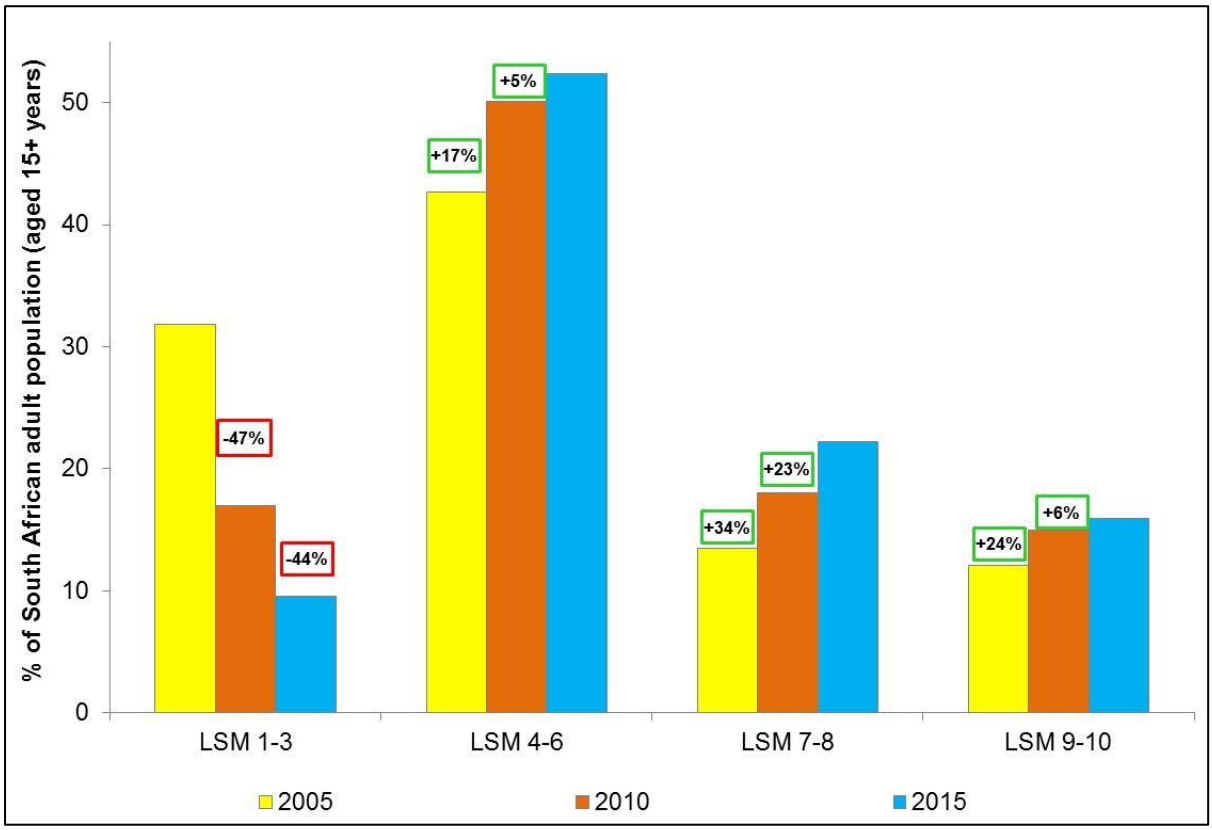

Figure 2.7: An illustration of class mobility in South Africa from 2005 to 2015 (SAARF, 2005; SAARF, 2010; SAARF, 2015)

Table 2.1: Summary of characteristics of the main socio-economic sub-groups in South Africa (Sources: ES October 2017 release & March 2018 release; Stats SA IES 2010/2011; Stats SA LCS 2014/2015)

Variables:		**Marginalised consumer segment:**		**Lower middle-income consumer segment:**			**Upper middle-income consumer segment:**		**Affluent consumer segment:**		
Population proportion	**Stats SA ED**[1,2]	ED 1 to ED 3 (30%)		ED 4 to ED 6 (30%)			ED 7 to ED 8 (20%)		ED 9 to ED 10 (20%)		
	SEM segments 2018[3]	SEM 1 & SEM 2 (27%)		SEM 3 to SEM 5 (33%)			SEM 6 to SEM 7 (19%)		SEM 8 to SEM 10 (21%)		
Population size (SEMs) 2018[3]		10.7 million		13.4 million			7.9 million		8.2 million		
Average monthly household income	**SEMs** (ES October 2017 release)[4]	SEM 1: R3404 SEM 2: R4 275		SEM 3: R5 210 SEM 4: R6 434 SEM 5: R7 442			SEM 6: R9 432 SEM 7: R12 914		SEM 8: R18464 SEM 9: R26 683 SEM 10: R34 574		
	Stats SA EDs[2] (Stats SA LCS 2014/15)	ED 1: R1 682 ED 2: R2 454 ED 3: R3 151		ED 4: R3 913 ED 5: R4 689 ED 6: R6 115			ED 7: R8 242 ED 8: R13 310		ED 9: R22 115 ED 10: R49 472		
Residential location	**Rural / Urban & metro**[5] (ES March 2018 release)	SEM 1: 75%/25% SEM 2: 60%/40%		SEM 3: 48%/52% SEM 4: 24%/76% SEM 5: 13%/87%			SEM 6: 8%/92% SEM 7: 5%/95%		SEM 8: 2%/98% SEM 9: 1%/99% SEM 10: 1%/99%		
Education level (SEMs)[5] (ES March 2018 release)		***SEM 1***	***SEM 2***	***SEM 3***	***SEM 4***	***SEM 5***	***SEM 6***	***SEM 7***	***SEM 8***	***SEM 9***	***SEM 10***
	Primary school	13%	12%	6%	6%	3%	3%	3%	2%	<1%	<1%
	High school	54%	47%	41%	38%	36%	33%	27%	21%	13%	12%
	Matric	31%	38%	48%	49%	50%	51%	49%	41%	40%	42%
	Post-matric	2%	3%	5%	7%	10%	13%	22%	35%	47%	46%
Work status[5] (ES March 2018 release)	**Unemployed proportion**	32%	29%	30%	24%	20%	17%	15%	8%	5%	2%
Dominant provincial location[5, 6]**:** (ES March 2018 release)		KZN, EC, LP, GP		GP, KZN, EC, WC, LP			GP, WC, KZN		GP, WC, KZN		

[1] *Proportion of total households. Each ED represents 10% of the households in South Africa.*
[2] *Source: Stats SA LCS 2014/2015* (Stats SA, 2017a) *(most recent available source with particular variable).*
[3] *Proportion of population aged 15 years and older. Source: ES 2018 (March 2019 release)* (BRC, 2019) *(most recent available source with particular variable).*
[4] *Source: ES October 2017 release* (BRC, 2017a) *(most recent available source with particular variable).*
[5] *Source: ES March 2018 release* (BRC, 2018) *(most recent available source with particular variable).*
[6] *KZN=KwaZulu-Natal; EC=Eastern Cape; LP=Limpopo, GP=Gauteng; WC=Western Cape*

2.3 EXPLORING FOOD EXPENDITURE PATTERNS ACROSS THE SOCIO-ECONOMIC SPECTRUM IN SOUTH AFRICA

In order to explore food expenditure patterns across the socio-economic spectrum, this section addresses a number of key aspects:

- Proportion of total expenditure allocation to food;
- Proportion contribution of various food groups to total food expenditure;
- Dominant food items in the various food groups (from an expenditure perspective).

As this section deals with food expenditure on various food groups, it is important to specify an appropriate food group classification approach. The Food-Based Dietary Guidelines for South Africa (SA FBDG) (Vorster et al., 2013) consists of 11 guidelines (as discussed in Chapter 1), involving seven food groups (Vorster et al., 2013): starch-rich foods; vegetables and fruits; legumes; chicken, fish, lean meat and eggs; milk, maas and yoghurt; fats and oils; and water. Even though sugar and foods and drinks high in sugar, are not included as an official food group in the SA FBDG, a 'caution' guideline on the intake of these foods was also included among the 11 guidelines. To present an overview of household-level food expenditure from a food-group perspective, the following food categories, based on the SA FBDG are considered in this chapter: starch-rich foods, fresh produce (fruit and vegetables), legumes, meat and eggs, liquid dairy (milk, maas, yoghurt), fats / oils, and sugar-rich foods. In recent years the dietary intake of sugar has been receiving increased attention in the context of rising overweight and obesity levels in South Africa (Vorster et al., 2014; Tugendhaft et al., 2016; Myers et al., 2017). A tax on sugar-sweetened beverages also came into effect on 1 April 2018. Consequently, a decision was made to also include sugar and foods high in sugar (e.g. confectionery, jam, sugar-sweetened beverages) in the household-level expenditure analysis in this section.

In the absence of recent nationally representative food intake data across the socio-economic spectrum (Mchiza et al., 2015) this section is based on nationally representative household-level food expenditure data. Data were obtained from the most recent household-level expenditure study conducted by Stats SA –the LCS 2014/2015 (Stats SA, 2017a). The Stats SA household-level food expenditure data were reworked to facilitate better overlap between the 'food expenditure groups' applied by Stats SA and the food groups of the SA FBDG.

2.3.1 Proportion of total expenditure allocated to food

According to household-level expenditure data from LCS 2014/2015 (Stats SA, 2017a) the proportion of households' total expenditure allocated to food purchases, changes significantly across the socio-economic spectrum, ranging from approximately 33% for marginalised consumers to 6% for the wealthiest 10% of households in South Africa (Figure 2.8). According to the United States Department of Agriculture Economic Research Service (USDA ERS) (2011) food accounts for approximately 50% of household budgets in low-income countries and approximate 30% of household budgets in middle-income countries.

Thus the food expenditure proportion of lower-income households in South Africa is closer to the value reported for middle-income countries than for low-income countries.

Lower-income households with higher food expenditure proportions are generally more vulnerable to rising food prices (McLachlan & Landman, 2013; Schönfeldt et al., 2010). The vulnerability of lower-income households is further evident from Figure 2.8 illustrating that the monthly per capita food expenditure[29] for half of the population fell below the 2014/2015 Stats SA Food Poverty Line.

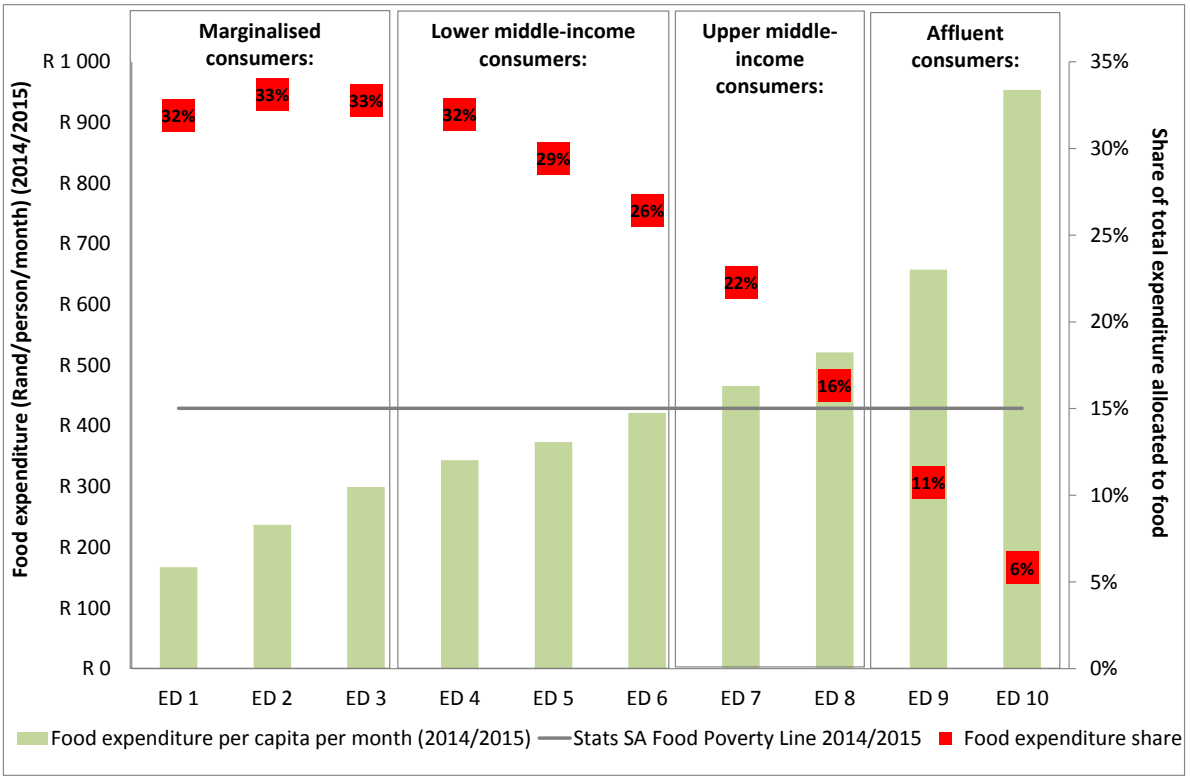

Figure 2.8: Proportion of total expenditure allocated to food and estimated food expenditure per capita per month according to Stats SA IES 2014/2015 (Stats SA, 2017a)

2.3.2 Contribution of various food groups to total food expenditure

According to data extracted from Stats SA LCS 2014/2015 (Stats SA, 2017a), the food expenditure (excluding out-of-home food consumption) of marginalised and lower middle-income consumers was dominated by starch-rich foods (in first position) and animal-source food (red meat, chicken, fish and eggs), followed by sugar-rich foods, fresh produce, liquid dairy and fats / oils (see Table 2.2). Among upper middle-income and affluent consumers, animal-source foods moved into the dominant position from a food expenditure perspective, followed by starch-rich foods (Table 2.2). Compared to food budget shares for

[29] The monthly food expenditure per capita was estimated by dividing total food expenditure per ED by the average household size per ED according to Stats SA LCS 2014/2105. Food expenditure figures were adjusted for under-reporting by taking into account that according to Stats SA the food expenditure data reported in Stats SA LCS 2014/2105 captured ±71% of food expenditure captured in the national accounts (Stats SA, 2017a).

low-, middle- and high-income countries reported by the USDA ERS (2011)[30], the South African budget shares allocated to starch-rich foods and meat/fish were higher, while the budget shares allocated to dairy and fruit / vegetables were lower than the typical values reported by USDA ERS (2011). This could be partly due to unique South African eating patterns, even though food price movements during 2014/2015 could also have contributed to these observations. As regards to fruit and vegetables, the 2012 South African National Health and Nutrition Examination Survey (SANHANES-1) (Shisana et al, 2014) concluded that South Africans are eating too little fruit and vegetables.

Sugar and sugar-rich foods contributed between 9.0% and 9.5% to the total food expenditure of the various consumer segments, representing the third largest expenditure group for marginalised and middle-income consumers. As mentioned earlier in this chapter, the dietary intake of sugar has been receiving increased attention in the context of rising overweight and obesity levels in South Africa (Vorster et al., 2014; Tugendhaft et al., 2016; Myers et al., 2017). This has led to a tax on sugar-sweetened beverages that came into effect on 1 April 2018.

A movement towards higher affluence levels was generally associated with a decreasing contribution towards total food expenditure for starch-rich foods, fats / oils and legumes. The expenditure contribution of animal-source foods, liquid dairy and fresh produce generally increased with affluence level (Table 2.2), to be in line with global observations (FAO, 2018). Over the last three decades the consumption of animal-source foods increased by more than three times in low- and middle-income countries with the major driving forces including population growth, urbanisation, income gains and globalisation (FAO, 2018).

When we consider the actual estimated household-level food expenditure on food groups (from Stats SA LCS 2014/2015) across the socio-economic spectrum (Figure 2.9), it is evident that rising affluence levels were associated with increased household-level expenditure on animal-source foods, fresh produce, liquid dairy, sugar-rich foods and fats / oils. The largest expenditure gaps between marginalised consumers and affluent consumers were observed for the animal-source foods, fresh produce and dairy which are all critical food categories contributing to dietary diversity. Household-level expenditure on starch-rich foods increased from marginalised- to upper middle-income consumers, but decreased somewhat for affluent consumers.

Some of these movements are typically associated with the nutrition transition characterised by more Western-orientated diets containing amongst other things relatively less staple foods, and more animal-source foods, fats and sugar (Steyn, 2006; Shisana et al, 2014; Bourne et al., 2002; Kruger et al., 2005; Delgado, 2003; Du et al., 2004; Popkin & Du, 2003). Factors such as economic growth, rising per capita income and urbanisation have been shown to result in the increased consumption of animal-source foods (Delgado et al., 1999; Pica-Ciamarra & Otte, 2009).

[30] USDA ERS (2011) food budget shares for low-, middle- and high-income countries respectively: Cereals: 26.4%, 15.3% and 10.9%, Meat & fish: 22.3%, 25.5% and 20.1%; Dairy: 8.8%, 12.2% and 8.3%; Fruit & vegetables: 20.5%, 17.8% and 12.4%.

Table 2.2: Expenditure contributions of food groups to total food expenditure[31] for the main consumer socio-economic sub-segments (Stats SA LCS 2014/2015 (Stats SA, 2017a))

	Contribution of food group to total food expenditure of consumer segment (Stats SA LCS 2014/2015):			
	Margina-lised:	**Lower middle-income:**	**Upper middle-income:**	**Affluent:**
Food group 1: Starch-rich foods	37.6%	32.2%	26.5%	17.8%
Food group 2: Meat, chicken, fish, eggs	26.7%	30.5%	35.1%	39.1%
Food group 3: Milk, maas, yoghurt	5.7%	6.1%	6.9%	7.7%
Food group 4: Fats, oils	4.8%	4.4%	4.2%	3.7%
Food group 5: Fruit, vegetables	7.1%	6.5%	6.7%	9.9%
Food group 6: Legumes	1.6%	1.6%	1.2%	0.8%
Additional category: Sugar, sugar-rich foods	9.4%	9.5%	9.2%	9.0%
Other food items	7.1%	9.2%	10.2%	12.0%

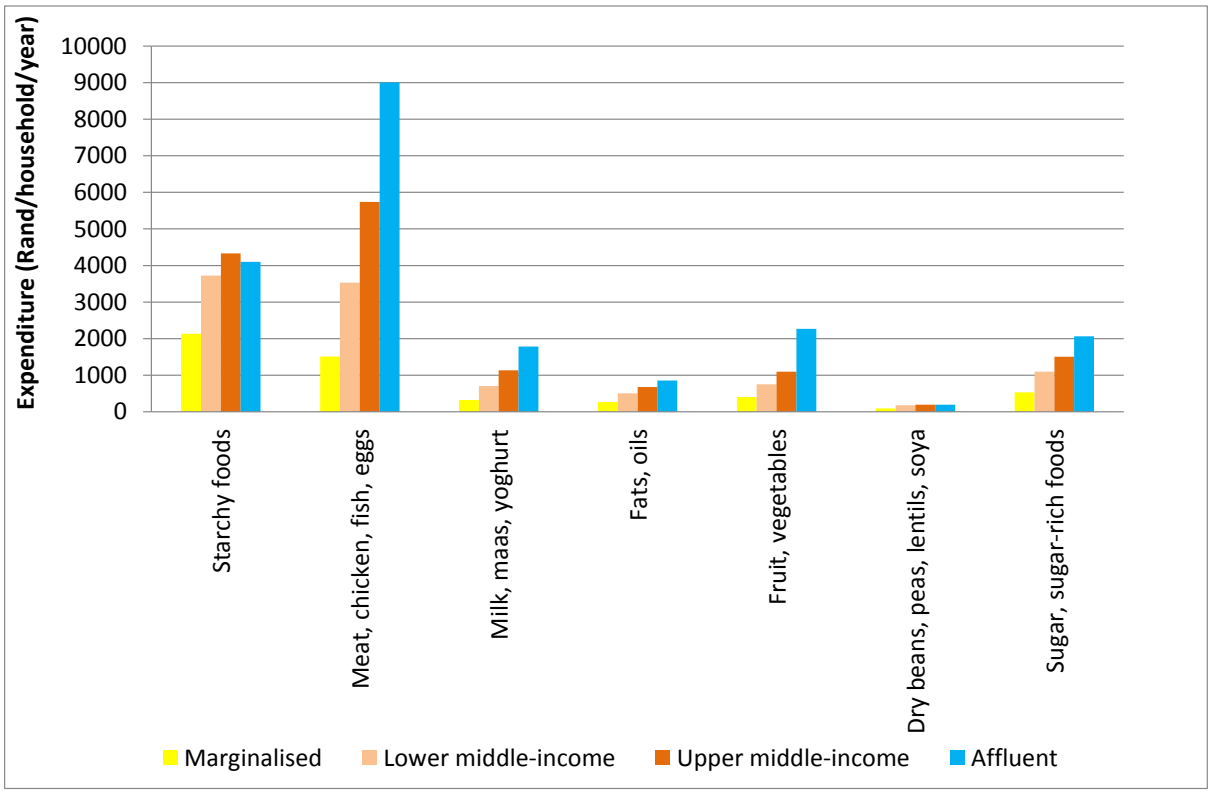

Figure 2.9: Household-level expenditure on food categories for marginalised, lower middle-income, upper middle-income and affluent consumers in South Africa 2014/2015 using Stats SA LCS 2014/2015 (Stats SA, 2017a)

2.3.3 Dominant food items in food groups

As illustrated in the previous section, the expenditure levels and contributions of food groups to total food expenditure vary across the socio-economic spectrum. In this section, an overview is presented of the dominant specific food items in the various food groups, to explore further differences in the food intake patterns of different socio-economic

[31] Excluding out-of-home food intake.

groupings. Household-level food expenditure data from the Stats SA LCS 2014/2015 was reworked for the identified food groups, after which the dominant food items in the various food groups for the four main socio-economic sub-groups were identified.

In the first food group, the dominant starch-rich food options were generally maize meal, bread and rice. With rising socio-economic levels the relative importance (in the socio-economic sub-groups from a perspective of expenditure on the food group) of maize meal, brown bread and rice decreased, while the relative importance of white bread, processed starch-rich foods (e.g. baked goods, breakfast cereals) and pasta increased. In a review of dietary surveys undertaken among South African adults during the period 2000 to 2015, Mchiza and co-workers (2015) found that maize porridge, brown bread and white bread were among the ten foods most frequently consumed by South Africans.

Chicken, beef, fish and eggs dominated in the animal-source food group as is evident in Table 2.3, while only chicken and eggs are amongst the ten foods most frequently consumed by South Africans (Mchiza et al., 2015). The relative expenditure on chicken and eggs decreased with rising affluence levels, while the relative expenditure on beef, mutton/lamb, pork and cheese increased. In the liquid dairy group, the expenditure contribution of liquid milk and yoghurt increased with rising affluence levels, while expenditure on sour milk / maas declined. Even though full cream milk was among the ten most frequently consumed foods by South Africans (Mchiza et al., 2015), the number of dairy portions were found to be in the range of 0.4 to 0.5 compared to a recommendation of at least 2.0 per day.

Regarding the fats / oils food group, the expenditure contribution of edible oil decreased with rising affluence level, while it increased for margarine and peanut butter (Table 2.3). Margarine and oil were also among the ten foods most frequently consumed by South Africans (Mchiza et al., 2015). Baked beans and dried beans dominated the legumes food group.

Even though Mchiza and co-workers (2015) concluded that fruit and vegetables (particularly tomato, onion, green leafy vegetables and cabbage) were among the ten foods most frequently consumed by South Africans, the number of portions consumed was approximately 50% below recommended levels. The dominant fruit options were apples, bananas and oranges, while the dominant vegetable options consisted of tomatoes, cabbage, onion, spinach, carrots and pumpkin. A significant increase in the diversity of fresh produce was observed as the affluence levels increased. The higher expenditure of more affluent consumers on processed foods is evident from the rising expenditure contributions of products such as processed starch-rich foods (e.g. baked goods and breakfast cereals), as well as sugar-rich processed foods as shown in Table 2.3).

The typical food expenditure patterns particularly of the less affluent consumer segments in South Africa serve as a critical clue to understand the typical food intake patterns of consumers – particularly if the absence of recently available food intake data in the South African context is taken into consideration. This will be further discussed in more detail in Chapter 3 where the methodology applied to develop the healthy food baskets is discussed.

Table 2.3: Dominant food items in the various food groups for socio-economic consumer sub-groups (calculated from Stats SA LCS 2014/2015) (Stats SA, 2017a)

Food group:	Marginalised consumers:	Lower middle-income consumers:	Upper middle-income consumers:	Affluent consumers:
Food group 1: Starch-rich foods[1]	Maize meal (33%) Brown bread (23%) Rice (13%) White bread (9%) Potatoes (8%) Wheat flour (6%)	Maize meal (29%) Brown bread (21%) Rice (13%) White bread (12%) Wheat flour (7%) Potatoes (7%)	Brown bread (22%) Maize meal (20%) White bread (17%) Rice (12%) Potatoes (6%) Wheat flour (6%) Breakfast cereals (6%)	Brown bread (18%) White bread (15%) Baked goods (14%) Breakfast cereals (11%) Maize meal (10%) Rice (9%) Potatoes (6%) Pasta (4%) Wheat flour (4%)
Food group 2: Meat, chicken, fish, eggs[1]	Chicken (52%) Beef (16%) Fish (10%) Eggs (9%) Polony, Vienna sausages (3%)	Chicken (47%) Beef (22%) Fish (8%) Eggs (8%) Polony, Vienna sausages (4%) Pork (3%)	Chicken (37%) Beef (27%) Eggs (7%) Fish (7%) Mutton/lamb (5%) Pork (5%) Polony, Vienna sausages (4%)	Beef (30%) Chicken (23%) Mutton/lamb (9%) Fish (8%) Cheese (7%) Pork (6%) Eggs (5%) Polony, Vienna sausages (4%)
Food group 3: Milk, maas, yoghurt[1]	Milk (fresh, long life) (60%) Sour milk, maas (29%) Yoghurt (8%)	Milk (fresh, long life) (63%) Sour milk, maas (24%) Yoghurt (11%)	Milk (fresh, long life) (72%) Sour milk, maas (14%) Yoghurt (12%)	Milk (fresh, long life) (78%) Yoghurt (15%) Sour milk, maas (5%)
Food group 4: Fats, oils[1]	Edible oil (79%) Margarine (15%) Peanut butter (5%)	Edible oil (66%) Margarine (23%) Peanut butter (8%)	Edible oil (54%) Margarine (32%) Peanut butter (11%)	Margarine (41%) Edible oil (39%) Peanut butter (11%)

NOTE: The percentages in brackets indicate the expenditure contribution of the specific food item to the total expenditure within the particular food group.

[1] The food items presented account for at least 90% of the total expenditure within the particular food group.

Table 2.3: (continued) Dominant food items in the various food groups for socio-economic consumer sub-groups (calculated from Stats SA LCS 2014/2015) (Stats SA, 2017a)

Food group:	Marginalised consumers:	Lower middle-income consumers:	Upper middle-income consumers:	Affluent consumers:
Food group 5: Fruit[2]	Apples (33%) Bananas (32%) Oranges (15%)	Apples (35%) Bananas (28%) Oranges (12%)	Apples (30%) Bananas (24%) Oranges (9%) Grapes, raisins (5%) Watermelon (4%)	Apples (19%) Bananas (19%) Avocado (8%) Grapes, raisins (7%) Oranges (5%) Peach, mango, pear, water-melon strawberries, (3% each)
Food group 5: Vegetables[2]	Tomatoes (fresh) (27%) Cabbage (fresh) (20%) Onions (fresh) (19%) Spinach / morogo (fresh) (8%)	Tomatoes (fresh) (22%) Onions (fresh) (17%) Cabbage (fresh) (15%) Spinach / morogo (fresh) (6%) Carrots (fresh) (5%) Pumpkin (fresh) (4%) Beetroot (fresh) (3%)	Tomatoes (fresh) (18%) Onions (fresh) (15%) Cabbage (fresh) (9%) Pumpkin (fresh) (5%) Carrots (fresh) (5%) Spinach / morogo (fresh) (5%) Peppers (fresh) (3%) Beetroot (fresh) (3%) Lettuce (fresh) (2%)	Tomatoes (fresh) (12%) Onions (fresh) (10%) Lettuce, carrots, pumpkin, cucumber (fresh) (5% each) Mushrooms (fresh) (4%) Peppers (fresh) (4%) Spinach / morogo (fresh) (3%) Cabbage (fresh) (3%) Beetroot, corn kernels, broccoli, cauliflower (fresh) (2% each)
Food group 6: Legumes[1]	Dried beans (50%) Baked beans (in tomato sauce) (41%)	Baked beans (in tomato sauce) (47%) Dried beans (43%)	Baked beans (in tomato sauce) (53%) Dried beans (33%) Soya products (6%)	Baked beans (in tomato sauce) (54%) Dried beans (21%) Soya products (5%) Pea products (17%)
Additional group: Sugar, sugar-rich foods	Granular sugar (87%) Sugar-rich foods (13%)	Granular sugar (79%) Sugar-rich foods (21%)	Granular sugar (65%) Sugar-rich foods (35%)	Granular sugar (32%) Sugar-rich foods (68%)

NOTE: The percentages in brackets indicate the expenditure contribution of the specific food item to the total expenditure within the particular food group.

[1] The food items presented account for at least 90% of the total expenditure within the particular food group.

[2] The food items presented account for at least 70% of the total expenditure within the particular food group.

2.4 SUMMARY

This chapter has provided literature-based background information relating to the socio-demographic characteristics and typical food expenditure patterns within the socio-economically diverse South African consumer landscape.

Even though the focus of the thesis is on the affordability of more ideal nutritionally balanced food baskets, it was important to firstly describe the typical socio-demographic and economic characteristics in the South African consumer spectrum (as presented in Sections 2.1 and 2.2 in this chapter) to establish the segmentation context used in the thesis. Section 2.1 dealt with socio-demographic characteristics of the consumer landscape in South African on a more aggregate level and presented background information on population size and growth, cultural diversity, income inequality, household income and factors indicating pressure on consumer ability to cope financially. The discussion presented a view of South African consumers, characterised by cultural diversity, a young (but ageing) population age structure, high levels of urbanisation, socio-economic diversity and a high level of income inequality. Despite positive nominal growth in household disposable income over the last decade, several factors contributed to the pressure on household income, such as high levels of unemployment, rising debt and a large number of young people who have to be supported in the financial structures of households.

In relation to the high level of inequality and consumer diversity in South Africa, (as presented in Section 2.2), the discussion then shifted focus to a more disaggregated view of the South African consumer continuum. Four sub-segments were discussed: marginalised consumers (poorest 30% of the population), lower middle-income consumers (30% of the population), upper middle-income consumers (20% of the population) and affluent consumers consisting of the wealthiest fifth of the South African population. The discussion showed that rising socio-economic class is generally associated with higher household income levels, increasing urbanisation, higher education levels and lower unemployment. Furthermore, the presence of upward social class mobility (with the most significant growth among the middle-class segments), was highlighted in Section 2.2. Such mobility is important because of the evolution of typical food consumption patterns as consumers move upwards in the socio-economic spectrum.

When applying nutritionally balanced food baskets to investigate the affordability of healthy eating, a thorough understanding of the typical, actual food expenditure patterns across the socio-economic spectrum is critical to gauge the discrepancies and nutritional implications of the gaps between estimated actual food expenditure patterns and 'ideal' food expenditure (as defined by nutritionally balanced food baskets). Subsequently Section 2.3 explored the typical food expenditure patterns across the socio-economic spectrum in South Africa. Food groups were defined according to the official SA FBDG and focused on seven groups: starch-rich foods; fresh produce (fruit and vegetables); legumes; meat, fish and eggs; liquid dairy (milk, maas, yoghurt); fats/ oils; and sugar-rich foods.

The food budget share of South African households generally ranged from approximately a third of total expenditure for marginalised consumers to approximately 6% for the

wealthiest 10% of households in South Africa in 2014/2015. The vulnerability of lower-income households (with higher food budget proportions) to rising food prices was noted from the literature. The discussion also further emphasised the vulnerability of lower income households in South Africa by showing that the estimated monthly per capita food expenditure for half of the population fell below the official 2014/2015 Stats SA Food Poverty Line.

When we consider the expenditure on specific food groups, Section 2.3 showed that higher affluence levels was generally associated with a decreasing share contribution towards total food expenditure for starch-rich foods, fats / oils and legumes and an increasing expenditure contribution for animal-source foods. Even though household-level expenditure (Rand value) on starch-rich foods increased from marginalised to upper middle-income consumers, it decreased somewhat for affluent consumers. For animal-source foods, fresh produce, liquid dairy, sugar-rich foods and fats / oils typical household-level expenditure increased significantly with rising affluence levels – with the rising expenditure attributed to a combination of larger food quantities and the purchase of more expensive product options. The largest expenditure gaps were observed between marginalised consumers and affluent consumers in relation to animal-source foods, fresh produce and dairy – generally recognised as more nutrient dense and more expensive items in consumer food intake. Some of these movements are typically associated with the nutrition transition characterised by more Western-orientated diets containing, amongst other things, relatively less staple foods, and more animal-source foods, fat and sugar (Steyn, 2006; Shisana et al, 2014; Bourne et al., 2002; Kruger et al., 2005; Delgado, 2003; Du et al., 2004; Popkin & Du, 2003). The nutrition transition in the South African context will be elaborated on in more detail in subsequent chapters of this thesis. Section 2.3 concluded with a detailed discussion of the dominant food items in the various food groups for the four main socio-economic sub-groups (from an expenditure perspective) – as this is an important input in the design of the nutritionally balanced food baskets from the point of view of establishing the typical food expenditure and intake patterns of consumers.

The complexity and dynamic nature of the South African consumer landscape is evident from the information presented in this chapter. These complexities should be an integral consideration for policy makers and role-players in South African food value chains and the food security context. This chapter provided the context for the nutritionally balanced food baskets presented in Chapter 3 of this thesis.

As illustrated in this chapter, starch-rich staple foods and animal-source foods are the dominant food groups from a household-level expenditure perspective. The nutritionally balanced food basket models which were developed and will be presented in Chapter 3, will subsequently be applied in case studies of these two dominant food groups in Chapters 4 to 6 – in order to determine consumption adherence to dietary guideline principles in the South African context.

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CHAPTER 3: MEASURING THE COST AND ATTAINABILITY OF HEALTHY EATING IN SOUTH AFRICA

3.1 INTRODUCTION

Following the justification of the study and statement of objectives (Chapter 1), Chapter 2 presented a discussion of food intake within the dynamic socio-demographic consumer landscape in South Africa. In this chapter, the focus shifts from actual food expenditure and intake patterns of the South African population, towards more ideal food intake scenarios represented by hypothetical healthy eating plans based on national nutritional guidelines. Despite taking into account the broader socio-economic spectrum in South Africa, the analyses presented in this chapter have a strong emphasis on the lower-income segments of the South African population, due to the more significant food- and nutrition-security vulnerability and more severe income constraints observed among these consumers.

According to the World Health Organisation (WHO) health is a multi-dimensional concept that can be defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). A diverse selection of aspects influence the health of individuals, including social status, income, the physical environment (e.g. safe water, clean air, safe housing, healthy workplaces, infrastructure), individual characteristics and behaviour (e.g. lifestyle, culture, education level, genetics, gender, involvement in social support networks), the availability and usage of health services, as well as food intake (e.g. quantity, quality and diversity of food intake) (WHO, 2018).

The food decisions of consumers are influenced by a complex range of interrelated factors, that are related to the consumer (such as age, gender, education, income, social aspects, culture, nutrition knowledge, cooking skills, perceptions, previous experience and beliefs regarding health), the features of the food item (e.g. taste, visual characteristics, texture, nutrient content, availability, cost / price, preparation / cooking options, packaging and foods consumed together), as well as environmental characteristics (e.g. household size, life cycle stage of household, social class mobility, employment status and urbanisation) (Pilgrim, 1957; Khan, 1981; Randall & Sanjur, 1981; Shepherd, 1985; Shepherd, 1989; Von Alvensleben, 1997).

Food affordability can be defined as "the cost of the diet of a household relative to the household's income" (Lee et al., 2013). As mentioned above, the prices of food items, as well as the income of the consumers, are potential influencing factors affecting consumer food decisions. The role of food prices in food choice has been widely studied internationally (Glanz et al., 1998; Turrell et al., 2002; Pula et al., 2014; Aschemann-Witzel et al., 2018), and also in the South African context (Louw et al., 2017; National Agricultural Marketing Council (NAMC), 2019). Income (combined with food prices, thus implying food affordability) can impact on consumer food demand by restricting demand (i.e. restricting the food choices of the consumer in terms of intake quantities, as well as the types and quality of foods that are affordable) and by affecting consumer attitudes, motives and other consumer-related variables (Von Alvensleben, 1997). In addition to the influence of food affordability on dietary patterns, nutritional status and health, it also affects consumer

access to food with a subsequent food security impacts (Gross et al., 2000). The negative food and nutrition security outcomes of rising food prices and income pressure on households have been widely reported internationally and for South Africa (World Bank, 2008; Committee on World Food Security, 2011; Mkhawani et al., 2016; Naicker et al., 2015; Musemwa et al., 2015; Chakona & Shackleton, 2017; Temple et al., 2011).

From the perspective of total food supply at the national level, South Africa is generally viewed as food secure through a combination of food production and food imports (Statistics South Africa (Stats SA), 2019a). However, food security involves more than just the availability of adequate total energy at a national level – access to food by all households, dietary diversity and dietary quality are also of critical importance (World Food Summit, 1996).

Figure 3.1 presents the Global Food Security Index for South Africa, from 2012 to 2018 (Economist Intelligence Unit, 2018), illustrating the gradual improvement in the overall food security status in South Africa (+6.5%) over this time period. In 2018, South Africa ranked 45th among 113 countries in the Global Food Security Index. In terms of the index sub-components, South Africa achieved a higher index score for food availability than for food affordability (in the second position) and food quality and safety (in the third position).

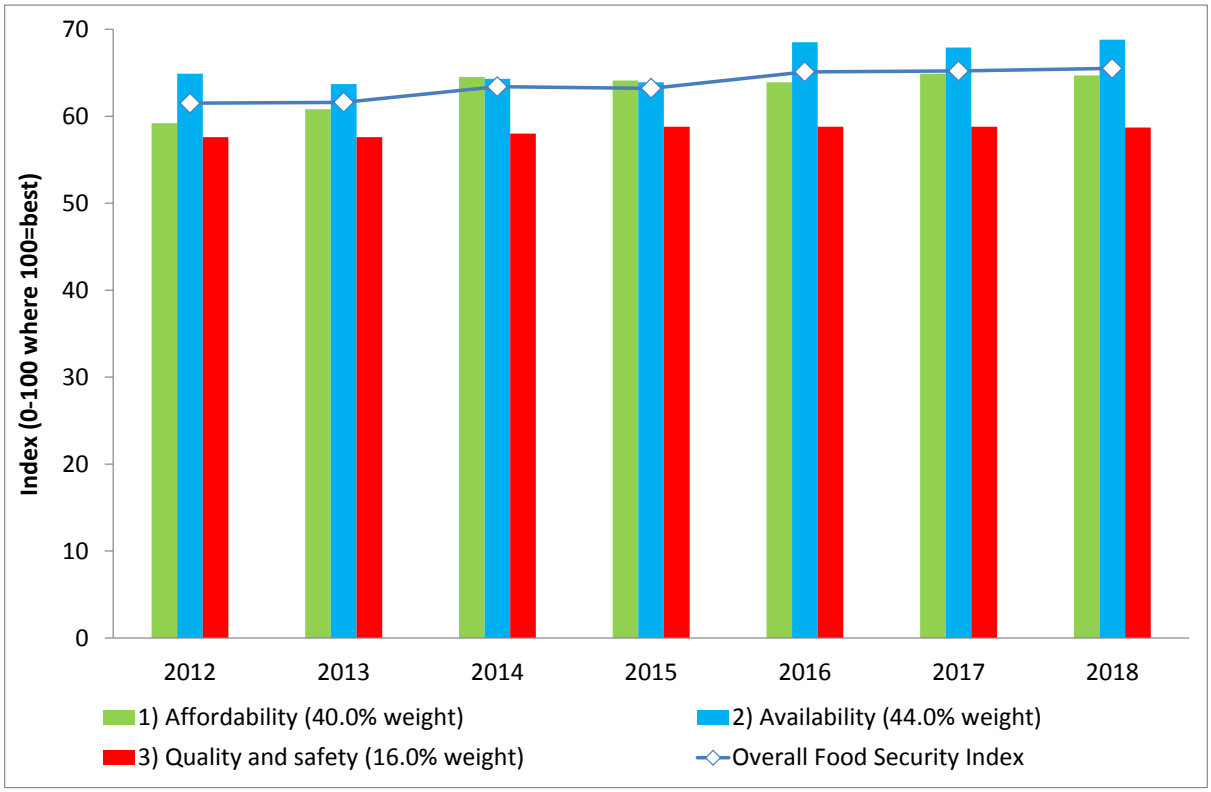

Figure 3.1: The Global Food Security Index for South Africa for the period 2012 to 2018 (Economist Intelligence Unit, 2018)

Poverty and food insecurity are realities faced by many South Africans. In 2015, 55.5% of the population were not able to afford acceptable quantities of food and non-food items (as measured by the Stats SA upper-bound poverty line), while 25.2% of people lived in extreme poverty and were "unable to purchase or consume enough food to supply them with the

minimum per-capita-per-day energy requirement for adequate health" (as measured by the Stats SA food poverty line) (Stats SA, 2017a). In 2012, 28.3% of the people in South Africa was "at risk of hunger" and 26.0% food insecure (i.e. suffering hunger) according to the South African National Health and Nutrition Examination Survey (SANHANES-1) (SANHANES 2012). From an alternative perspective a comparison of household income across the socio-economic spectrum (Stats SA, 2017b), with the International Poverty Line of the World Bank (US$1.90 per person per day) (World Bank, 2015) presents a slightly more optimistic view, revealing that an estimated 40% of the South African population lived under the International Poverty line in 2014/2015 (refer to Figure 1.3 in Chapter 1). According to the Global Food Security Index, South Africa ranked 45th among the 113 countries considered in 2018, with an overall food security score of 65.5%, an affordability score of 64.7%, an availability score of 68.8% and a 58.7% score for food quality and safety (Economist Intelligence Unit, 2018). The highest overall food security score of approximately 85% was reported for countries like Singapore, the United Kingdom (UK), Ireland, the United States of America (USA) and the Netherlands – thus implying that only 15% of these populations were food insecure.

The vulnerability of lower income South African households to income pressure and rising food prices is further emphasised when we consider the typical strategies employed by households to cope with food shortages. Among farmworker households (employed on a commercial farm), the following food coping strategies were often used: households had to rely on cheaper food (e.g. chicken feet), eat less-favoured food (e.g. meat bones), gather food from the wild, consume seed stock (e.g. maize) and reduce portion sizes (protein foods and side dishes) (Kruger et al., 2008). Surveys among lower income rural households in KwaZulu-Natal in 2010 (n=390) and Limpopo in 2011 (n=599), revealed that high food costs and rising food prices were prominent factors that caused pressure on household food security (D'Haese et al., 2013; De Cock et al., 2013). In KwaZulu-Natal it was found that more than 90% of households that were questioned, had to reduce their food intake to cope with food shortages (D'Haese et al., 2013). Among the Limpopo households, reduced food intake, reduced portion sizes, restricting intake in favour of children and skipping meals for an entire day applied respectively to 47%, 44%, 40% and 34% of households as food coping strategies (De Cock et al., 2013). Consuming less meat and fresh produce (vegetables and fruit), more staple foods, in addition to a reduction in portion size were common coping strategies for urban low-income households in Gauteng. In 2017, these strategies were used by 96% and 85% of questioned households, respectively (n=89) (Bureau for Food and Agricultural Policy (BFAP), 2018). In general, these food coping strategies are associated with starch-based diets characterised by inadequate dietary variety.

Food affordability is a critical determinant in the food choice process which affects most consumers in South Africa where food purchased from supermarkets is increasingly becoming the dominant source of food for households (D'Haese & Van Huylenbroeck, 2005; Hendriks, 2005; Baipheti & Jacobs, 2009; Schönfeldt et al., 2010; Pereira, 2013; Peyton et al., 2015; Crush & Frayne, 2011). Even though the Stats SA Consumer Price Index (CPI) for

food indicates inflation on a representative basket of food items (based on the actual food expenditure patterns of households), no national-level tool is available to quantify the cost of healthy eating in South Africa. Such a measurement has become increasingly critical in recent years as the South African food landscape experienced a significant wave of food inflation (Stats SA, 2018a). According to the Organisation for Economic Co-operation and Development (OECD), the food inflation rate in South Africa is in fact,-among the highest in the world (OECD, 2018)) and greater variations occurred in the incidence of food poverty over time (Stats SA, 2017a). Furthermore, South Africa is facing a complex nutritional dilemma with unacceptable high levels of child stunting (indicative of chronic energy deficiencies) coupled with a high prevalence of overweight and obesity among adults. This is in turn linked to an increase in the role that non-communicable diseases play in mortality in South Africa (Shisana et al, 2014).

The nutritional landscape in South Africa is further complicated by the nutritional transition process that is taking place. This transition refers to the shift in dietary patterns leading to the increased consumption of sugar, saturated fats and refined foods, as well as lower consumption of fibre-rich foods (Ghattas, 2014). Driving factors of the nutrition transition include rapid demographic, social and economic changes, increased urbanisation and changes in food systems (including technological advances enhancing the availability of low-cost, energy-dense, nutrient-poor foods) (Ghattas, 2014). The nutrition transition has negative health implications such as obesity and associated non-communicable diseases.

An improved understanding of the cost of basic healthy eating in South Africa at a national level could yield an improved understanding of the discrepancies between actual and more ideal (healthier) food expenditure patterns. This could provide insight into the nutritional implications of these diets and could contribute to the formulation of policy actions to help the nation achieve the goals of the National Development Plan 2030 and the United Nations Sustainable Development Goals pertaining to food- and nutrition security.

In this chapter, the development and costing of monthly 'healthy' food baskets for households in South Africa is presented, comprising of recommended quantities of foods from all the relevant food groups, based on the official South African national dietary recommendations. The healthy food basket tool is then applied to:

- To measure the affordability of basic healthy (nutritionally balanced) eating in South Africa over time;
- To investigate the expenditure gap and nutritional implications of comparing actual estimated food expenditure levels and potential expenditure on a nutritionally balanced food basket across the socio-economic spectrum;
- To compare the South African CPI inflation rate on food with the inflation rate observed in relation to the balanced food baskets over time.

3.2 METHODOLOGY

3.2.1 Background literature

A number of countries (e.g. UK, Canada, New Zealand, USA, Australia and Ireland) have been using baskets of 'healthy' food to monitor food cost and availability (Health Canada, 2009; Carlson et al., 2007a; Carlson et al., 2007b; Department of Human Nutrition, University of Otago, 2018; Palermo & Wilson, 2007; Williams, 2010; Tsang et al., 2007; Scott et al., 2018; Friel et al., 2004). The various healthy food baskets described in the reviewed literature aimed to achieve a variety of objectives such as comparing the cost of healthy versus unhealthy foods, comparing the cost of healthy food in urban versus rural settings, examining the availability of healthy foods in various geographical settings, informing social grant policies, development of educational resources on healthy eating with a limited budget, investigating trends in food prices of healthy food items over time and comparing the affordability of healthy eating against particular household income scenarios (Williams, 2010; Lee et al., 2013). Methodologically these healthy food baskets vary in terms of numerous components (Lee et al., 2013; Williams, 2010), such as:

- The geographical level of monitoring (national, state, provincial or community level);
- The regularity of monitoring (e.g. monthly, *ad hoc* or once-off);
- The basis for defining 'healthy' food (e.g. focusing only on fruits and vegetables, based on national dietary guidelines, a selection of items which include 'more realistic' food items which are not generally considered as healthy or a selection of food items based on actual food choices made by consumers, measured with the help of nutritional surveys or household expenditure surveys);
- The socio-economic level of the target audience (e.g. healthy basket options varying from low-cost to moderate-cost to liberal-cost);
- The 'target audience' (e.g. hypothetical reference households or developed for specific age or gender groupings);
- The format of food items included [e.g. packaging sizes monitored, branded, generic or least expensive items monitored, level of processing considered (e.g. fresh, frozen, refrigerated, canned, juice options)];
- The methodology employed to obtain food price data (e.g. manual or electronic observations, in-store or online, the type of food stores surveyed, quantity of stores monitored and control for seasonality).

A number of assumptions apply to most existing healthy food baskets described in literature, including minimal food waste at household-level, the majority of purchased foods are consumed, all food consumed by the reference group is prepared at home, equitable consumption of food amongst individual household members according to their nutritional needs and the purchasing of all food required by the household (i.e. no production of food at household-level taken into consideration) (Lee et al., 2013).

The monthly monitored NAMC 28-item food basket[32] (NAMC, 2019) is based on a selection of food items (and specific popular packaging sizes) commonly purchased by South African households and not on nutritional principles or a particular family size / composition. In a study investigating the "status of household food security targets in South Africa", Jacobs (2009) mainly applied the NAMC food basket. However, the basket was not nutritionally balanced or compiled for any particular household size or time period.

Rose and Charlton (2002a) applied quantitative indicators from income and expenditure data surveys to investigate food insecurity in South Africa and calculated the cost of nine different individual types of food plans. The food plans (also referred to as food ration scales) were compiled in 1993 by the previous South African Department of National Health and Population Development. It was based on nutrient recommendations from the USA. The plans specified the minimum quantities of food items that would fulfil the nutritional needs of nine different age-gender groups. Currently, a tender process is followed by the South African Department of Health (DoH) to update the Food Ration Scales (DoH, 2019).

Since 2014, PACSA (The Pietermaritzburg Agency for Community Social Action) has been monitoring a basic, but nutritionally complete diet, on a monthly basis focusing on the Pietermaritzburg area in KwaZulu-Natal (PACSA, 2018). Once a month, food retail prices are observed in selected stores in Pietermaritzburg based on a standardised methodology. In the South African context no evidence could be found of existing examples of nationally representative, regularly updated healthy or nutritionally balanced food baskets.

3.2.2 Methodology overview

To address this gap, the healthy food baskets which were developed as the main outcome of this thesis provide an approach to enable the regular (monthly) monitoring of the cost and affordability of healthy eating in South Africa at a nationally representative level in a cost-effective manner[33]. These healthy food baskets were based on the best publically available data foundations (see Figure 3.2), including:

- Official nutrition recommendations of the South African DoH;
- Consideration of actual food preferences at a socio-economically disaggregated level obtained from official Stats SA household-level income- and expenditure survey data;
- Official nationally representative food retail prices, as reported by Stats SA;
- Household size and –composition data obtained from household-level Stats SA studies.

Furthermore, these healthy food baskets were also developed to be a versatile and adaptable tool to monitor the cost and affordability of healthy eating:

[32] Items in the NAMC 28-item food basket: Apples, baked beans tinned, bananas, dried beans, beef mince, beef offal, brown bread, white bread, cabbage, cheddar cheese, chicken giblets, frozen chicken portions, instant coffee, eggs, canned pilchards, super maize meal, margarine, full-cream milk, onions, oranges, peanut butter, polony, potatoes, white rice, white sugar, sunflower oil, Ceylon/black tea and tomatoes.

[33] Some countries, such as Canada, engage in extensive government funded food price monitoring specifically for the purpose of compiling healthy food baskets (Ministry of Health Promotion Ontario, 2010). However, due to the fiscal challenges facing a developing country like South Africa, an approach was followed to utilise existing nationally representative food price data as inputs.

- Healthy food baskets were developed at two costing levels (a thrifty / low-cost option and a moderate-cost option, with expansion possibilities towards an 'affluent' option – thus with the potential to be adapted across the socio-economic spectrum;
- The healthy food basket models were designed to allow for the characteristics of different households to be accounted for, e.g. in terms of the total household size, as well as the number of household members from different age and gender groupings;
- The model has the potential to be expanded to a geographically disaggregated level (e.g. provincial level or even more specific geographical regions) subject to the availability of data on food prices and food preferences pertaining to the particular geographical area.

The methodology applied in this thesis to develop and cost healthy food baskets was based on the official "Guidelines For Healthy Eating" of the DoH (DoH, 2013). International examples of healthy food baskets based on official national nutritional guidelines include the USDA (USA Department of Agriculture) Food Plans (Carlson et al., 2007a; Carlson et al., 2007b) and the Health Canada National Nutritious Food Basket (Health Canada, 2009).

The DoH "Guidelines for Healthy Eating" present two sample food intake patterns based on all the food groups and show the energy and nutrients required by individuals of different age and gender groups with average height and moderate activity levels (see Table 3.1 for more detail). 'Pattern A' was designed as a more economical option, including all the food groups, but contained proportionally more starch-rich food units. 'Pattern B' also covered all the food groups and specifies more units of vegetables, fruit, liquid dairy, as well as animal-source foods (specifically meat, chicken, fish, cheese and eggs) compared to 'Pattern A'. Pattern A and Pattern B specified the number of daily single serving units recommended for the various groups, where a SSU refers to a single unit of a particular food within a particular food group providing a similar amount of nutrients as other units within the same group (DoH, 2013).

The USDA Food Plans (Carlson et al., 2007a; Carlson et al., 2007b) also monitors healthy food baskets at various levels, including a thrifty food plan (a minimal cost nutritious meal plan achieved with limited resources) as well as low-cost-, moderate-cost- and liberal plans.

The next step involves the allocation of specific food items to the two food intake patterns as specified in the "Guidelines For Healthy Eating". To investigate the affordability of healthy eating from the perspective of the more vulnerable segments of the population, a selection of food items had to be identified which are included in the "Guidelines For Healthy Eating", as well as typically consumed by lower-income consumers in South Africa.

In the absence of recent nationally representative food intake data across the socio-economic spectrum for South Africa (Mchiza et al., 2015), an alternative source had to be utilised to estimate the typical food preferences of lower income consumers. Intake quantities and the relative importance of foods in the various food groups) for the dominant food types within the various food groups were estimated by applying historical food retail price data obtained from Stats SA to nationally representative household-level food expenditure data from Stats SA. The 2010/2011 Stats SA Income and Expenditure Survey (IES) (Stats SA, 2012) and the 2014/2015 Living Conditions Survey (LCS) (Stats SA, 2017b)

were used. The weighting of products was based on the estimated number of servings consumed, as estimated from household-level expenditure data – following a similar approach to Health Canada (Health Canada, 2009). The focus was on the poorest 30% of households.

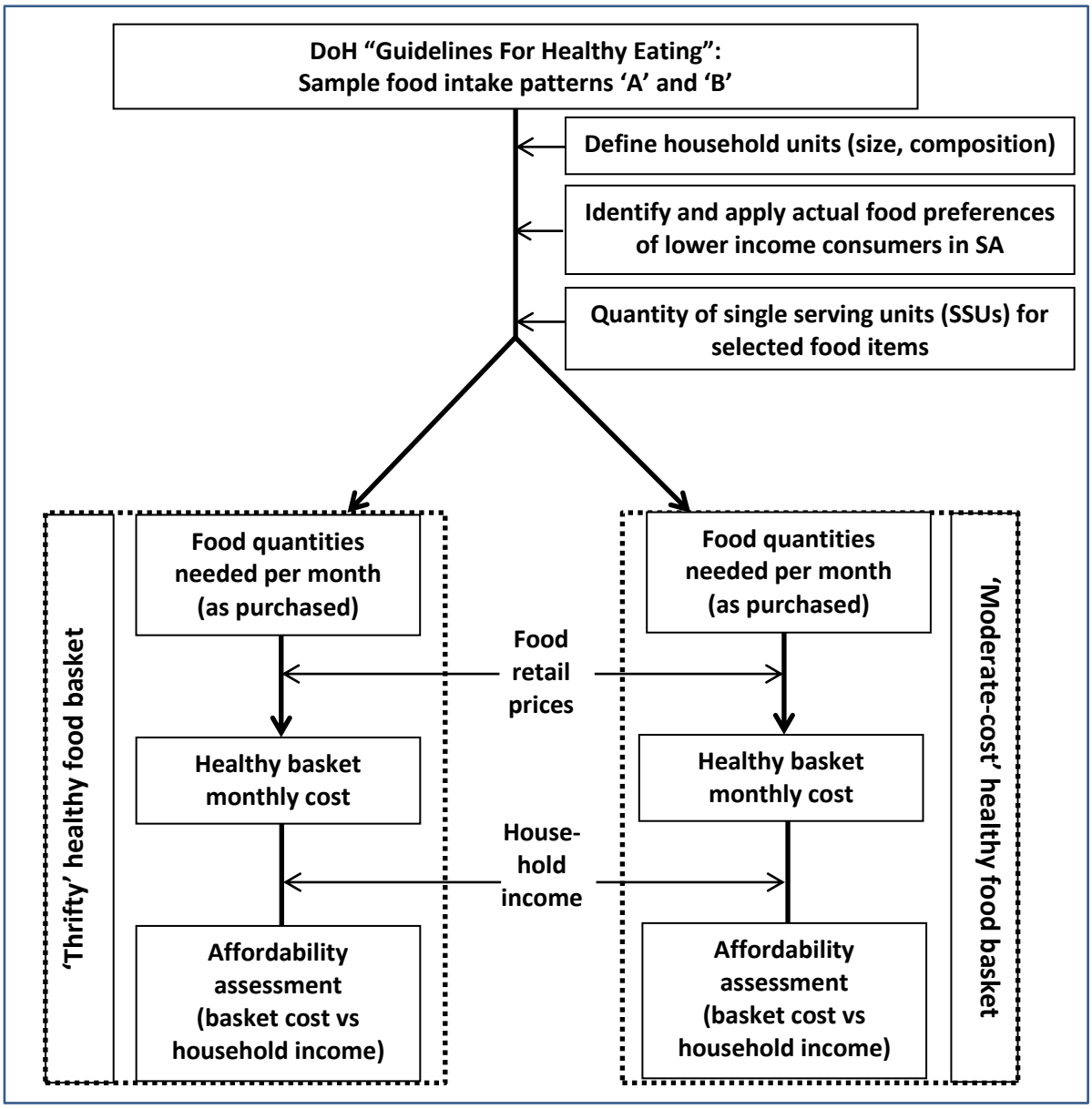

Figure 3.2: Methodology overview

Since officially monitored nationally representative Stats SA food retail prices for urban areas are used to calculate the cost of the healthy baskets, the final product selection to compile the baskets had to be included in the list of items monitored by Stats SA on a monthly basis. Table 3.2 gives an overview of the 25 food items included in the healthy food baskets. Due to significant limitations in terms of the list of food items monitored by Stats SA in rural areas, it was not possible to calculate and compare the healthy basket costs for rural areas in South African at a national aggregate level. Items such as salt, seasonings and sauces were not included in the healthy baskets due to retail price availability constraints.

Coffee and tea are also excluded as these items are not included in the DoH "Guidelines For Healthy Eating". Since the emphasis of the SA "Guidelines For Healthy Eating" is on a fresh or minimally processed food options (DoH, 2013), items such as processed convenience and snack foods were excluded from the healthy food baskets (similar to Health Canada (2009)).
It is important to note that healthy food baskets excluded the following: Food-away-from home (i.e. take-away and restaurant meals), foods purchased for religious or cultural reasons, infant formula and baby food, as well as foods pertaining to special diets for health conditions (similar to the Ontario Canada nutritious food basket (Ministry of Health Promotion Ontario, 2010)). The assumption was also made that all food that is purchased, is consumed (thus assuming zero food waste at the household-level).
Once the products in the healthy food baskets have been identified, the next step involved the quantification of single serving unit (SSU) serves, where a SSU refers to a single unit of a particular food within a particular food group providing a similar amount of nutrients as other units within the same group (DoH, 2013). To calculate food purchasing expenses it is important to state all SSU serves in the format in which the various products are usually purchased (e.g. raw or 'ready-to-eat' [e.g. bread, fresh produce and tinned food]). The quantification for a SSU was based on a combination of three main sources: the DoH "Guidelines For Healthy Eating" (DoH, 2013), the official SA FBDG (Vorster et al., 2013) and the DoH Food ration scales for hospitals and health institutions (DoH Directorate Nutrition, 2001). Table 3.3 presents the SSU quantities applied in the healthy food basket models.
The monthly food quantity requirements for the three energy categories (6 500 kJ/day, 8 500 kJ/day and 10 500 kJ/day) could then be estimated, followed by the application of food retail prices to calculate the cost of the food requirements for the various energy categories. Due to the objective to design a nationally representative healthy food basket, the officially monitored Stats SA food retail prices in rural and urban areas were applied. These prices are recorded by Stats SA on a monthly basis to develop the CPI for food and non-alcoholic beverages (NAB) (Stats SA, 2017c).
Some healthy food baskets in other countries utilise price data gathered specifically for the costing of healthy food baskets e.g. Canada (Health Canada, 2009) and Australia (Williams, 2010), while others such as the USDA Food Plans (Carlson et al., 2007b) are based on national average food price data. Regarding high and rising levels of urbanisation in South Africa, the assumption was made that all food required by households are purchased.
Since a range of packaging size options is monitored by Stats SA for certain food items, the packaging size selection was based on the most popular packaging size[34] for a particular product, as well as the requirement that the selected packaging size should provide for the needs of the reference family for one to two weeks.

[34] According to a personal communication with Marietjie Bennett (Director: Price Statistics Compilation, Stats SA) in March 2017, field workers gathering food retail price data to compile the CPI (food) record the size of a product which is the most popular (based on shelf space allocations) in a particular retail outlet. Consequently the number of observations could be viewed as a proxy for packaging size popularity, e.g. rice (2kg), brown bread (700g), wheat flour (2.5kg), maize meal (2.5kg), fresh milk (2l), cheddar cheese (1kg), eggs (dozen or three dozen), brick margarine (500g), peanut butter (400g), sunflower oil (750ml or 2l) and white sugar (2.5kg).

Table 3.1: Overview of the healthy eating plan patterns within the "Guidelines for Healthy Eating" (DoH, 2013)

Food category:	Food examples:	Number of daily single serving units recommended					
		Food intake pattern 'A': (Thrifty option)			Food intake pattern 'B': (Moderate-cost option)		
		6 500 kJ/day	8 500 kJ/day	10 500 kJ/day	6 500 kJ/day	8 500 kJ/day	10 500 kJ/day
		Children 6 – 9 years Elderly females (>64 years)	Children 10 – 13 years Adult females (19-64 years) Elderly males (>64 years)	Children 14 – 18 years Adult men (19-64 years)	Children 6 – 9 years Elderly females (>64 years)	Children 10 – 13 years Adult females (19-64 years) Elderly males (>64 years)	Children 14 – 18 years Adult men (19-64 years)
Starch-rich foods	Bread, maize, potato, rice, pasta	8	11	15	5	7	10
Vegetables	All fresh or frozen vegetables	3	3	3	3	3	5
Fruit	All fresh fruit	1	1	1	2	2	2
Legumes	Dry beans, lentils, split peas, soya mince	1	1	1	1	1	1
Fish, chicken, meat, eggs	Fish, skinless chicken, lean meat, eggs, liver, cheese	1	1	1	2	2	2
Milk, maas, yoghurt	Milk, maas, yoghurt (low fat or fat free)	1	1	1	1	2	2
Fats, oils	Vegetable oil, margarine, peanut butter	4	6	8	4	6	8
Sugar	Sugar (brown or white), jam	2	6	6	2	6	6

Table 3.2: Summary of food items included in the healthy food baskets

Food group:		**Food items included in healthy baskets: (listed in order of importance for lower income households)**	**Additional comments:**
Starch-rich foods		Maize meal (super) Brown bread Rice (white rice) Potatoes Wheat flour	• Selected items represented approximately 92% of starch-rich foods expenditure of the poorest 30% of households in SA in LCS 2014/2015. • White bread was excluded from the healthy baskets as brown bread has a higher fibre content. • Even though brown rice would be a more optimal choice than white rice, the latter was included in the basket due to retail price availability constraints.
Vegetables & fruit	Vegetables	Tomatoes Onions Cabbage Carrots Pumpkin	• Selected items represented approximately 72% of vegetable expenditure (fresh and processed) of the poorest 30% of households in SA in LCS 2014/2015. • Even though spinach is a popular vegetable among lower income households, it could not be included in the healthy baskets due to retail price availability constraints.
	Fruit	Apples Bananas Oranges	• Selected items represented approximately 79% of fruit expenditure (fresh and processed) of the poorest 30% of households in SA in LCS 2014/2015. • Ideally consumers should focus on unprocessed and 'in season' fresh produce.
Legumes		Beans (dried) Baked beans in tomato sauce	• According to the DoH "Guidelines for Healthy Eating" this food group includes products such as dry beans, lentils, split peas and soya mince. However, due to retail price availability constraints only dried beans and baked beans in tomato sauce could be included in the healthy baskets.

Table 3.2: (continued) Summary of food items included in the healthy food baskets

Food group:	Food items included in healthy baskets: (listed in order of importance for lower income households)	Additional comments:
Fish, chicken, meat, eggs, cheese	Chicken (Individually quick frozen (IQF) pieces) Beef (lean mince) Eggs (large) Canned fish (pilchards in tomato sauce) Cheese (cheddar)	• Selected items represented approximately 91% of animal-source food expenditure (excluding liquid dairy) of the poorest 30% of households in SA in LCS 2014/2015. • Lean mince was selected as the beef product due to the absence of bones and limited fat content of the product. • Canned pilchards in tomato sauce are the most popular fish option among the poorest 30% of households in SA in LCS 2014/2015.
Milk, maas, yoghurt	Milk (low fat)	• Liquid milk, fermented milk products (particularly maas) and yoghurt account for approximately 99% of the liquid dairy expenditure of the poorest 30% of households in SA in LCS 2014/2015. However, maas and yoghurt could not be included in the healthy baskets due to retail price availability constraints.
Fats, oils	Sunflower oil Margarine Peanut butter	• Edible oil, margarine and peanut butter account for approximately 98% of the fats / oils expenditure of the poorest 30% of households in SA in LCS 2014/2015.
Sugar[2]	White sugar	• Although sugar (including high-sugar foods) is not an official food group within the South African Food-based Dietary Guidelines (SA FBDG) it is dealt with in a 'caution' guideline stating: "Use sugar and foods and drinks high in sugar sparingly, and not between meals" (Vorster et al., 2013). • Although the DoH "Guidelines For Healthy Eating" also list 'jam' as an option in this food category, it was not possible to include jam in the healthy baskets due to retail price availability constraints.

Table 3.3: Defining SSU serves

Food group:	Product:	SSU (as purchased):	SSU (ready-to-eat):	Notes:
Starch-rich foods	Maize meal (super)	25g[1]	75g (calculated)	Estimated raw to cooked conversion rate of 3 (Bognár, 2002).
	Brown bread	40g[2]	40g[2]	-
	Rice	22g (calculated)	65g[2]	Estimated raw to cooked conversion rate of 2.98 (Bognár, 2002).
	Potatoes	100g[1]	80g[1]	Estimated raw to cooked conversion rate of 0.8 (Bognár, 2002).
	Wheat flour	45g (calculated)	40g[1]	Estimated raw to cooked conversion rate of 0.9 (Bognár, 2002).
Meat, fish, eggs, cheese	Chicken	173g (calculated)	85g[3]	Conversion rate raw to cooked (lean, skinless, boneless): 0.49 (Bognár, 2002)
	Beef	129g (calculated)	85g[3]	Conversion rate raw to cooked (lean, boneless): 0.66 (Bognár, 2002)
	Eggs	100g[1]	90g (calculated)	Estimated raw to cooked conversion rate of 0.9 (Bognár, 2002).
	Canned pilchards	85g[3]	85g[3]	-
	Cheddar cheese	28g[3]	28g[3]	-
Dry beans, peas, lentils, soya	Dry beans	30g[1]	75g[1]	Conversion rate[2] applied: 40g raw: 100g cooked
	Baked beans	100g[2]	100g[2]	-
Milk, maas, yoghurt	Full cream milk	200ml[1]	200ml[1]	-
Fat, oil	Vegetable oil	5ml[1]	5ml[1]	-
	Margarine	5g[1]	5g[1]	-
	Peanut butter	10g[1]	10g[1]	-
Fruit	Apples	105g (calculated)	80g[3]	Yield rate applied: 76%[4]
	Bananas	118g (calculated)	80g[3]	Yield rate applied: 68%[4]
	Oranges	114g (calculated)	80g[3]	Yield rate applied: 70%[4]
Vegetables	Tomatoes	70g[2]	65g[2]	55g-85g (70g average) as purchased, 50g-80g (65g average) edible portion[2]
	Cabbage	110g[2]	72.5g[2]	100g-120g (110g average) as purchased, 65g-80g (72.5g average) edible portion[2]
	Onion	100g[2]	85g[2]	100g as purchased, yielding 85g peeled onion[2]
	Pumpkin / butternut	120g[2]	95g[2]	110g-130g (120g average) as purchased, 90g-100g (95g average) edible portion[2]
	Carrots	70g[2]	65g[2]	55g-85g (70g average) as purchased, 50g-80g (65g average) edible portion[2]
Sugar	White sugar	5g[2]	5g[2]	-

[1] DoH "Guidelines For Healthy Eating" (DoH, 2013).

[2] (DoH Directorate Nutrition, 2001): Food ration scales for hospitals and health institutions.

[3] SA FBDG (Dairy: Schönfeldt et al. (2013); Fruit and vegetables: Naude (2013).

[4] In the absence of formal yield rate data for South Africa, the following grey literature web source was referenced: http://www.christianchefs.org/charts/yields.html

The focus on weekly shopping or shopping every second week was justified by data from the Nielsen Shoppergraphics Syndicated Report released in 2018. In 2018 South African households typically had 60 shopping trips per year (thus on average 1.15 shopping trips per week) (Nielsen, 2018).

The packaging size option selected to cost the healthy food baskets can have a profound effect on the estimated monthly cost of healthy eating. For example, in 2018 the average monthly unit prices (calculated from Stats SA monitored food retail prices for urban areas) for a one kilogram packet of maize meal was 37% more than the unit cost for a five kilogram packet, while the unit cost for 750ml sunflower oil was 52% more expensive than the unit cost for a two liter container.

The following family unit options were included: a single adult male, a family of three or single-parent household (consisting of an adult female, a younger and older child), a family of four (made up of an adult male, an adult female, a younger and older child), a family of six (consisting of an adult male, an adult female, an elderly person, two younger children and one older child).

The assumptions were also made that the reference family seeks the lowest food prices possible, has store access and literacy skills that enable them to identify the lowest price, and that individual(s) in the household have the available time and food preparation knowledge to make meals at home from the ingredients contained in the healthy baskets (similar assumptions to the Ontario Canada nutritious food basket (Ministry of Health Promotion Ontario, 2010)).

The family of four was based on a typical family typology deduced from Stats SA IES 2010/2011[35] and LCS 2014/2015[36] household-level characteristics (Stats SA, 2017b), the family of three was selected as a hypothetical single parent household, while the family of six was selected as a hypothetical larger family unit. Healthy food basket methodologies implemented in other countries focused on a variety of 'reference family units' mostly influenced by typical population characteristics and policy objectives. The USDA food plans are calculated for a two-member family (adult male and adult female), as well as a family of four (adult male, adult female, younger child and older child) (Carlson et al., 2007b). For Ireland, the costing of a healthy food basket was calculated for a four member household (adult male, adult female, a younger and older child), a three member household (one adult and two children), a single adult, a single female pensioner and a pensioner couple (MacMahon & Moloney, 2016). Some healthy food basket methodologies have a larger focus on individuals from specific age and gender groups [e.g. in New Zealand (Department of Human Nutrition, University of Otago, 2018) and Canada (Health Canada, 2009)].

[35] IES 2010/2011: Average household size of poorest 50% of households was 3.6 members ≈4 (younger children 0.8≈1; older children 0.7≈1; adult males 1.0; adult females 1.1≈1).

[36] LCS 2014/2015: Average household size of poorest 50% of households was 3.2 members ≈4 (younger children 0.7≈1; older children 0.6≈1; adult males 0.9≈1; adult females 1.0).

The calculated healthy basket costs were then compared to a selection of household income scenarios, with income derived from minimum wage earnings, child grants and old age pensions (where applicable) (valued applicable from January to June 2019). As from mid-2019 the South African National Minimum Wage was set at R20 per hour or an equivalent of R3 500 per month (National Minimum Wage Act, Act no. 9 of 2018). In 2019, the monthly South African child grant amounted to R410, subject to a maximum yearly household income contribution of R48 000 per salary earner (South African Social Security Agency (SASSA), 2018a). The current National Minimum Wage falls within this parameter, as it cumulates to R42 000 per wage earner per year if full time employment applies. At present the South African old age pension grant is R1 700 per month (for people of ages 61 to 74 years) and R1 720 per month (for people of ages 75 years and older) (SASSA, 2018b).

Table 3.4 presents a summary of the selected household income scenarios. The analysis also considers the potential impact of school feeding on the ability of a household to afford a basic healthy food basket. The National School Nutrition Programme supplies meals to over 9 million children enrolled in more than 20 000 public schools in South Africa on a daily basis (Devereux et al., 2018). It was assumed that the home-based total dietary needs of a child receiving a nutritionally balanced school lunch Mondays to Fridays, reduced by 20%.

Table 3.4: Household income scenarios tested (2018/2019)

Option:	Household Size:	Household structure:	Number of wage earners:	Child support grants?	Old age pension grant?	Monthly household income implied:
1	1	1 adult male	1	No	No	R3 500
2	1	1 pensioner (female)	0	No	Yes	R1 700
3	2	1 adult male 1 adult female	2	No	No	R7 000
4	3	1 adult female 2 children	1	No	No	R3 500
5	3	1 adult female 2 children	1	Yes	No	R4 320
6	4	1 adult male 1 adult female 2 children	2	No	No	R7 000
7	4	1 adult male 1 adult female 2 children	2	Yes	No	R7 820
8	6	1 adult male 1 adult female 3 children 1 pensioner	2	No	No	R7 000
9	6	1 adult male 1 adult female 3 children 1 pensioner	2	Yes	Yes	R9 520

Section 7.3 in Chapter 7 presents a discussion of the limitations and possible solutions of the healthy food basket approach applied in this chapter.

3.2.3 Nutritional adequacy of the healthy food baskets for a family of four

The nutritional adequacy of the thrifty healthy food basket (THFB) and the moderate-cost healthy food basket (MHFB) was evaluated by comparing the nutritional profile of the baskets with dietary recommendations (Table 3.5). The nutritional profile of the baskets was calculated according to data from the South African Food Data System (SAFOODS) as described in the South African Medical Research Council Food Composition Tables for South Africa (SAFOODS, 2017)[37]. In the absence of the official South African Recommended Daily Allowances (RDA), values from the USA Institute of Medicine are used as reference values (Institute of Medicine, 2006)[38,39]. For macronutrients, the recommended share of total energy derived from particular macronutrients was used (total carbohydrates: 45 – 65%; total fat: 20 – 35%; total protein: 10 – 35%) (Institute of Medicine, 2005), using the following energy conversion factors: 17 kilojoules (kJ) per gram for protein and total carbohydrates, and 37 kJ per gram for fat (Klensin et al., 1989).

The THFB and MHFB met 94.2% and 87.1% of the estimated energy requirements (EER) of the reference family, respectively. The energy derived from carbohydrates, protein and fat is within the recommended ranges. As expected, the energy contribution of carbohydrates is higher in the THFB (62% of total energy versus 53% contribution in the MHFB). The total carbohydrate EER contribution of 53% can be viewed as quite a low value, as it is closer to the lower limit of the recommendations. The energy contribution of protein is higher in the MHFB (19% of total energy versus 14% contribution in the THFB). In terms of micronutrients the healthy baskets met at least 85% or more of the various individual nutrient requirements, with the exception of potassium, calcium and vitamin D. The healthy food basket developed for Victoria (Australia) met a minimum of 85% of the nutritional requirements of the reference households (Palermo & Wilson, 2007), thus comparable to the healthy baskets presented in this thesis.

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[37] Product descriptions in the SAFOODS Food Composition Tables: Maize meal (super white fortified, cooked soft porridge), bread (brown, fortified), rice (white, cooked), potato (boiled with skin, flesh and skin consumed), chicken (meat only, frozen, boiled), beef (topside lean mince, moist cooked), egg (chicken, whole, boiled or poached), polony (beef and pork), pilchards in tomato sauce, cheddar cheese, milk (low fat / 2% fat, fresh), sunflower oil, margarine (brick/hard), peanut butter (smooth style), apple (raw, average values for Golden Delicious and Granny Smith varieties), banana (raw, peeled), orange (raw, peeled), tomato (raw), cabbage (boiled), onion (raw), pumpkin (boiled), carrot (boiled, flesh and skin consumed), sugar (white, granulated), dried beans (cooked) and baked beans in tomato sauce.

[38] RDA values were used for: Minerals: Calcium, copper, iron, magnesium, phosphorus, zinc; Vitamins: A, C, D, E, thiamine (B1), riboflavin (B2), niacin (B3), B6, folate and B12. In the absence of RDA (Recommended Dietary Allowances) values, adequate intake (AI) values were used for: manganese, potassium, sodium, pantothenic acid and biotin.

[39] Dietary recommendations for the following reference individuals were used: Child 4 to 8 years old, male child 9 to 13 years old, adult female (19 to 50 years old) and adult male (19 to 50 years old).

Table 3.5: Calculated nutritional adequacy of the THFB and the MHFB for a family of four (adult male, adult female, younger and older child)

Category:	Nutritional component:	Measurement:	Reference values:				Thrifty healthy basket:	Moderate-cost healthy basket
			Young child	Older child	Adult male	Adult female		
Energy		% of EER[1]	6 500kJ/day	8 500kJ/day	10 500kJ/day	8 500kJ/day	94.2%	87.1%
Macro-nutrients:	Total carbohydrates	% of EER	Based on 17kJ/gram of carbohydrates[4,5]				62.4%	52.8%
	Total protein	% of EER	Based on 17kJ/gram of protein[4,5]				13.8%	18.9%
	Total fat	% of EER	Based on 37kJ/gram of carbohydrates[4,5]				20.7%	25.9%
Micro-nutrient: Minerals	Calcium (Ca) (mg)	% of RDA[2]	1000[4]	1300[4]	1000[4]	1000[4]	38.0%	59.6%
	Iron (Fe) (mg)	% of RDA	10[4]	8[4]	8[4]	18[4]	134.4%	107.7%
	Magnesium (Mg) (mg)	% of RDA	130[4]	240[4]	410[4]	315[4]	93.5%	90.6%
	Phosphorous (P) (mg)	% of RDA	500[4]	1250[4]	700[4]	700[4]	104.1%	133.7%
	Potassium (K) (mg)	% of AI	3.8[4]	4.5[4]	4.7[4]	4.7[4]	42.3%	51.0%
	Zinc (Zn) (mg)	% of RDA	5[4]	8[4]	11[4]	8[4]	181.0%	156.2%
	Copper (Cu) (mg)	% of RDA	440[4]	700[4]	900[4]	900[4]	147.7%	143.5%
	Manganese (Mn) (µg)	% of AI[3]	1.5[4]	1.9[4]	2.3[4]	1.8[4]	91.6%	84.3%
Micro-nutrient: Vitamins	Vitamin A (µg)	% of RDA	400[4]	600[4]	900[4]	700[4]	120.0%	114.0%
	Vitamin B1 (Thiamin) (mg)	% of RDA	0.6[4]	0.9[4]	1.2[4]	1.1[4]	168.5%	127.8%
	Vitamin B2 (Riboflavin) (mg)	% of RDA	0.6[4]	0.9[4]	1.3[4]	1.1[4]	106.8%	136.5%
	Vitamin B3 (Niacin) (mg)	% of RDA	8[4]	12[4]	16[4]	14[4]	222.6%	221.0%
	Vitamin B6 (mg)	% of RDA	0.6[4]	1[4]	1.7[4]	1.3[4]	421.0%	281.4%
	Folate (µg)	% of RDA	200[4]	300[4]	400[4]	400[4]	171.3%	127.1%
	Vitamin B12 (µg)	% of RDA	1.2[4]	1.8[4]	2.4[4]	2.4[4]	130.9%	255.8%
	Vitamin B5 (Pantothenic acid) (mg)	% of AI	3[4]	4[4]	5[4]	5[4]	152.5%	245.3%
	Vitamin B7 (Biotin) (µg)	% of AI	12[4]	20[4]	30[4]	30[4]	194.2%	229.7%
	Vitamin C (mg)	% of RDA	25[4]	45[4]	90[4]	75[4]	102.2%	142.1%
	Vitamin D (µg)	% of RDA	15[4]	15[4]	15[4]	15[4]	15.7%	31.9%
	Vitamin E (mg)	% of RDA	7[4]	11[4]	15[4]	15[4]	152.3%	160.7%

[1] EER = Estimated Energy Requirements; [2] RDA = Recommended Dietary Allowances; [3] AI = Adequate Intake; [4] Institute of Medicine (2005); [5] Klensin and co-workers (1989); [6] DoH (2013).

Added sugar contributes approximately 1.5% of the total energy in the healthy baskets. This value is in accordance with the SA FBDG (<6%) (Temple & Steyn, 2013), for individuals who could be considered as having an elevated risk of the adverse health implications of added sugar in the diet. The SA FBDG for salt specifies an average salt intake of less than 5g salt or less than 2g sodium per day (Wentzel-Viljoen et al., 2013). Compared to a daily family intake level of maximum 8g of sodium, the sodium content of the THFB and MHFB are 65.5% and 50.0%, respectively – thus adhering to the South African guideline.

3.3 RESULTS AND DISCUSSION

3.3.1 Healthy food baskets cost and inflation over time

From January 2013 to January 2019, the cost of the THFB for the four-member reference family increased by 32.6% to R2 515/household/month (Figure 3.3), which is slightly higher than the 30.1% increase in disposable income per capita of households from 2013 to 2018 (South African Reserve Bank, 2019) thus pointing towards an deteriorating ability to afford healthy eating over time. During this period the price increases for fruit were particularly high (+54.8%), followed by liquid dairy (+40.0%), starch-rich foods (+32.9%), animal-source foods (i.e. meat, fish, eggs) (+29.3%) and legumes (+30.0%). In the past, the cost of the THFB was comparable to values of the 'PACSA Minimum Nutritional Food Basket' for a family of four, e.g. R2 356 in September 2017 (compared to a THFB cost of R2 352) and R2 373 in May 2018 (compared to a THFB cost of R2 477) (PACSA, 2018; Smith et al., 2017). Cost differences between the 'PACSA Minimum Nutritional Food Basket' and the healthy food baskets developed in this thesis are mainly attributed to methodology differences, particularly geographical scope and basket composition.

From January 2013 to January 2019 the MHFB increased by 33.6% to R3 642/household/month (Figure 3.3), thus increasing by one percentage point more than the THFB – suggesting that increased dietary diversity is associated with slightly higher healthy food basket inflation. From January 2013 to January 2019 the MHFB was (on average) 43.6% more expensive than the THFB. The price premium associated with the MHFB is expected, seeing that this basket includes relatively more servings of fresh produce (vegetables and fruit), liquid dairy and animal-source foods (fish, chicken, meat, eggs and cheese) – typically representing the more expensive items in consumer food baskets.

Both the THFB and MHFB were more expensive than the Stats SA National Food Poverty Line (NFPL), which was defined (per person per month) as R386 in 2013, R417 in 2014, R441 in 2015, R498 in 2016, R531 in 2017 and R547 in 2018. PACSA (2018) also concluded that the typical food expenditure of households fell below the National Food Poverty line, while the per capita per month cost of their minimum nutritionally balanced food basket was above the NFPL.

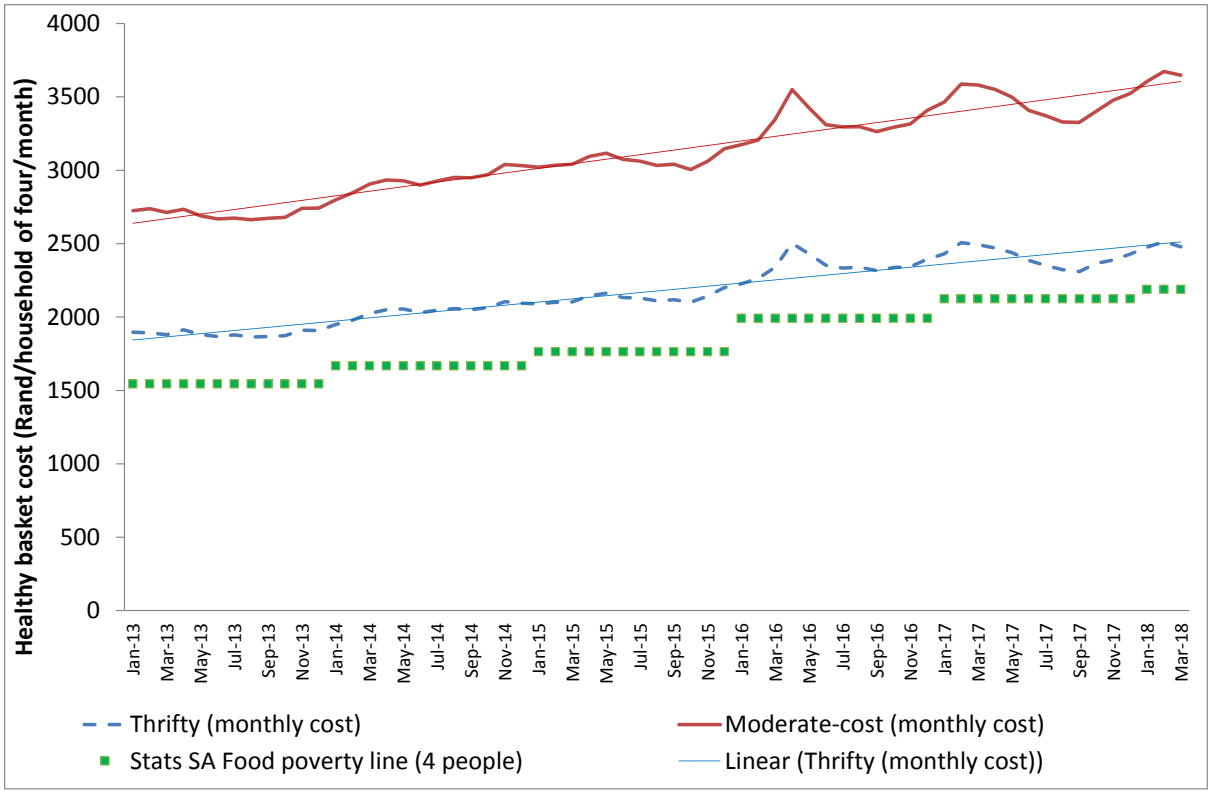

Figure 3.3: Nominal Rand value prices for the healthy food baskets (reference family of four), regarding the period January 2013 to January 2019 (Own calculations for the healthy food baskets; National Food Poverty Line data obtained from Stats SA (2018b)

Even though the healthy food baskets were consistently higher (i.e. more expensive) than the Stats SA NFPL from 2013 to 2018 (Figure 3.3) the price premium of the healthy food baskets above the NFPL has been decreasing over time. From 2013/2014 to 2017/2018 the price premium of the healthy food baskets above the NFPL has decreased from 22.3% to 12.5%, which can possibly be viewed as an indication that the NFPL is moving closer to becoming a more accurate measure of the cost of healthy eating in the South African context.

In the THFB, animal-source foods (28.3%), followed by vegetables (20.3%), starch-rich foods (18.5%) and liquid dairy (13.0%) made the largest contributions to total basket cost from 2013 to 2018 (Table 3.6). Animal-source foods dominated expenditure in relation to the MHFB (30.3% cost contribution), followed by vegetables (16.5%), liquid dairy (15.9%), fruit (12.2%) and starch-rich foods (8.3%) (Table 3.6). Thus, compared to the THFB, the MHFB had a higher cost contribution share from animal-source foods, liquid dairy and fruit – which was attributed to the increased dietary diversity of the MHFB.

From 2013 to 2018 some fluctuations were observed in terms of the contributions of the various food groups to the total healthy basket costs (Table 3.6). Notably the share contributed by starch-rich staples to the cost of the THFB was particularly high during the period impacted by the 2015/2016 drought that occurred in South Africa.

Table 3.6: Food group contributions to the healthy food basket costs – 2013 to 2018 (Own calculations based on Stats SA retail prices)

Thrifty healthy basket (THFB):							
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**Average 2013-2018**
Starch-rich foods	17.8%***(L)	17.7%***(L)	18.4%	20.4%***(H)	19.3%***(H)	17.4%***(L)	18.5%
Fish, chicken, meat, eggs	28.4%	28.4%	28.8%***(H)	26.5%***(L)	28.1%	29.3%***(H)	28.3%
Liquid dairy	12.7%	13.2%	13.3%	13.0%	13.0%	13.0%	13.0%
Fats, oils	3.9%***(H)	3.6%	3.5%***(L)	4.0%***(H)	3.7%	3.5%***(L)	3.7%
Fruit	8.1%	8.0%	8.1%	9.3%	9.7%***(H)	9.5%	8.8%
Vegetables	21.8%***(H)	21.8%***(H)	20.7%	19.5%	18.3%***(L)	19.9%	20.3%
Sugar	1.6%	1.5%	1.6%	1.7%	1.8%***(H)	1.7%	1.6%
Legumes	5.7%	5.9%***(H)	5.5%***(L)	5.6%	6.0%***(H)	5.8%	5.8%

Moderate-cost healthy basket (MHFB):							
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**Average 2013-2018**
Starch-rich foods	8.0%***(L)	8.0%***(L)	8.3%	9.3%***(H)	8.7%	7.7%***(L)	8.3%
Fish, chicken, meat, eggs	39.6%	39.5%	40.1%***(H)	37.4%***(L)	39.1%	40.3%***(H)	39.3%
Liquid dairy	15.5%	16.1%	16.2%	16.0%	15.8%	15.6%	15.9%
Fats, oils	2.7%	2.5%	2.5%	2.8%	2.6%	2.4%	2.6%
Fruit	11.3%***(L)	11.1%***(L)	11.3%***(L)	13.2%	13.5%	13.0%	12.2%
Vegetables	17.8%***(H)	17.7%***(H)	16.8%	16.0%	14.9%***(L)	15.9%	16.5%
Sugar	1.1%	1.0%	1.1%	1.2%	1.3%***(H)	1.2%	1.1%
Legumes	4.0%	4.1%	3.8%***(L)	4.0%	4.2%***(H)	4.0%	4.0%

**** Average value differs significantly from six year average value at p<0.00 (one-sided t-test)*

(H) = Value significantly higher than six year average value; (L) -= Value significantly lower than six year average value

The cost contribution of animal-source foods was particularly high in 2018. Meat prices spiked in 2018 due to various factors, including lagged impacts of the drought, farmers starting to rebuild their herds and the fact that export markets were still open before the outbreak of foot and mouth disease in 2019 (BFAP, 2018; BFAP, 2019).

The annual inflation rate on the MHFB was generally higher than the annual inflation rate on the THFB (Figure 3.4), with the most significant exception observed during the severe 2015/2016 drought in South Africa when staple food prices (particularly maize meal prices) rose significantly. The annual inflation rate of the healthy food baskets was lower than the inflation on the CPI for food and NAB for all urban areas in 70.5% of the 61 months from January 2014 to January 2019 Figure 3.4).

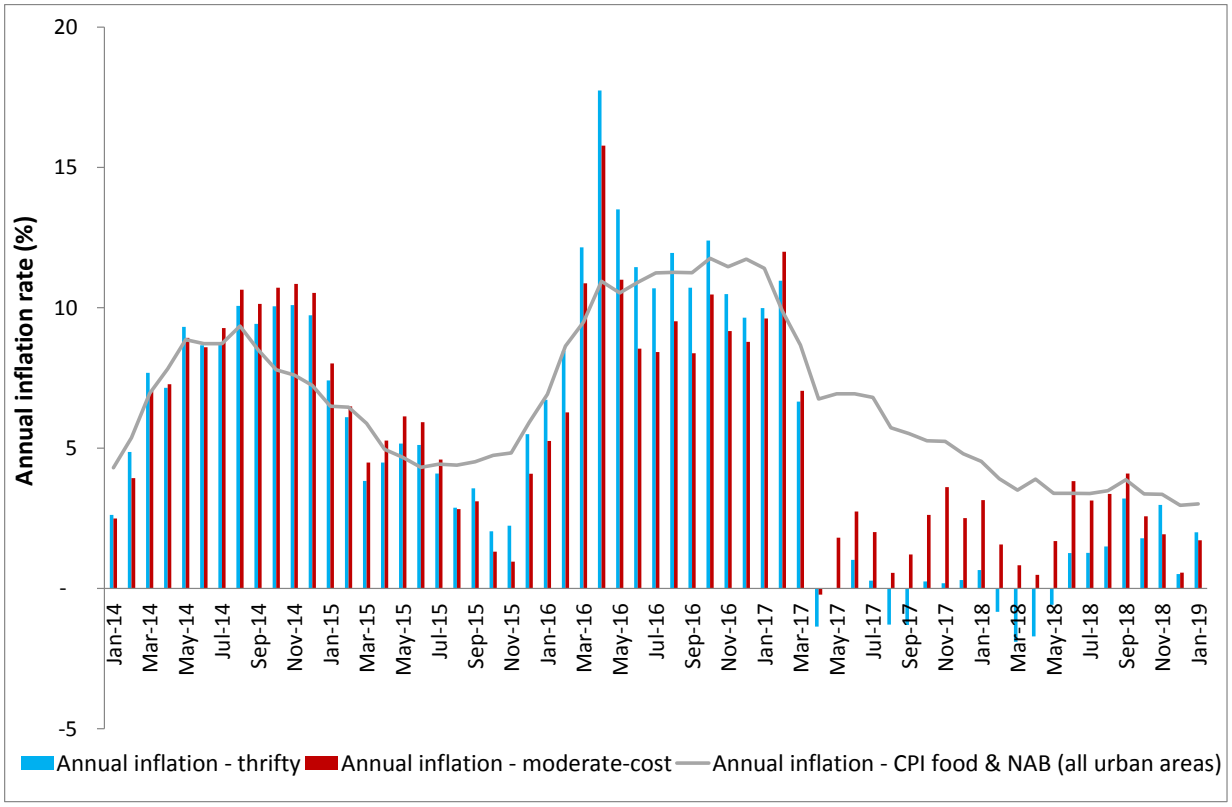

Figure 3.4: Annual inflation rates on the thrifty and moderate-cost healthy food baskets compared to the CPI for food and NAB (all urban areas) (January 2014 to January 2019) (Own calculations for the healthy food baskets and CPI data obtained from Stats SA (2019b))

Annual inflation on the healthy baskets exceeded CPI inflation on food and NAB in periods of higher food inflation, such as the 2015/2016 drought. These differences are rooted in the dissimilar product weights used to compile the CPI food and NAB (all urban areas) and healthy food baskets.

In the first half of 2017 a sharp drop in both CPI annual inflation, as well as the annual inflation on the healthy food baskets can be observed, linked to post-drought recovery in

some South African food market environments. During this period significant food retail price deflation on maize meal[40], vegetables (potatoes, onions, cabbage, carrots and tomatoes) and sunflower oil drove the decrease in food inflation on the healthy food baskets.

In the UK, Jones and co-workers (2014) concluded that for the period 2002 to 2012 the cost of healthier food items increased faster than less-healthy items. Healthier food items were also generally more expensive compared to less-healthy food options, thus rendering healthier diets less-affordable.

Comparing annual monthly values for 2013 and 2018, it is evident that the cost of certain food categories in the healthy food baskets increased more than others, particularly fruit (+51%), sugar (+38%), animal-source foods (+34%), liquid dairy (+31%) and legumes (+31%). The lowest cost increases were observed for fats / oils (+17%), vegetables (+18%) and starch-rich staple foods (+27%). The higher cost increases observed for fruit, animal-source foods and legumes could be detrimental to consumer ability to afford the necessary dietary diversity in their daily food intake as set out in the SA FBDG (Vorster, 2013). Williams (2010) also reported more severe price increases for fruit compared to other food options between 2000 and 2009 in Illawarra (Australia), noting the concern pertaining to this observation in view of a national initiative to promote the intake of vegetables and fruit.

3.3.2 Evaluating the affordability of the healthy food baskets

3.3.2.1 Evaluating the affordability of healthy food baskets in comparison to household income typologies

The following section explores the potential affordability of the compiled healthy food baskets in the South African context. The poorest 40% of households in South Africa (classified in Expenditure Decile (ED) 1 to 4) allocated approximately a third of total expenditure to food in 2010/2011 and 2014/2015 (with a high value of 35% reported in 2010/2011 for the poorest 20% of households), decreasing to approximately 23% for middle-income households and 8% for affluent households (Stats SA, 2012; Stats SA, 2017b) (Figure 3.5).

[40] During the post-drought recovery process maize prices declined significantly when the maize commodity market moved from shortfall and import parity (due to the drought) to all-time record crops in the subsequent season, pushing prices to export parity levels (BFAP, 2018).

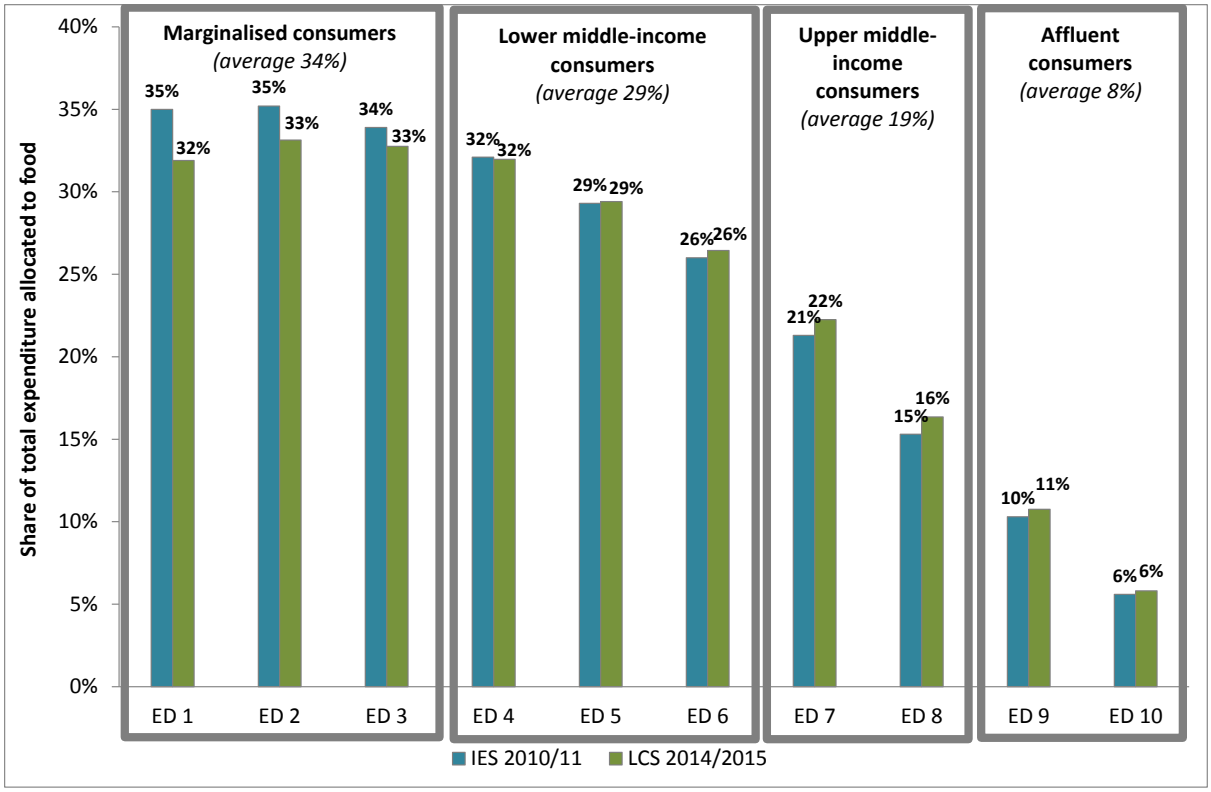

Figure 3.5: Typical food expenditure shares of socio-economic sub-segments in South Africa (Stats SA, 2017a; Stats SA, 2012)

Among female-headed households in a semi-rural settlement in the Limpopo province of South Africa, Mkhawani and co-workers (2016) reported that half of their sampled households had a food expenditure share of 50% - thus reporting a food expenditure share above the 35% (as mentioned above) for low-income households.

A household where two members are earning a minimum wage (earning R7 000 per month in total) can potentially be categorised as ED 6 to 7, typically spending up to 26% of total expenditure on food (Stats SA, 2017b). However, the food expenditure share of such a household can potentially increase significantly in the case of part-time or seasonal employment.

The affordability of the healthy food baskets in 2018 for the household income scenarios described in Table 3.4, is presented in Table 3.7. A healthy food basket is deemed affordable if the food expenditure share is 35% or lower for the particular household income scenario – corresponding to the highest food expenditure share value observed in the Stats SA household-level expenditure studies discussed above.

For a single adult male and a household consisting of two wage-earning adults, both the THFB and MHFB were affordable in 2018 with food expenditure shares of below 18% to 19% for the THFB and 27% to 29% for the MHFB. None of the household groupings with children could afford the MHFB in 2018 (even with child grants and school feeding taken into

consideration). The affordability challenge was the greatest for the single-parent household and the six-member family unit, which is a cause for grave concern.

In 2018, a single-parent household (mother and two children) and the six-member household could only afford the THFB if the households benefitted from child grants for both children, school feeding scheme benefits and an old age pension where relevant – with food expenditure shares of 35.1% and 33.9%, respectively being on or extremely close to the 'cut-off' value of 35% defined above. The reference family of four (two adults and two children) could afford the THFB with their two-person wage income. For such a household the food expenditure share varied from 34.0% (wage income only), to 31.2% (wage income supplemented with child grants), to 28.2 % (wage income supplemented with child grants and school feeding scheme benefits). In the context of Adelaide in Australia, Tsang and co-workers (2007) reported that the cost of a healthy food basket represented 35% of the average weekly earnings (in May 2005), while Williams (2010) reported a healthy food basket share of 31.9% (in 2009) in Illawarra (Australia) – thus these shares are comparable to the expenditure shares of up to 34.0% mentioned above for the reference family of four people with wage income from two workers. For scenarios with a food expenditure share close to 35%, any additional shocks (e.g. rapidly rising food prices or lower household income levels) can potentially move these household groupings into a range where even the THFB will not be affordable.

The analysis presented in Table 3.7 indicates that child support grants and an old age pension (where relevant) help to improve the affordability of the healthy food baskets. A single female pensioner could only afford the THFB in 2018, with a 33.3% food expenditure share. From the perspective of child support grants, the average monthly cost of the THFB for a child aged 4 to 10 years and aged 10 to 14 years in 2018 amounted to R566 and R775, respectively. In 2018, the child grant allocation of R410 per child per month was approximately 28% lower than the amount required to provide a basic (thrifty) balanced diet for a child aged 5 to 9 years. PACSA (2018) observed a comparable value of 31% for children aged 3 to 9 years. Thus, the child support grant is not adequate to cover basic food expenses or any other additional expenses. The healthy basket costs for children in 2018 were also higher than the current monthly per capita Stats SA National Food Poverty line of R547.

Table 3.7: Healthy basket affordability for different household income scenarios (2018)

Option:	House-hold Size:	Household structure:	Number of wage earners:	Child support grants?	Old age pension grant?	School feeding benefit?	Monthly household income implied:	Thrifty healthy basket:		Moderate-cost healthy basket:	
								Average cost 2018 (Rand/ month)	Share of household income:	Average cost 2018 (Rand/ month)	Share of household income:
1	1	1 adult male	1	No	No	No	R3 500	R655	18.7%	R1 004	28.7%
2	1	1 pensioner (female)	0	No	Yes	No	R1 700	R566	33.3%	R775	45.6%*
3	2	1 adult male 1 adult female	2	No	No	No	R7 000	R1 265	18.1%	R1 892	27.0%
4	3	1 adult female 2 children	1	No	No	No	R3 500	R1 742	49.8%*	R2 437	69.6%*
5	3		1	Yes	No	No	R4 320	R1 742	40.3%*	R2 437	56.4%*
6	3		1	Yes	No	Yes	R4 320	R1 516	35.1%	R2 127	49.2%*
7	4	1 adult male 1 adult female 2 children	2	No	No	No	R7 000	R2 441	34.9%	R3 554	50.8%*
8	4		2	Yes	No	No	R7 820	R2 441	31.2%	R3 554	45.4%*
9	4		2	Yes	No	Yes	R7 820	R2 205	28.2%	R3 222	41.2%*
10	6	1 adult male 1 adult female 3 children 1 pensioner	2	No	No	No	R7 000	R3 573	51.0%*	R5 103	72.9%*
11	6		2	Yes	Yes	No	R9 520	R3 573	37.5%*	R5 103	53.6%*
12	6		2	Yes	Yes	Yes	R9 520	R3 224	33.9%	R4 616	48.5%*

* Food expenditure share values above 35% are shown in red and marked with an *

3.3.2.2 Evaluating the affordability of healthy food baskets in comparison to typical household income levels across the socio-economic spectrum

Another approach that can be used to evaluate the affordability of the healthy food baskets involves a comparison with the typical household income levels across the socio-economic spectrum. Household income levels reported in Stats SA LCS 2014/2015[41] (Stats SA, 2017b) and the Establishment survey per SEM (socio-economic measurement) segment for 2016 have been adjusted to estimated 2018 income levels (The Broadcast Research Council of South Africa (BRC) & TNS, 2017; The BRC & TNS, 2019) by applying the growth rates in disposable income per capita of households between 2014 and 2018, as well as between 2016 and 2018 respectively (South African Reserve Bank, 2019). The household income level required to afford the THFB and MHFB in 2018 (reference family of four) were estimated by assuming a maximum food expenditure share of 35% as explained above.

Figure 3.6 and Figure 3.7 illustrate that the least wealthy 50% of households in South Africa (i.e. ED 1 to ED 5 and SEM 1 to SEM 4) could not afford the THFB in 2018. Only the wealthiest 40% of households could afford the MHFB (i.e. ED 7 to ED 10 and SEM 6 to SEM 10). This clearly illustrates that healthy eating is out of reach for a large share of the people in South Africa.

In order to purchase the healthy food baskets in 2018, a four member marginalised household had to spend approximately 62% of total income on food (increasing to 91% in the case of the MHFB) – thus not allowing adequate remaining budget for non-food expenses. The significant food affordability challenges facing lower income households are even more pronounced if the findings of Stats SA in 2015 are taken into consideration: i.e. that poor households (operating below the upper-bound poverty line) represented 40.0% of households in South Africa, with an average income approximately five times less than for non-poor households, higher food expenditure shares (30.0% versus 10.5% for non-poor households), as well as larger typical households (4.6 members versus 2.4 members for non-poor households) (Stats SA, 2017a).

[41] Income from work, capital, pensions, social insurance, family allowances, income from individuals, other income and imputed rent on owned dwelling (Stats SA, 2017a)

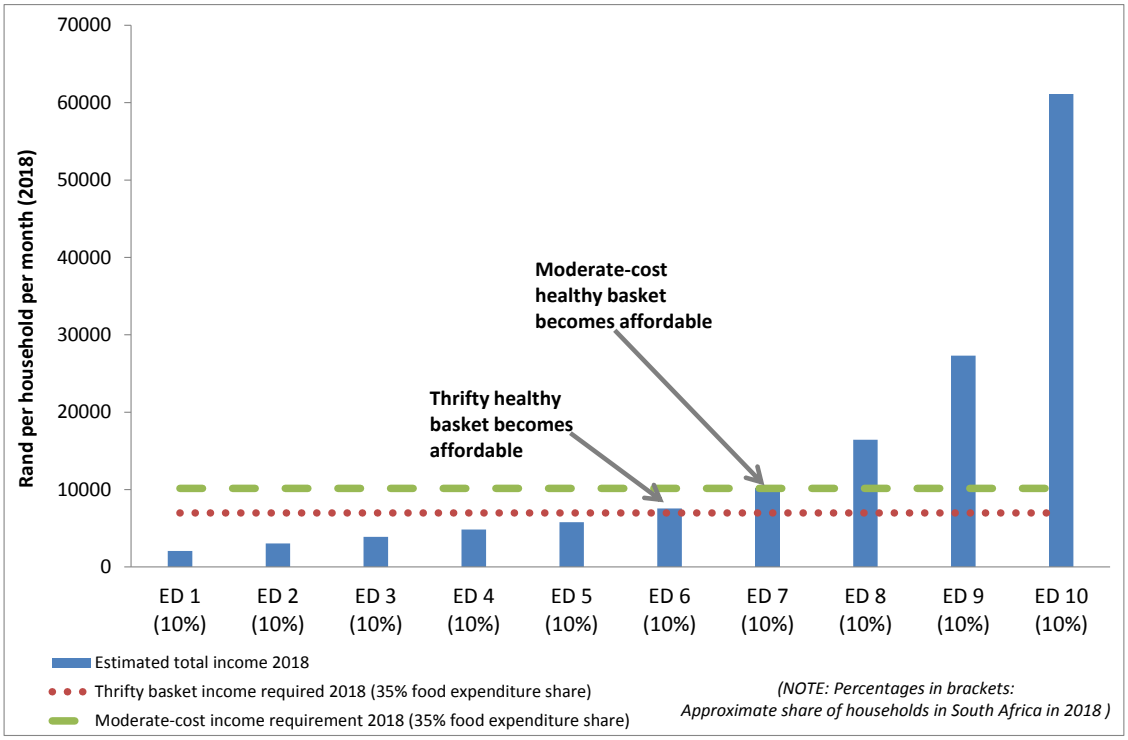

Figure 3.6: The affordability of the healthy food basket in 2018 across the socio-economic spectrum in South Africa from an ED perspective (Own calculations, Stats SA LCS 2014/2015)

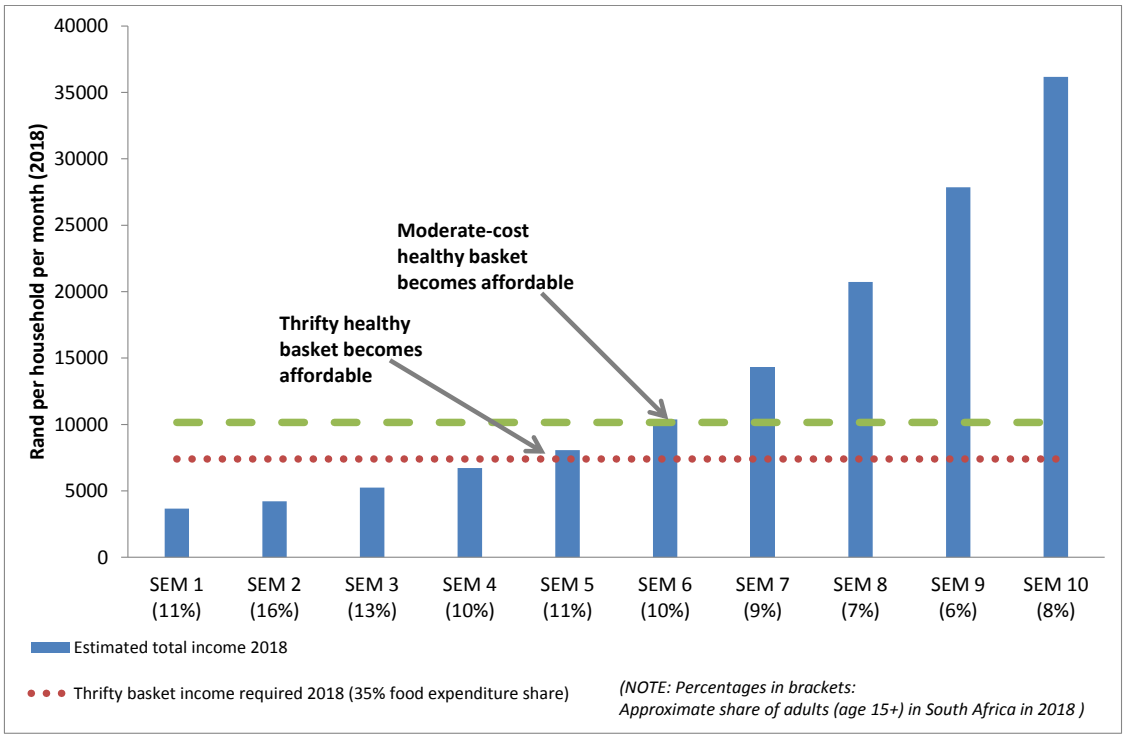

Figure 3.7: The affordability of the healthy food basket in 2018 across the socio-economic spectrum in South Africa from an SEM segment perspective (Own calculations, Establishment Survey 2018)

3.3.3 Estimating the gap between actual food expenditure and healthy basket costs

An analysis of the potential gap between actual food expenditure levels versus the cost of the thrifty basic healthy food basket and the MHFB in 2018 (focusing on the more socio-economically vulnerable section of the South African socio-economic spectrum), is illustrated in Figure 3.8. Actual food expenditure is estimated by applying typical food expenditure proportions from Stats SA LCS 2014/2015 (Stats SA, 2018) to estimated household-level income levels per SEM segment (BRC, 2017; BRC, 2019).

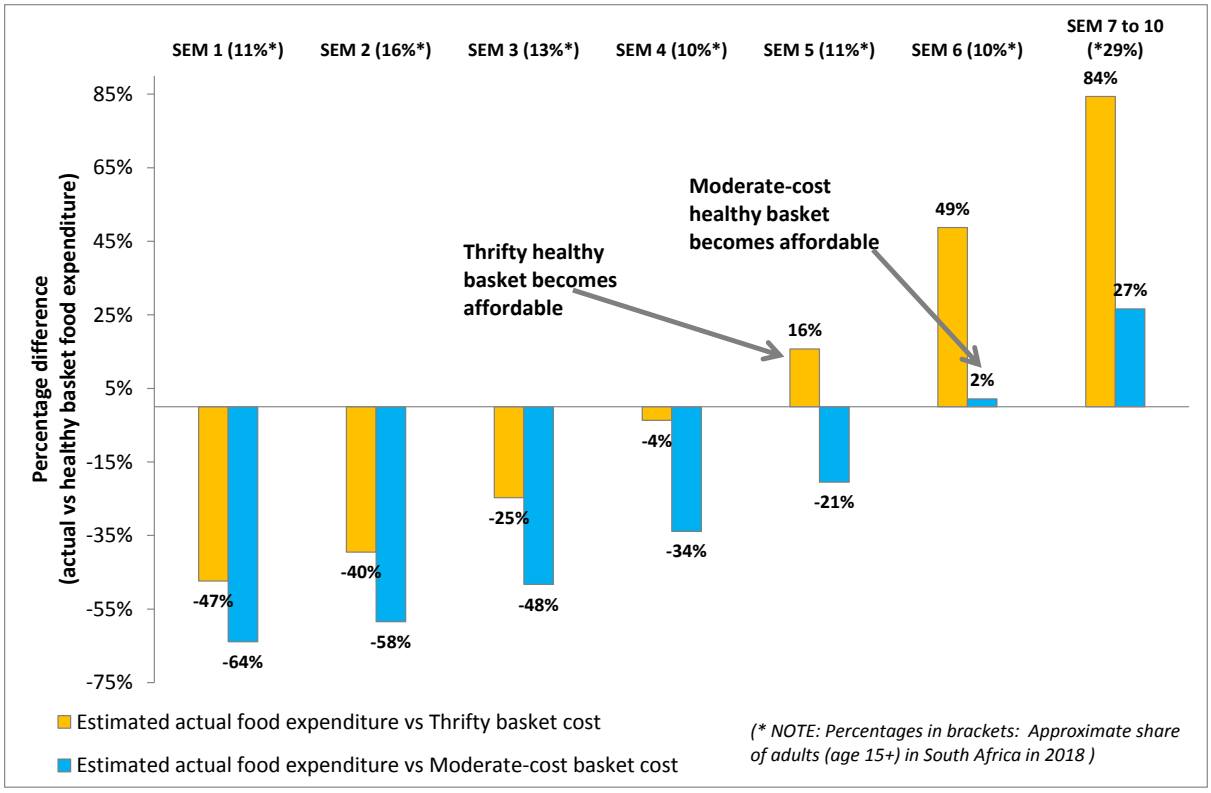

Figure 3.8: The gap between estimated actual food expenditure and the cost of basic healthy eating (2018) (Own calculations, Establishment Survey 2018)

In terms of the THFB, the healthy eating affordability gap is the most significant for marginalised consumers (SEM segments 1 and 2), with actual food expenditure up to 47% lower than the cost of the THFB. For SEM segment 3 (i.e. least affluent lower middle-income consumers) the healthy eating affordability gap is also significant (estimated at 24%), improving to -4% for SEM segment 4. Positive healthy eating affordability gaps (i.e. indicating the ability to afford the healthy food baskets) are observed from SEM segment 5 and higher up in the socio-economic spectrum (thus including approximately 50% of the population).

The healthy eating affordability gap for the MHFB is 64% for the least affluent tenth of the population, gradually becoming less negative up to SEM segment 6 (with a positive gap of 2%) – thus indicating an ability to afford the MHFB. However, the healthy eating

affordability gap for this group in terms of the MHFB is very close to zero – thus suggesting that consumers in SEM segment 6 could potentially move towards a negative healthy eating affordability gap if exposed to low income growth and / or significant rising food prices. Policy interventions targeting the improvement of the affordability of food and / or improved income levels can potentially contribute to improve the severe healthy eating affordability gaps as illustrated in Figure 3.8. Temple and co-workers (2011) concluded that the cost average premium of a specific healthier diet was 69% (in rural communities in the Western Cape province), comparable to the results of this study which shows that the cost of the THFB in 2018 was 59% higher than the typical food expenditure of the least affluent 50% of households in South Africa.

The analyses presented up to this point in the chapter have shown that approximately 50% of the South African population spends enough money on food to afford the THFB, while only approximately 40% of the South African population can afford the MHFB in view of their total food expenditure. However, adequate total food expenditure does not necessarily mean that the composition of household food baskets adhere to healthy eating principles. Consequently, it is also critical to consider the composition of household expenditure on specific food groups and food items (Section 3.4), to further investigate the gap between actual and more ideal eating patterns across the socio-economic spectrum.

3.3.4 Food group expenditure contributions

In the absence of recent nationally representative food intake data and also the absence of food intake data disaggregated in terms of the socio-economic spectrum for South Africa (Mchiza et al., 2015), the most recent household-level food expenditure data, namely the Stats SA LCS 2014/2015 was utilised to compare actual and more ideal (average THFB monthly values in 2014/2015) food expenditure patterns[42]. From 2013 to 2018, the THFB was dominated by fresh produce (29% contribution), followed by animal-source foods (24%), starch-rich staple foods (24%) and liquid dairy (13%) (Figure 3.9). A similar food group contribution was reported by Tsang and co-workers (2007) in relation to the Adelaide healthy food basket in Australia. The composition of the MHFB was dominated by animal-source foods (35%), followed by fresh produce (30%), liquid dairy (16%) and starch-rich staples (11%) – thus generally relying less on starch-rich staples and more on animal-source foods and fresh produce[43] (Figure 3.9).

[42] It is important to keep in mind that the total expenditure of a household on a particular food group is affected by the type of food items chosen, the prices of these food items, as well as the quantities purchased.

[43] To cover the potential cost of miscellaneous food used in meal preparation (e.g. spices, seasonings, condiments, baking supplies, soup, coffee, tea), 5% was added to the healthy basket costs in this section – to make the comparison with actual food expenditure patterns more realistic. A similar approach was followed in the development of a nutritious food basket for Ontario (Canada) (Ministry of Health Promotion Ontario, 2010).

According to Stats SA LCS 2014/2015, the food expenditure of marginalised and lower middle-income households was dominated by starch-rich staple foods (26% and 29%, respectively) and animal-source foods (i.e. fish, chicken, meat and eggs) (37% and 31%, respectively), followed by fruit and vegetables (7% and 6%, respectively). For upper middle-income and affluent households food expenditure is dominated by animal-source foods (33% and 37%, respectively), followed by starch-rich staples (25% and 17%, respectively) and fresh produce (6% and 10%, respectively).

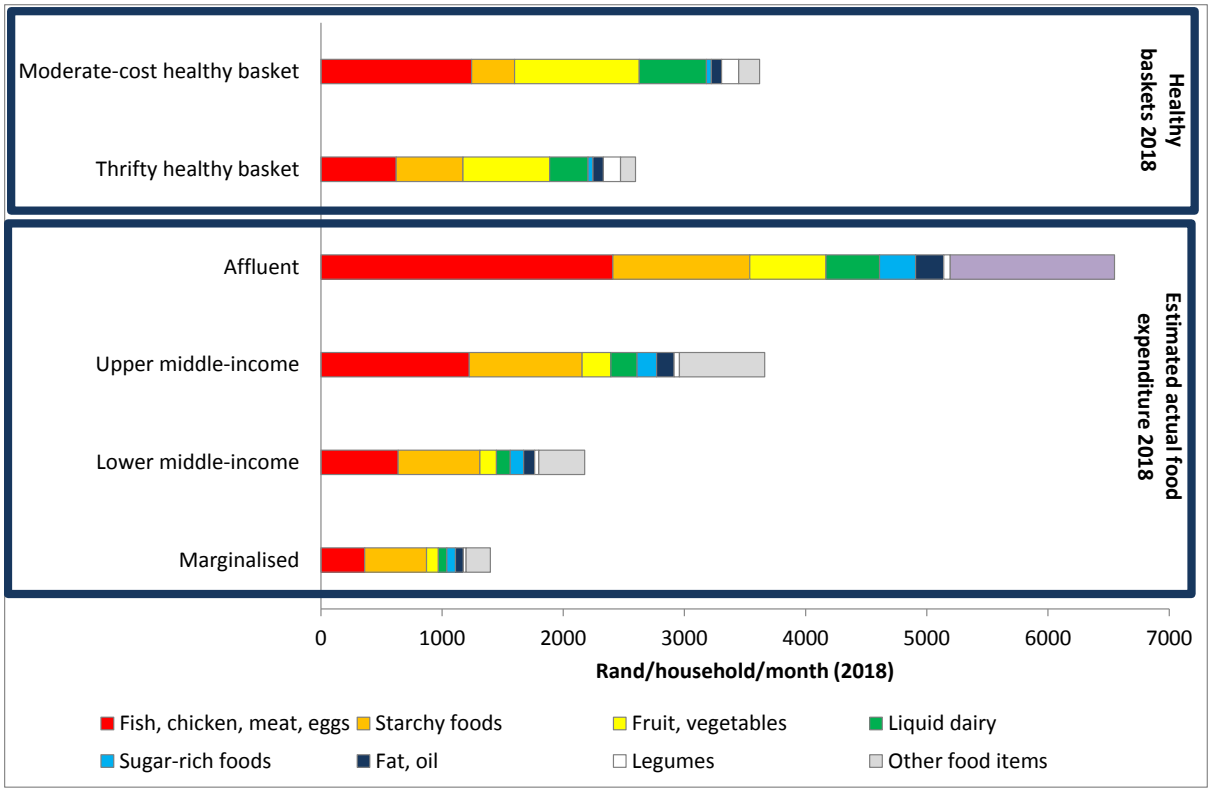

Figure 3.9: Contributions of various food categories to the total cost of the thrifty- and moderate-cost healthy food baskets (2018), compared to estimated household-level expenditure across the socio-economic spectrum in 2018 (Own calculations)

In general, rising affluence levels were associated with larger shares of food expenditure allocated to animal-source foods, fresh produce and liquid dairy, while decreasing food expenditure shares were observed for starch-rich staple foods, fats / oils, sugar and legumes (Figure 3.9). When we consider absolute expenditure levels, Table 3.8 presents a summary comparing the estimate actual expenditure of socio-economic consumer segments with the THFB.

Table 3.9 presents an overview of the top 20 individual food items typically purchased by the poorest 50% and most affluent 50% of households in South Africa (according to LCS 2014/2015), compared to the top 20 items contributing to the THFB cost in 2014/2015. The top 20 items included in the actual food expenditure of households overlapped with the THFB top 20 expenditure items in terms of animal-source foods (e.g. chicken, beef, fish,

eggs, milk), starch-rich foods (e.g. maize meal, bread, potatoes, wheat flour, rice), edible oils and vegetables (e.g. tomatoes). In general, compared to the THFB, the least wealthy half of the population spent larger food expenditure shares on starch-rich staples, edible oils and sugar.

Across the socio-economic spectrum total expenditure on starch-rich staple foods was adequate to afford the THFB. However, the food expenditure contribution shares from maize meal, bread, rice, wheat flour and potatoes were higher than for the THFB for the least affluent half of the population (Table 3.8). The reliance of lower-income households on starch-rich staple foods is widely acknowledged (Vorster, 2013).

Table 3.8: Comparing the actual expenditure on food groups by socio-economic consumer segments with the thrifty healthy food basket (Own calculations),

Food group:	**Marginalised consumers:**	**Lower middle-income consumers:**	**Upper middle-income and affluent consumers:**
Animal-source foods	*Lower*	Adequate	Adequate
Starch-rich staples	Adequate	**Higher**	Adequate
Fruit and vegetables	*Lower*	*Lower*	*Lower*
Liquid dairy	*Lower*	*Lower*	*Lower*
Fat, oil	*Lower*	**Higher**	Adequate
Legumes	*Lower*	*Lower*	*Lower*
Sugar	**Higher**	**Higher**	**Higher**

Expenditure was generally inadequate probably linked to low income levels and high food prices. Excluding the meat (Chapter 4) and starch groups (Chapter 5), food intake in 2018 was according to the Abstract of Agricultural Statistics (Department of Agriculture, Forestry and Fisheries - Directorate Statistics and Economic Analysis, 2019) as follows:

- The per capita intake from fruit and vegetables amounted to approximately 86 kg/capita/year, which was lower than the estimated 'ideal' intake[44] associated with these foods in the healthy food baskets (approximately 175 kg/capita/year);
- The per capita intake from dried beans amounted to approximately 2.1 kg/capita/year, which is lower than the estimated 'ideal' intake associated with legumes in the healthy food baskets (approximately 11 kg/capita/year);
- The per capita intake from fresh milk amounted to approximately 39 kg/capita/year, which is lower than the estimated 'ideal' intake associated with milk, maas and yoghurt in the healthy food baskets (approximately 73 kg/capita/year);
- The per capita intake from sugar amounted to approximately 35 kg/capita/year, which is higher than the estimated 'ideal' intake associated sugar in the healthy food baskets (approximately 6.4 kg/capita/year);

[44] Estimated by applying daily quantities prescribed in the "Guidelines For Healthy Eating" and SSU definitions.

- The three-year average (2016 to 2018) per capita intake of vegetable oil and peanuts (consumed in the form of peanut butter) in South Africa was 14.1 kg/capita/year (OECD/FAO, 2019), which is higher than the estimated intake of fats / oils in the healthy food baskets (approximately 11 kg/capita/year)

The CRIBSA (Cardiovascular Risk in Black South Africans) study (Jaffer et al., 2009) also concluded that the results of the daily intake from various food groups were particularly low for fruit / vegetables[45] and dairy[46] - approximately 50% and 75% below recommended levels, respectively. The daily intake from cereals[47] was closer to guideline levels. In a review of dietary surveys undertaken among adults in South Africa (2000 to 2015), Mchiza and co-workers (2015) also concluded that even though fresh produce and milk were among the ten most frequently eaten food items by South Africans, the number of portions consumed were well below recommended levels.

Thus, although items such as milk and certain fresh produce were part of both the top 20 food expenditure lists (for less and more wealthy consumers) (Table 3.9), as well as the most widely consumed items (as discussed above) the inadequate intake levels of particularly fresh produce and dairy, raises concerns regarding the dietary diversity and nutrient intake of South African consumers – particularly in lower income brackets.

Among female-headed households in a semi-rural village in the Limpopo Province of South Africa, Mkhawani (2016) found that all the sampled households commonly purchased maize meal, oil, salt, teabags, milk, bread and sugar, while 60% of households purchased chicken feet in bulk, frozen fish in bulk, Mopani worms, tinned fish, tomatoes, onions and cabbage. Significant overlap is evident when comparing this list of commonly purchased foods to the information presented in Table 3.9 for lower income households, with both sources mentioning maize meal, oil, milk, bread, sugar, chicken, fish, tomatoes, onions and cabbage.

In a review of dietary surveys in the adult South African population from 2000 to 2015, (Mchiza et al., 2015) it was concluded that the most frequently consumed items were added sugar, NAB (e.g. tea, coffee, fruit juice and cold drinks), starch-rich staple food (maize porridge, brown bread, white bread, rice, potatoes), full cream milk, margarine, fruit and vegetables (particularly cabbage, tomato and onion). Many of these items are part of the healthy food baskets developed in this thesis (specifically maize meal, brown bread, rice, potatoes, milk, margarine, fruit, vegetables and sugar (in moderation)) and are present in the top 20 expenditure items listed in Table 3.9 for the least- and most affluent households in South Africa.

[45] Daily intake of fruit and vegetables: males = 2.2 portions, females = 2.6 portions compared to a general recommendation of 5 portions per day (Jaffer et al., 2009; Mchiza et al., 2015).

[46] Daily intake of dairy: males = 0.5 portions, females = 0.4 portions compared to a general recommendation of 2 portions per day (Jaffer et al., 2009; Mchiza et al., 2015).

[47] Daily intake of cereals: males = 8.2 portions, females = 7.3 portions compared to a general recommendation of 10 portions per day (Jaffer et al., 2009; Mchiza et al., 2015).

Table 3.9: Overview of the top 20 food items typically purchased by the poorest 50% and most affluent 50% of households in South Africa, compared to the top 20 items contributing to the thrifty basket cost in 2014/2015 (Stats SA, 2017a)

Least affluent 50% of households:	Most affluent 50% of households:	Thrifty basket 2014/2015:
(The listed items accounted for approximately 78% of total food expenditure by this segment in 2014/2015)	*(The listed items accounted for approximately 66% of total food expenditure by this segment in 2014/2015)*	*(The listed items accounted for approximately 97% of the total cost of this basket in 2014/2015)*
Chicken (14.0%)	**Chicken** (11.1%)	**Chicken** (18.0%)
Bread (11.4%)	**Bread** (8.8%)	**Milk** (13.3%)
Maize meal (11.1%)	**Beef** (8.2%)	**Tomatoes (fresh)** (8.1%)
Rice (4.6%)	**Milk** (4.6%)	**Bread** (7.0%)
Granular **sugar** (4.5%)*	**Maize meal** (3.8%)	**Cabbage (fresh)** (6.6%)
Beef (4.0%)	*Aerated cold drinks* (3.5%)	**Maize meal** (6.5%)
Aerated cold drinks (3.7%)	**Fish** (2.6%)	**Beef** (5.1%)
Edible oils (3.3%)	**Rice** (2.5%)	**Onions** (5.0%)
Milk (2.9%)	Mutton, lamb (2.4%)	Beans dried (3.6%)
Potatoes (2.7%)	Granular **sugar** (2.3%)	Apples (3.4%)
Fish (2.5%)	Boerewors (2.3%)	**Eggs** (3.2%)
Eggs (2.3%)	**Eggs** (2.2%)	Bananas (3.1%)
Wheat flour (2.3%)	*Baked goods various* (1.9%)	**Edible oils** (2.7%)
Boerewors (1.5%)	*Breakfast cereals* (1.7%)	**Fish** (2.2%)
Sour milk, maas (1.4%)	Cheese (1.7%)	Baked beans in tomato sauce (2.1%)
Tomatoes (fresh) (1.4%)	**Edible oils** (1.6%)	**Rice** (1.8%)
Onions (1.0%)	**Potatoes** (1.4%)	Oranges (1.6%)
Cabbage (fresh) (1.0%)	Margarine (1.4%)	**White sugar** (1.5%)
Breakfast cereals (0.9%)	Fruit juices (1.2%)	**Wheat flour** (1.4%)
Baked goods various (0.9%)	**Wheat flour** (1.2%)	**Potatoes** (1.4%)

Notes:

- *Percentage in brackets refers to the expenditure contribution of the particular food item to total expenditure on food and NAB for the particular group considered.*
- *Products overlapping between the thrifty basket top 20 products and the actual expenditure patterns are shown in* **bold type**.
- *Less-desirable food items are shown in red italics.*
- ** A limited quantity of granular sugar is included in the THFB as set out in the "Guidelines For Healthy Eating", but it should be kept in mind that sugar is often included in the list of less-desirable food items from a healthy eating perspective – if not consumed in moderation as specified in the SA FBDG.*

For all socio-economic sub-groups expenditure on sugar and sugar-rich foods was higher than the sugar budget allocation within the THFB. The prominence of sugar and sugar-rich foods in the food baskets of South African consumers is also evident from the 2018 Nielsen Shoppergraphics Syndicated Report, listing sugar and ready-to-eat cereals (which are often high in sugar and other refined carbohydrates) among the items on which the highest amount is spent by the average household in South Africa (in addition to frozen chicken and long life milk). The tendency of lower income households to have a significant focus on products that provide inexpensive sources of energy such as sugar, margarine, oil and low-cost baked goods (that are high in sugar and fat) has been reported by Temple and Steyn (2009).

Across the socio-economic spectrum, several less-desirable food items[48] were included in the list of top 20 food items from a food expenditure perspective, (Table 3.9). The prominence of these foods is emphasised by the review of dietary surveys in the adult South African population from 2000 to 2015, with Tydeman-Edwards (2012), revealing that 'less-desirable' food items (e.g. rich in sugar, salt and/or processed foods) also appeared in the lists of most frequently consumed items among adults in 2012 (e.g. cold drinks, cake / biscuits, sweets / chocolates, stock and crisp chips). In 2014/2015, expenditure on aerated cold drinks (sugar-rich and artificially sweetened options combined) ranked highly (at positions seven and six) for the least affluent and more affluent segments, respectively. These were then also some of the motivational forces behind the tax on sugar-sweetened beverages imposed in South Africa that came into effect on 1 April 2018. The typical expenditure on granular sugar was higher for the most affluent half of the population, compared to the THFB basket in 2014/2015 –pointing towards an inflated reliance on sugar-rich foods among higher income groups in South Africa. A rising emphasis on processed foods is one of the typical manifestations of the nutrition transition (Drewnowski & Popkin, 1997). The nutrition transition typically increases the intake of fat, sugar, salt and energy of individuals, but does not really contribute diverse micronutrients to the diet. Negative health outcomes have been associated with the nutrition transition process, including the rising prevalence of obesity and non-communicable diseases (Shisana et al, 2014).

Dietary diversity generally increases with rising socio-economic status, as evident from household-level food expenditure data from Stats SA LCS 2014/2015 showing that the number of food products contributing 70% to total food expenditure of a particular segment increased from 15 food items[49] for marginalised consumers, to 20 food items[50] for lower

[48] Based on the potentially high sugar contents and high levels of processing of food items, including aerated cold drinks, processed breakfast cereals and baked goods.

[49] Staples (maize meal, brown bread, white bread, potato, wheat flour, rice), animal-source foods (chicken, beef, fish, eggs), liquid dairy (milk, fermented milk products), granular sugar, edible oil and fresh tomatoes.

[50] Staples (maize meal, brown bread, rice, white bread, wheat flour, potato, breakfast cereals), animal-source foods (chicken, beef, fish, eggs, pork, polony / Vienna sausages), liquid dairy (milk, fermented milk products), high-sugar foods (granular sugar, high-sugar foods e.g. jams, sweets, chocolates), fat / oil (edible oil, margarine) and fresh tomatoes.

middle-income households, to 25 food items[51] for upper middle-income households, to 39 food items[52] for affluent households (Stats SA, 2017a). The importance of income levels as a determinant of dietary diversity has been shown in numerous studies, where rising income is associated with greater dietary diversity and the inclusion of more non-staple food items (including items making meals more palatable) (Oldewage-Theron & Kruger, 2011; Bahadur KC et al., 2018; Legwegoh & Hovorka, 2013; Thorne-Lyman et al., 2010).

According to the 2012 SANHANES-1 (Shisana et al, 2014) the overall dietary diversity score for South Africans was 4.02, with the lowest dietary diversity scores observed in rural informal and urban informal areas (generally recognised to be associated with lower household income levels than in urban formal areas (Stats SA, 2017a)), as well as on a provincial level in the Eastern Cape, North-West, KwaZulu-Natal, Limpopo and Northern Cape. The Eastern Cape, KwaZulu-Natal and Limpopo are also the least affluent provinces in South Africa (The World Bank, 2018). Thus, the areas and provinces with lower dietary diversity scores mentioned above, affirm the association between household income levels and dietary diversity scores.

3.3.5 A geographically disaggregated (provincial) view on food affordability

When we consider the period January 2009 to April 2019, monthly year-on-year inflation on food and NAB was the highest in the Northern Cape, followed by the Eastern Cape, Free State and Western Cape Provinces of South Africa (see Table 3.10). The Northern Cape and Eastern Cape also had high incidences of food inflation rates above total country food inflation. The lowest food inflation rates are observed for the North-West province, followed by KwaZulu-Natal, Mpumalanga and Limpopo.

Food inflation variations between provinces could result from food price differences and / or differences in the typical food expenditure patterns within the various provinces (Figure 3.10). Based on household-level expenditure data obtained from Stats SA LCS 2014/2015, provinces such as the Western Cape, Northern Cape, Free State, Mpumalanga and Gauteng have a relatively larger expenditure allocation to animal-source foods (chicken, meat, fish, eggs and dairy), while provinces such as Limpopo, Eastern Cape, KwaZulu-Natal, North-West and Mpumalanga have relatively larger expenditure allocation to bread and cereals (with a strong focus on maize meal) as well as on fats / oils.

[51] Staples (brown bread, maize meal, white bread, rice, potato, wheat flour, breakfast cereals, baked goods e.g. rusks, biscuit, crackers), animal-source foods (chicken, beef, eggs, fish, mutton/lamb, pork, polony / Vienna sausages), dairy (milk, fermented milk products, cheese), high-sugar foods (granular sugar, high-sugar foods e.g. jams, sweets, chocolates), fat / oil (edible oil, margarine) and vegetables (fresh tomatoes, fresh onions, mixed vegetables).

[52] Staples (brown bread, white bread, breakfast cereals, maize meal, rice, baked foods (rusks, biscuits, crackers), potato, cakes / tarts, bread (whole-grain & other), pasta, wheat flour), protein foods (beef, chicken, mutton / lamb, fish, pork, eggs, polony / Vienna sausages, biltong / dried sausage, bacon, ham), dairy (milk, cheese, yoghurt, fermented milk products), high-sugar foods (high-sugar foods e.g. jams, sweets, chocolates, granular sugar), fat / oil (edible oil, margarine, peanut butter), vegetables (fresh tomatoes, fresh onions, mixed vegetables), fruit (apples, bananas) and baked beans.

Table 3.10: Overview of CPI inflation on food and NAB in the provinces of South Africa (January 2009 to April 2019) (Own calculations based on Stats SA CPI April 2019 release)

	Ranking - average food inflation* Jan 2009 to April 2019	Food inflation in province higher than total country food inflation (Jan 2009 to April 2019) (% of 124 months)
Northern Cape	6.8% (1) (Highest)	58.1% (2)
Eastern Cape	6.7% (2)	56.5% (3)
Free State	6.6% (3)	64.5% (1) (Highest)
Western Cape	6.5% (4)	54.0% (4)
Gauteng	6.4% (5)	51.6% (5)
Limpopo	6.3% (6)	43.5% (7)
Mpumalanga	6.3% (7)	42.7% (8)
Kwazulu-Natal	6.3% (8)	46.0% (6)
North-West	6.0% (9) (Lowest)	31.5% (9) (Lowest)

** Average monthly year-on-year inflation rate on food and NAB*

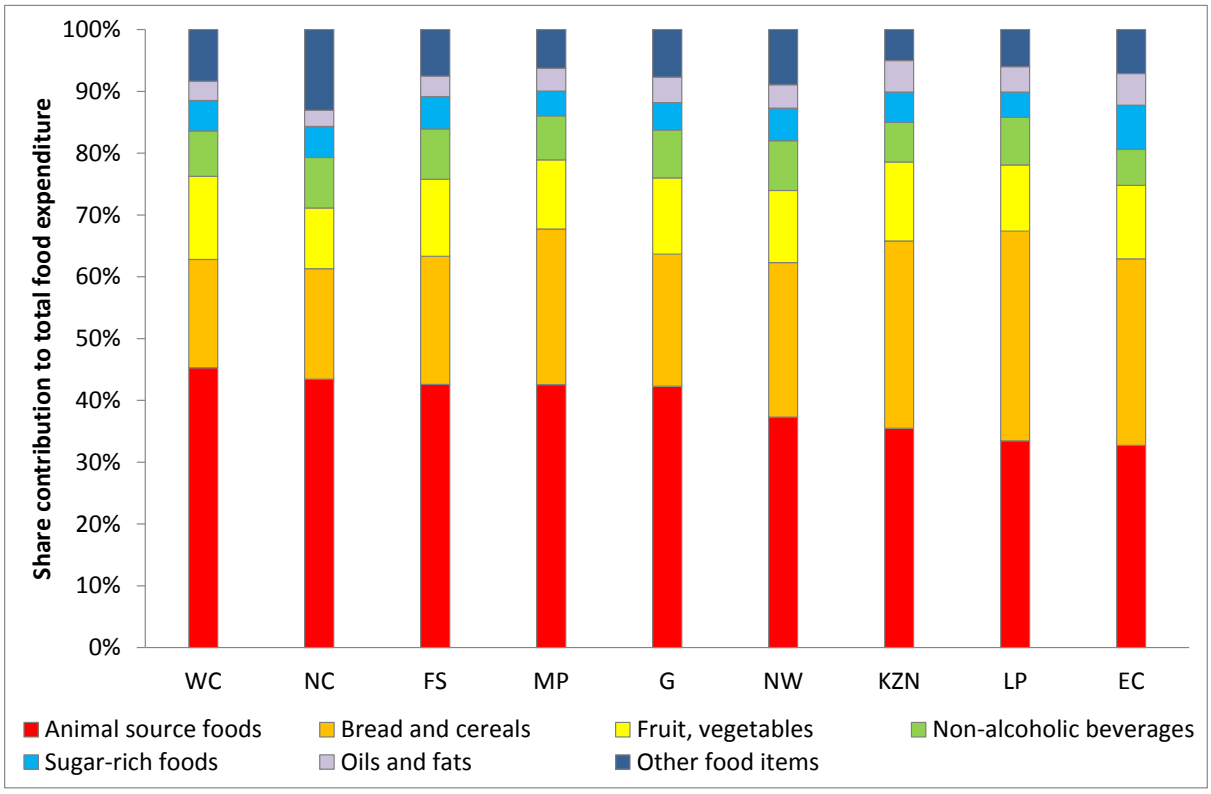

Figure 3.10: The composition of food expenditure in the provinces of South Africa according to Stats SA Living Conditions Survey 2014/2015 (Stats SA, 2017a)

Examples of other interesting differences in the food expenditure patterns in the provinces are summarised in Table 3.11 (based on Stats SA LCS 2014/2015). The data presented in this section suggest differences in both the food inflation rates in the various provinces in South Africa, as well as difference in the typical food expenditure patterns in the provinces. Thus, ideally the healthy food basket methodology should be applied for each province separately, to evaluate the affordability of healthy eating at a provincial level. This can potentially enable affordability evaluation against the household income levels specific to

the various provinces[53]. However, the Stats SA food retail price observations are not at present available at a provincial level, thus preventing healthy food basket calculations at a provincial level.

Table 3.11: Examples of food preferences in the various provinces of South Africa based on Stats SA LCS 2014/2015 (Stats SA, 2017b)

Food item:	**Relatively more popular (i.e. relatively larger expenditure share allocation) in:**
Maize meal	Limpopo, Mpumalanga, KwaZulu-Natal, North-West, Free State, Eastern Cape
Rice	Eastern Cape and KwaZulu-Natal
White bread	Western Cape
Wheat flour	Eastern Cape and Northern Cape
Baked goods and baked cereals	Western Cape and Gauteng
Potatoes	Western Cape, Eastern Cape and KwaZulu-Natal
Dried beans and samp	Eastern Cape and KwaZulu-Natal
Fish (fresh, chilled, frozen)	Western Cape
Canned pilchards	Limpopo
Yellow cheese	Western Cape
Pork	Western Cape and Free State
Mutton/lamb	Northern Cape and Western Cape
Sour milk, maas, Amageu	Eastern Cape and KwaZulu-Natal
Cabbage	Eastern Cape and Limpopo
Aerated cold drinks	Limpopo, Mpumalanga, Gauteng, North-West

3.4 CONCLUSIONS

While the South African CPI monitors changes in the cost of food and NAB based on typical average food expenditure ratios (Stats SA, 2017c), no nationally applied tool could be found that monitors the cost of basic healthy eating in the South African context on a regular basis. To address this gap, a food basket model was developed of healthy (nutritionally balanced) eating with the primary objective to measure the cost of basic healthy eating at a national level on an on-going monthly basis.

Two fundamental building blocks of the healthy food baskets were the official South Africa nutrition recommendations[54] and typical (socio-economically disaggregated) food purchasing patterns[55] within the South African context. Healthy basket costing was based on the official urban retail prices monitored by Stats SA, after which affordability and accessibility of foods were subsequently analysed by comparing healthy food basket costs to

[53] According to Stats SA LCS 2014/2015 the average total expenditure of households in less-affluent provinces such as Limpopo, North-West and the Eastern Cape was approximately 56% lower than for the most affluent provinces (Western Cape and Gauteng) (Stats SA, 2017b).

[54] Specifically based on the SA FBDG (Vorster et al., 2013), as well as the "Guidelines For Healthy Eating" of the National DoH (DoH, 2013).

[55] In the absence of recent, nationally representative and socio-economically disaggregated food intake data, typical food purchasing patterns were deduced from Stats SA household-level expenditure data obtained from the IES 2010/2011 (Stats SA, 2012) and LCS 2014/2015 (Stats SA, 2017a).

selected typical household income scenarios (including income earned through labour activities, as well as social benefits). The healthy (nutritionally balanced) food baskets developed in this thesis should be viewed as a tool to develop a benchmark cost of healthy eating in the South African context within the limitations of the stated and accepted assumptions, and should not be viewed as a 'recommended menu' – in view of the actual complexity of consumer food intake behaviour (Ministry of Health Promotion Ontario, 2010). Ideally, individuals and households should apply the SA FBDG (Vorster et al., 2013) and "Guidelines For Healthy Eating" (DoH, 2013) in ways that fit their unique food preferences and circumstances, ideally consuming a much wider range of foods than only the items contained in the healthy food basket models.

Two healthy food basket models were developed in this thesis, with both models containing food items from all the food groups[56]: The THFB represents a more economical option with proportionally more starch-rich staple food units, while the MHFB has proportionally more units of vegetables, fruit, liquid dairy, as well as animal-source foods (fish, chicken, meat, eggs and cheese) compared to the THFB. Key findings of this chapter are summarised below.

Key findings 1: Cost of the THFB

From January 2013 to January 2019 the cost of the THFB for the four-person reference family increased by 32.6% to R2 515[57] per month. During this period the dominant cost contributions came from animal-source foods, followed by vegetables, starch-rich staple and liquid dairy.

Key findings 2: Cost of the MHFB

The cost of the MHFB increased by 33.6% to R3 642 per month during this period (it, therefore, was on average 43.6% more expensive than the THFB during this period due to more extensive dietary diversity). Animal-source foods, followed by vegetables, liquid dairy and fruit generally dominated the cost of the MHFB, with higher cost contributions than observed for the THFB for animal-source foods, liquid dairy and fruit (attributed to the higher dietary diversity of the MHFB).

Key findings 3: Inflation rate comparisons

In general, the annual monthly inflation rate on the healthy baskets exceeded CPI food inflation, due to differences in the product category weights applied to compile the CPI food and NAB (all urban areas) and the healthy food baskets. The more severe inflation observed for fruit, animal-source foods, liquid dairy and legumes in the healthy food baskets from 2013 to 2018 could have had negative implications for household-level dietary diversity.

[56] Food groups: Starch-rich staples, animal-source foods (meat, chicken, fish and eggs), liquid dairy, fresh produce (fruit and vegetables), fats / oils and legumes (dried beans, peas, lentils and soya). Included in the SA FBDG as a 'cautionary guideline', small quantities of sugar are also contained in the food plans of the DoH "Guidelines For Healthy Eating", even though high-sugar foods are not recognized as an official food group.

[57] The healthy basket costs were calculated from national average Stats SA food retail prices. However, if the food purchasing behaviour of a household has a strong focus on 'shopping around' between retailers for the best prices, the monthly cost of the healthy baskets could potentially be reduced to some degree. According to Nielsen (2018) 'shopping around' for best food prices is a prominent coping strategy for households.

Key findings 4: Inadequate Food Poverty Line

The monthly cost per capita of the THFB and the MHFB were higher than the Stats SA Food Poverty Line values from 2013 to 2018, thus implying that the national FPL is too low to enable individuals to buy adequate food to consume a satisfactory diet.

Key findings 5: Healthy basket affordability in terms of household income typologies

In 2018, based on a maximum 'cut-off' food expenditure share of 35% (as deduced from Stats SA IES 2010/2011 and LCS 2014/2015), the THFB was affordable to:

- A single adult male earning a minimum wage (approximately 19% food expenditure share);
- A 2-member household with an adult male and female earning two minimum wages (18% food expenditure share);
- A female pensioner (33% food expenditure share);
- A 4-member reference family (adult male, adult female, older child and younger child) (35% food expenditure share);
- A female-headed single parent 3-member household (one minimum wage income), also receiving child support grants and children receiving the benefit of school feeding;
- A 6-member household (parents, 3 children and a pensioner) with two minimum wage income sources, also receiving child support grants, an old age pension and children receiving the benefit of school feeding.

The MHFB was only affordable to a single adult male and the 2-member household (with food expenditure shares of 29% and 27% respectively). The analysis confirmed the increased pressure on households to afford basic healthy eating associated with larger household size as was also concluded by (Rose & Charlton, 2002b).

Key findings 6: Healthy basket affordability in terms of household income across the socio-economic spectrum

Based on a maximum food expenditure share of 35% for a reference family of four, the monthly household income required in 2018 to be able to afford the healthy baskets was approximately R7 400 monthly income for the THFB and R10 150 monthly income to purchase the MHFB, thus only representing an affordable option for the more affluent 50% and 40% respectively, of South African households (as was illustrated in Figure 3.6 and Figure 3.7. The estimated actual food expenditure was 47% lower than the cost of the THFB in 2018 and up to 64% lower than the cost of the MHFB, improving gradually towards middle-income segments. Temple et al. (2011) and Temple and Steyn (2009) also concluded that a healthy diet was not affordable for the majority of households in South Africa.

Key findings 7: Mounting pressure on consumers

In cases where the THFB (i.e. basic healthy eating) represented approximately 35% of the total expenditure, any additional shocks (e.g. rapidly rising food prices or lower household income levels) could move these household groupings into a space where even the THFB

would not be affordable any longer. Furthermore with South African consumers exposed to 'stress factors' such as rising fuel costs (Stats SA, 2019d), rising electricity costs (ESKOM, 2019) and an increased VAT (value added tax) rate since 1 April 2018 (South African Revenue Service (SARS), 2019), the pressure on the household budget share available for food purchasing has been increasing tremendously in recent years. According to Nielsen (2019) spending less on gas and electricity was a popular countermeasure among South African households to cope with rising utility costs. Such actions could affect consumer food intake if food options with shorter cooking times or no cooking times might become desirable. In certain cases this could be to the detriment of nutritional intake, for example of maize meal with a longer cooking time (but which is fortified with essential vitamins and minerals), are partially or fully replaced by white rice which is not fortified and thus makes a less-diversified micronutrient contribution to the diet.

Key finding 8: Comparing healthy food baskets to typical food expenditure

The items commonly purchased by households shown in Table 3.9, overlapped with numerous other literature sources dealing with the most widely consumed food items in South Africa (Mkhawani et al., 2016; Mchiza et al., 2015). The least affluent half of the South African population generally spent more on staples, edible oils and sugar (than the expenditure levels in the THFB), while having spent inadequately on animal-source foods, liquid dairy, fresh produce and legumes. These consumers generally have a high reliance on starch-rich staples (Vorster, 2013) as well as inexpensive sources of energy (i.e. low-cost energy-dense foods) such as sugar, margarine, oil, low-cost baked goods (e.g. cookies) and peanut butter (Temple & Steyn, 2009). However, they were not able to spend sufficient money on food to be able to afford the THFB.

The more affluent half of the population generally had adequate expenditure on starch-rich staples, animal-source foods and fats / oils, but lower expenditure levels than required to buy the THFB for liquid dairy, fresh produce and legumes. Across the socio-economic spectrum the estimated expenditure levels on fresh produce (fruit and vegetables), liquid dairy and legumes were lower than the expenditure levels required to afford the healthy food baskets. The inadequate intake of dairy and fresh produce in South Africa has been confirmed by Mchiza and co-workers (2015).

It is critical to keep in mind that even if a household spends enough on a particular food group to be able to afford the THFB or the MCHF this does not mean that the food choices of the particular household adhere to the SA FBDG. Chapters 4 to 6 of this thesis will apply the principles of the healthy food basket models to assess whether the intake of starch-rich staples and animal-source foods (representing the two largest food expenditure categories for households), by South African consumers adheres to the SA FBDG.

Key finding 9: Nutrition transition is a reality

Ronquest-Ross and co-workers (2015) concluded that from 1994 to 2012, along with upward consumer mobility, the most significant shifts in per capita consumption of food in South Africa were observed for selected animal-source foods (poultry, pork, eggs and fish),

fats / oils, packaged foods (e.g. sauces, dressings and condiments, sweet snacks, savoury snacks) and soft drinks. The presence of aerated cold drinks, breakfast cereals and baked goods among the top 20 food expenditure items of South African consumers (see Table 3.9) confirmed the importance of these items in the food baskets of South African consumers, as a typical manifestation of the nutrition transition process – which is increasingly associated with the increased prevalence of obesity and non-communicable diseases in the population (Shisana et al, 2014). These 'less-desirable' food items typically increase the intake of fat, sugar, salt and energy while contributing minimal micronutrients to the diet.

Food-away-from-home intake also contributes significantly to the nutrition transition process, generally recognized as selling inexpensive energy-dense food providing additional sources of fat (saturated and trans-fats in particular), refined carbohydrates, simple sugars and salt in diets (Nnyepi et al., 2015). According to household-level food expenditure data from the Stats SA LCS 2014/2015, the out-of-home food expenditure of middle-income and affluent segments were five times and fourteen times higher, respectively, than for marginalised consumers (Stats SA, 2017b). Furthermore the South African take-away / fast food sector has experienced significant growth with food sales at take-away and fast food outlets increasing by approximately 30% (after accounting for inflation) from 2008 to 2018 (Stats SA, 2019c).

A more detailed discussion of the evidence pointing towards the nutrition transition in South Africa developed in this thesis will be presented in the concluding chapter (Chapter 7) of this thesis.

Final remarks

Household income constraints combined with high and rising food prices lead to mounting pressure on the ability of lower income households in particular to afford a nutritionally balanced and adequate diet, as well as other critical expenses such as medical expenses, electricity and school fees (Mkhawani et al., 2016). Healthy eating is often hindered by numerous factors, such as the premium price associated with healthy food choices, a preference for low-cost foods with a high energy density (e.g. sugar, oil, low-cost cookies) to obtain enough energy despite limited budgets, as well the attractiveness of less-healthy food items with a high energy density due to taste- and convenience appeal (Temple & Steyn, 2009). Future research could focus on developing an improved understanding of consumer behavioral drivers of food choice (especially in the nutrition transition perspective), as well as knowledge and perceptions regarding healthy eating – to inform policies, consumer education and to enhance healthy eating in the South African context across the socio-economic spectrum.

Food poverty and insecurity is inversely related to a decreasing income and increasing household size (Rose & Charlton, 2002b; Williams, 2010). Poor nutrition affects health outcomes, such as mental development, productivity, income generating potential, academic achievement, morbidity and mortality rates in women and children and chronic disease prevalence (Nelson, 2000) – ultimately impacting on the social- and economic environment within a country.

The healthy food basket models developed in this thesis have been shown to be a useful tool to assess the affordability of basic healthy eating, as well as the gap between actual food intake and basic healthy eating in the South African context across the socio-economic spectrum. Through quantitative results (e.g. cost of healthy eating, share of population excluded from healthy eating) a valuable contribution can be made to the food security debate in South Africa with the potential to aid in the improvement of food security.

The adaptability of the models was also illustrated to accommodate variations in household size and household composition. Furthermore the healthy food basket models were also shown to be useful to assess adequacy of social assistance (e.g. child support grants and old age pensions) and minimum wage income levels. An improved understanding of the cost of basic healthy eating (updated on a regular basis) could enhance the success of health promotion activities, if healthy food affordability could be improved through appropriate public health policy interventions. The importance of monitoring the affordability of healthy eating is even more pronounced when we consider the potential future impact of climate change on rising food inflation (Ringler et al., 2010; Haile et al., 2017).

Food- and nutrition security are complex and multi-faceted concepts which are influenced by a diverse range of factors, such as social factors, economic factors, the physical environment, production methods, retail industry structure, social welfare policies, culture and cultural change, technological change, the behaviour of individuals and food affordability. Facing numerous pressure factors such as income pressure, rising food prices, rising fuel prices, rising electricity prices, urbanisation and time constraints fuelled by busy lifestyles, many South African consumers are facing a significant and increasing challenge to achieve an acceptable level of basic healthy eating. Potential policy interventions to improve the affordability of healthy eating in South Africa will be addressed in the concluding chapter of this thesis (Chapter 7).

To further illustrate the applicability of the healthy food basket approach, Chapters 4 to 6 applied the principles of the healthy food baskets in two case studies to investigate whether the starch-rich staple food intake and animal-source food intake (with specific references to meat, fish and eggs) adhere to the SA FBDG. These two food groups were selected as application case studies because they represent the two dominant household food expenditures in South Africa. The concluding chapter (Chapter 7) presents overarching conclusions on the thesis and a literature-based review on potential policy actions relevant in the context of food affordability improvement.

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CHAPTER 4: CASE STUDY 1 - DOES THE STARCH-RICH STAPLE FOOD INTAKE OF SOUTH AFRICAN CONSUMERS ADHERE TO THE FOOD-BASED DIETARY GUIDELINES?

4.1 INTRODUCTION

This thesis started out with an introductory discussion of food intake within the dynamic socio-demographic consumer landscape in South Africa (Chapter 2), followed by a description of the food basket models that were developed and applied to measure the cost of basic healthy (nutritionally balanced) eating in South Africa at a national level (Chapter 3). Starch-rich foods and animal-source foods (chicken, meat, fish and eggs) are the dominant expenditure categories for South African consumers, contributing approximately 25% and 31%, respectively of average food expenditure according to the Statistics South Africa (Stats SA) Living Conditions Survey (LCS) 2014/2015 (Stats SA, 2017a). More specifically among the marginalised and lower middle-income consumer segments in South Africa, starch-rich foods make the largest contribution to total food expenditure among all the food groups (Stats SA, 2017a). From a food intake perspective starch-rich foods (specifically maize porridge, brown bread, white bread and potatoes) and selected animal-source foods (chicken meat and eggs) are among the top ten most frequently consumed food items in the South African context (Mchiza et al., 2015). Starch-rich foods and animal-source foods were selected as the focus for two case studies in which the principles of the healthy food basket models were applied to investigate whether the staple food intake (Chapter 4) and the intake of animal-source foods (Chapter 5) of South African consumers adhere to the South African Food-based Dietary Guidelines (SA FBDG).

The SA FBDG "Make starchy foods part of most meals" aims to encourage the consumption of adequate dietary carbohydrates obtained from starch-rich foods that are whole-grain[58], minimally processed, traditional and/or indigenous) (Vorster, 2013). Starch-rich foods typically consumed in South Africa are maize-based foods (e.g. maize meal prepared as porridge, maize rice, samp[59], maize on the cob), wheat-based foods (e.g. white bread, brown bread, whole-grain bread, wheat flour, pasta and breakfast cereals), selected root vegetables (e.g. potatoes, sweet potatoes), other grains (e.g. rice, oats, sorghum) (Department of Health (DoH), 2013). From a household-level expenditure perspective[60] the dominant starch-rich food in South Africa is maize meal (accounting for approximately 23%

[58] Whole-grain (starch-rich) foods are defined by the South African Department of Agriculture, Forestry and Fisheries as "grains from cereals, which after milling (if milled), naturally contain all the components, namely endosperm, bran, germ and all the macronutrients, micronutrients and trace elements of the original unprocessed whole kernel" (Government Gazette, 2010a).

[59] Products such as maize meal, maize rice and samp originate from corn / maize kernels. Samp is a South African food consisting of coarsely broken corn kernels. Samp should have a maximum fat content of 1.5%, a maximum fibre content of 0.8%, a maximum of 5% have to be whole grain and not more than 5% should pass through a 2.36mm sieve (Department of Agriculture, Forestry and Fisheries, 2016). Samp is coarser than maize rice and maize meal.

[60] Estimated from household-level expenditure data reported in Stats SA LCS 2014/2015.

of expenditure on starch-rich foods in 2014/2015), followed by brown bread (21%), white bread (14%), rice (12%) and potatoes (7%) (Stats SA, 2017a).

According to the FAO (Food and Agriculture Organisation of the United Nations) / WHO (World Health Organisation) (Mann et al., 2007) it is recommended that carbohydrate-rich foods should provide 50% of total energy[61], with a general South African guideline to consume ten single serving units (SSUs)[62] on a daily basis (Vorster, 2013).

The intake of a diverse range of whole-grain and minimally processed starch-rich foods present consumers with various potential nutritional benefits, such as:

- providing the main energy source to the diet (Vorster, 2013);
- contributing to adequate nutrition by providing individuals with macronutrients (e.g. starch and other carbohydrates, fibre, protein and fat), as well as micronutrients (vitamins and minerals) (Vorster, 2013);
- contributing to dietary variety and the establishment of healthy eating patterns (Stephen et al., 2012; Vorster, 2013);
- contributing to dietary satiety (through the intake of fibre, oligosaccharides and resistant starch), linked to the prevention of excessive energy intake and overweight (WHO, 2003; Elia & Cummings, 2007); and
- protection against non-communicable diseases (NCDs) through a variety of mechanisms (WHO, 2003; Elia & Cummings, 2007; Mann et al., 2007; Van Dam & Seidell , 2007; Vorster, 2013),

The main objective of this chapter (i.e. to evaluate whether the starch-rich foods intake of South African consumers adheres to the SA FBDG) was achieved by the following secondary objectives:

- Comparing estimated per capita intake of starch-rich foods at a national level over time with the SA FBDG recommendation of 10 SSUs daily;
- Comparing the estimated per capita intake of starch-rich foods at a socio-economically disaggregated level, with the SA FBDG recommendation of 10 SSUs daily;
- Evaluating whether the starch-rich food intake of South African consumers adheres to the guideline of being whole-grain and/or minimally processed;
- To evaluate whether the starch-rich food intake of South African consumers adheres to the guideline of including traditional and/or indigenous starch-rich staple options.

Affordability and availability are key criteria associated with starch-rich staple foods. This is particularly critical for lower income households which rely on these foods as a primary energy source to a greater degree than higher-income households (Vorster, 2013). Given the important role of starch-rich staple food affordability, the fifth secondary objective in this chapter is to investigate the affordability of dominant starch-rich foods in the South African context over time.

[61] The total energy needs of an individual dependent on factors such as the age, gender and activity level of the individual (DoH, 2013).

[62] A SSU of the various food options in a particular food group provides similar quantities of nutrients compared to other units in the same food group (DoH, 2013).

4.2 BACKGROUND: STARCH-RICH STAPLE FOODS IN THE INTERNATIONAL CONTEXT

Certain starch-rich foods are viewed as staple foods that are "eaten regularly and in such quantities as to constitute the dominant part of the diet and supply a major proportion of energy and nutrient needs" (FAO, 2015). Adequate nutrition also requires the consumption of a variety of foods to provide both adequate energy from macronutrients (such as protein, fat and carbohydrates) and micronutrients (vitamins and minerals) (FAO, 2015).

At a global level the dominant starch-rich staple foods are rice and wheat, followed by maize in the third position with daily per capita energy supply contributions of 2264 kilojoules (kJ), 2205 kJ and 615 kJ, respectively in 2013 (see Figure 4.1) (FAO, 2017). Further examples of starch-rich staple foods include cereals (e.g. millet and sorghum) and starch-rich tubers and root vegetables (e.g. cassava, potato and sweet potato) (FAO, 2015).

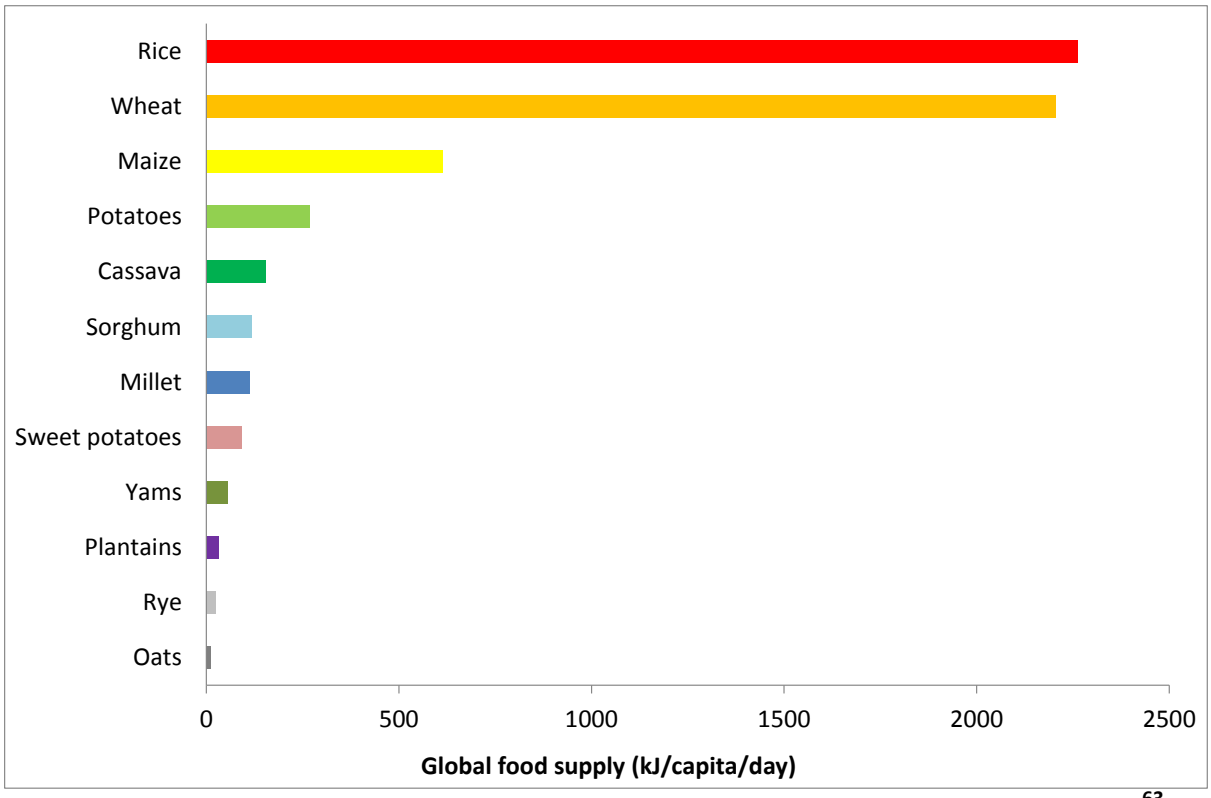

Figure 4.1: The relative importance of starch-rich staple foods at a global level in 2013[63] (FAO Food Balance Sheets (FAO, 2017))

The staple food consumption composition in South Africa differs from many other regions in the world (see illustration in Figure 4.2 based on the most recent available data form the FAOSTAT database) (FAO, 2017). North America, Europe and Oceania have a strong reliance on wheat while rice, followed by wheat, dominates in Asia and the Caribbean. Consumers in South America rely on a combination of wheat, rice and maize. African consumers eat mainly wheat, maize and rice with additional staple foods including cassava, sorghum, millet, sweet potatoes, potatoes and plantains (FAO, 2017). As illustrated in Figure 4.2, the dominant starch-rich staple food in South Africa is maize (mainly consumed as maize meal

[63] In the FAOSTAT database the most recent available data is for 2013.

porridge), followed by wheat (mainly consumed as white and brown bread), rice and potatoes (FAO, 2017; Stats SA, 2017a).

For South Africa the total estimated food energy supply from the selected starch-rich foods was higher than the other regions presented in Figure 4.2, being most comparable to Africa and Asia. According to the Organisation for Economic Co-operation and Development (OECD) and FAO Agricultural Outlook, the total estimated food energy supply from starch-rich foods was generally lower in wealthier regions (e.g. Oceania, North America and Europe) compared to less affluent regions[64] (OECD/FAO, 2019).

It is expected that the per capita consumption of starch-rich staple foods (including cereals, roots and tubers) will not increase significantly at a global level, as per capita consumption is close to saturation levels in numerous countries. Population growth is expected to be a major driver of the growth in the total demand for starch-rich staple foods, with global population growth projected to increase at a slower pace towards 2028 (OECD/FAO, 2018).

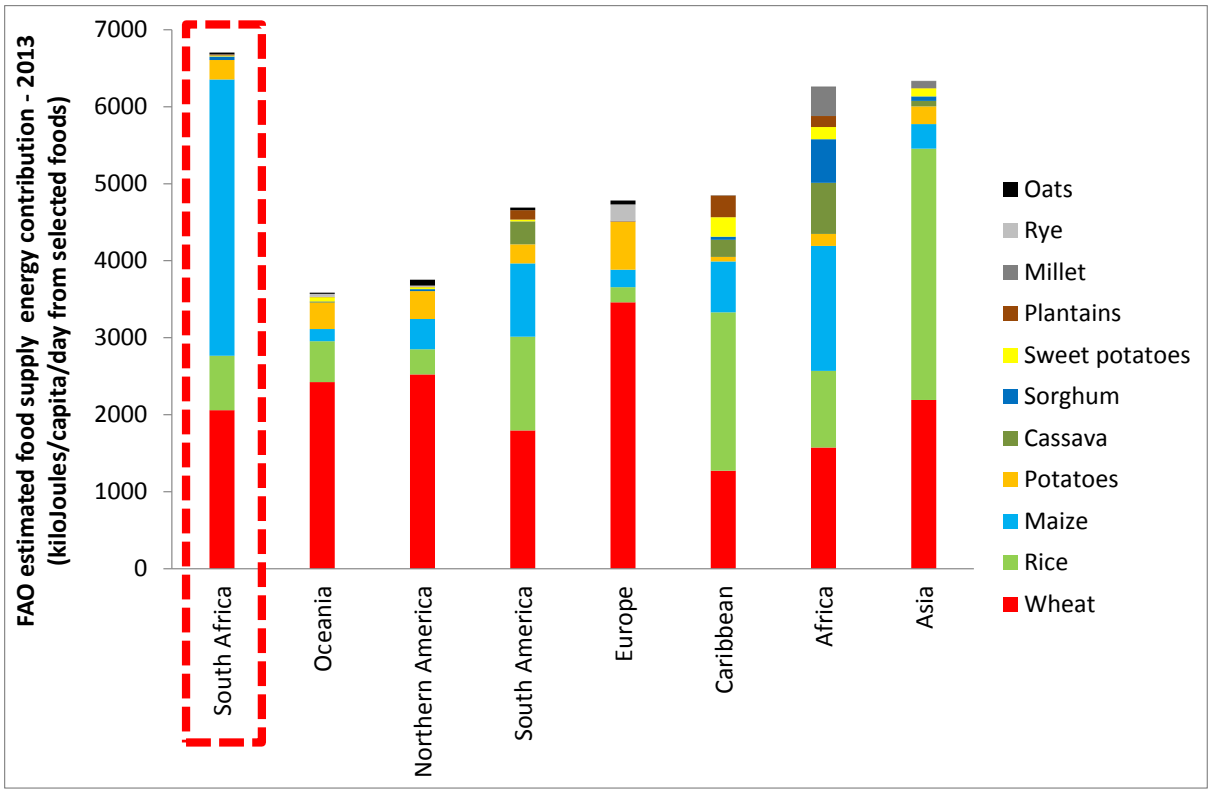

Figure 4.2: The relative importance of starch-rich staple foods in South Africa and various world regions in 2013 (FAO, 2017)

In least developed countries starch-rich staple foods are expected to preserve their role as the main energy source. Expectations are that the energy share contribution of staple foods in these countries could decline slightly from 73.4% (average value for 2015 to 2017) to 72.5% in 2027, with sugar and fats expected to be the dominant source of additional dietary energy (OECD/FAO, 2018).

[64] Examples of the gross domestic product (GDP) (purchasing power parity at current international $) in 2013 include the following (World Bank, 2019): United states $53 107, Australia $47 922, France $39 524, South Africa $12 816, India $5 252, Kenya $2 740.

Rice: According to the most recent OECD/FAO Agricultural Outlook (2019 to 2028) (OECD/FAO, 2019) per capita global rice consumption is projected to grow by 1.8% over the next decade with growth mainly coming from Africa, Europe and North-America. For the period 2016 to 2018 annual per capita rice intake in Asia was the highest (77.8 kg (kilogram)) followed by Latin America (28.6kg) and Africa (26.1kg).

Wheat: Global per capita wheat food consumption is projected to decrease over the next decade (especially in North-America and Africa). For the period 2016 to 2018 annual per capita wheat intake in Europe was the highest (109.0kg), followed by North America (80.0kg), Oceania (69.0kg), Asia (65.5kg), Latin America (54.4kg) and Africa (50.4kg) (OECD/FAO, 2019).

Maize: Global per capita maize food consumption is projected to increase by 8.4% over the next decade with growth mainly coming from Latin America and Africa (OECD/FAO, 2019), representing the highest projected growth rate in comparison to maize, wheat, rice and roots / tubers. For the period 2016 to 2018, maize consumption in Latin America was the highest (52.9kg/capita/year on average) and Africa (40.4 kg/capita/year).

Roots and tubers: Global per capita food consumption of roots and tubers is projected to increase by 7.1% in the next decade with growth mainly coming from Asia and Latin America (OECD/FAO, 2019). This represents the second highest projected growth rate compared to maize, wheat and rice. From 2016 to 2018 food intake of roots and tubers on an annual per capita basis was the highest in Africa (36.3kg), followed by Oceania (22.7 kg), Europe (17.1 kg), North America (12.4 kg), Latin America (12.0 kg) and Asia (10.4 kg).

4.3 METHODOLOGY

4.3.1 Per capita intake of dominant starch-rich foods on a SSU basis

The analysis process to estimate the per capita intake of starch-rich foods on a SSU basis for maize meal, brown bread, white bread, rice and potatoes (i.e. the dominant starch-rich foods consumed in South Africa as discussed in Section 4.1 and Section 4.2) was based on national aggregate figures on commodity quantities allocated for human consumption. These annual data series for the last decade (2008 to 2018) were obtained from the BFAP (Bureau for Food and Agricultural Policy) partial equilibrium sector model (BFAP, 2019), which is based on data sourced from industry organisations[65], combined with consultation between BFAP and the particular industries to yield the most accurate possible aggregate national consumption figures.

To develop an understanding of the intake of starch-rich foods from a nutritional perspective, data were needed on the per capita intake of specific food products – not only figures dealing with the main commodities (i.e. wheat and maize). In the absence of recent nationally representative food intake data, consumption was estimated based on a balance sheet approach where consumption is estimated by deducting trade from national production numbers, as well as industry manufacturing and trade data. Refer to Table 4.1

[65] For example, the South African Grain Information Service (SAGIS) and Potatoes South Africa.

for an overview of the methodology applied to calculate the annual per capita intake figures for maize, maize meal, wheat, bread, potatoes and rice.

The nutritional benefit to a consumer consuming a 100g (grams) of each of these staple food options could differ significantly due to varied product characteristics such as the typical carbohydrate, micronutrient and moisture contents of the foods, as well as the raw to cooked conversion factors (Table 4.2). To develop a measure of the relative importance of the various staple food options from a consumer nutritional value perspective, it was necessary to consider per capita intake from the perspective of a SSU.

A SSU was defined as 25g raw maize meal, 40g (1 slice) of bread, 22g raw rice and a 100g smaller-sized medium potato (DoH Directorate Nutrition, 2001; Vorster, 2013; DoH, 2012). According to Potato Regulation R. 1031 of 12 November 2010 (Government Gazette, 2010b), the weight of a medium potato ranges between 90g to 170g and within this range the weight of a small-medium potato is 90g to 120g. The assumption was made that a smaller size medium potato could weigh about 100g.

The per capita starch food intake figures were converted from kilogram per capita to the number of SSUs consumed per capita for annual time series data from 2008 to 2018. These results were then interpreted in terms of the changing contribution of various staple food options over time and compared to national nutritional guidelines.

4.3.2 The affordability of dominant starch-rich foods over time

The affordability of maize meal, bread, rice and potatoes was investigated by calculating the cost per SSU for these foods, based on historical food retail prices as monitored by Stats SA. The total cost of daily per capita servings consumed was also compared to and contrasted with household income levels and the estimated cost of actual consumption was compared with the cost of 'ideal' intake as specified in the balanced food basket models.

4.3.3 The intake of starch-rich foods from a socio-economically disaggregated perspective

In the absence of recent nationally representative food intake data in terms of quantitative food intake[66], household-level food expenditure data (Stats SA LCS 2014/2015) was analysed to explore the starch-rich foods expenditure and consumption patterns of different socio-economic segments of the South African population.

Estimated purchased quantities of the dominant staple options in South Africa (maize meal, brown bread, white bread, rice and potatoes) were derived from household-level expenditure data (Stats SA LCS 2014/2015) and official food retail prices monitored by Stats SA. The estimated purchased quantities were expressed in terms of SSUs to facilitate comparisons between staple options.

Stats SA acknowledged that the expenditure data for non-durable goods (including food and non-alcoholic beverages) are under-reported – attributed to methodology applied to obtain household-level data (Stats SA, 2017a). Subsequently the estimated purchase quantities were compared to calculated national intake figures and adjusted accordingly to account for

[66] SANHANES-1 (Shisana et al, 2014) reported food intake through scores and not actual intake quantities.

under-reporting errors caused by the methodology employed by Stats SA to generate household-level expenditure data.

4.3.4 Determining whether South African consumers prefer unrefined or minimally processed and traditional or indigenous starch-rich foods

These components of the analyses utilised the following data sources:

- SAGIS data on pan-baked products manufactured per month for the period July 2015 to July 2019 (SAGIS, 2019c);
- Intake levels of white and brown bread (national average and socio-economically disaggregated) derived from household expenditure data as explained in Section 4.3.3;
- Maize meal demand (disaggregated by maize meal type) estimated from SAGIS data on maize products manufactured, imported and exported per month for the period July 2015 to July 2019 (SAGIS, 2019a);
- Rice demand estimated from Trademap import data (Trademap, 2019);
- FAOSTAT Food Balance Sheets data (1961 to 2013) for South Africa on estimated food supply quantities for sorghum and millet (FAO, 2017).

4.4 RESULTS AND DISCUSSION

4.4.1 Per capita intake of maize meal, bread, rice and potatoes on a SSU basis

Figure 4.3 presents the estimated annual per capita consumption of maize grain, wheat grain, rice and potatoes (after removal of the non-edible components; chop in maize and bran in wheat grain). During the last decade (2008 to 2018), maize dominated the South African staple food complex (ten year average value of 61.7 kg/capita/year), followed by wheat (51.6 kg/capita/year, 16.4% below maize), potatoes (39.3 kg/capita/year, 36.3% below maize) and rice (18.1 kg/capita/year, 70.3% below maize meal).

Despite some fluctuations in maize demand a general declining trend is evident from Figure 4.3. In relation to the past decade, BFAP (2018) observed a decline in white maize food demand on a per capita basis, attributed to dietary diversification associated with income growth and class mobility. An analysis of food consumption changes in South Africa from 1994 to 2009 (Ronquest-Ross et al., 2015) based on FAOSTAT Food Balance Sheets, confirmed the dominance of maize in food and cereal consumption and observed a declining trend in per capita maize consumption (a 4.6% decrease in maize consumption between 1994 and 2009) attributed (similarly to the BFAP information mentioned above) to gradual movements to higher-value food items by households, arising from increasing income levels. In the next decade, BFAP projections indicate a slowing down in the trend of declining per capita maize intake due to slower income growth (BFAP, 2018). Since 2015 when the economic growth rate started declining, there has been an increase in the per capita consumption level of maize meal (BFAP, 2019).

Table 4.1: Methodology overview to estimate annual per capita intake figures

Product:	Measurement:	Calculation	
		Variable:	**Source:**
Maize	Annual per capita intake of maize with the non-edible components removed.	Annual quantity of maize grain allocated to human consumption.	BFAP partial equilibrium sector model (BFAP, 2019), based on SAGIS data
		Deducting 30.9% chop (the waste product from the milling process, usually used in animal feeds).	Average chop production as share of total maize products manufactured per month July 2015 to July 2019 (SAGIS, 2019a)
		Divided by South African (SA) population figures.	Population figures were sourced from the BFAP sector model (BFAP, 2019), which is based on data from Stats SA, the International Monetary Fund and the United Nations Population Prospects.
Maize meal	Annual per capita intake of maize meal.	Local demand for maize meal	SAGIS data on maize products manufactured per month plus maize meal imports less maize meal exports (SAGIS, 2019a).
		Divided by SA population figures.	As explained above.
Wheat	Annual per capita intake of wheat with the non-edible components removed.	Annual quantity of wheat grain allocated to human consumption.	BFAP partial equilibrium sector model (BFAP, 2019), based on SAGIS data
		Less 10% bran.	According to SAGIS (2019b), the bran component constituted on average 20.0% of the total wheat allocated to human consumption from July 2015 to July 2019. It is estimated that about half of the bran is diverted back into the human consumption chain to manufacture brown bread.
		Divided by SA population figures.	As explained above.
Bread	Annual per capita intake of bread.	Consumption proxy: Bread volumes (white bread and brown bread) manufactured per year.	SAGIS data on pan-baked products manufactured per marketing year (SAGIS, 2019c) for the period 2015/16 to 2018/19.
		Divided by SA population figures.	As explained above.
Potatoes	Annual per capita potato intake.	Annual quantity of potatoes allocated to human consumption.	BFAP partial equilibrium sector model (BFAP, 2019), based on industry data obtained from Potatoes South Africa.
		Divided by SA population figures.	As explained above.
Rice	Annual per capita intake of rice.	Estimated local demand for rice.	In the absence of official industry data for rice Trademap import data (Trademap, 2019) for rice were applied as a proxy for consumption figures, as South Africa is a net importer of rice (FAO, 2017).
		Divided by SA population figures.	As explained above.

Table 4.2: Comparison of staple food options from a nutritional perspective (per 100g) [1] (Wolmarans et al., 2010)

Selling format: Raw or ready-to-eat		Unit:	Super maize meal:	Brown bread:	White rice:	Potatoes:
		-	Raw	Ready-to-eat	Raw	Raw
Energy[1]		Kilojoules/100g	1380	1029	1494	325
Carbohydrates[1]		Gram/100g	74	43	70	15
Moisture[1]		%	< 1	40	5	80
Raw to cooked conversion factor[2]		-	3.020 (stiff porridge)	N/A	2.814 (boiled white rice)	0.918 (boiled potato with skin)
Fortified?		-	Yes	Yes	No	No
Micronutrients:	**Vitamin A (RE)**	µg (microgram)	184	84	0	0
	Vitamin B1 (Thiamine)	Mg (milligram)	0.43	0.46	0.02	0.14
	Vitamin B2 (Riboflavin)	mg	0.19	0.11	0.01	0.02
	Vitamin B3(Niacin)	mg	3.5	8.2	0.4	1.8
	Vitamin B6(Pyridoxine)	mg	0.63	2.13	0.093	0.21
	Vitamin B9(Folic acid)	mcg	210	130	3	10
	Iron	mg	2.6	4.1	0.2	1.2
	Zinc	mg	2.07	4.49	0.46	0.29

[2] *Convension factors deducted from Wolmarans et al., 2010*

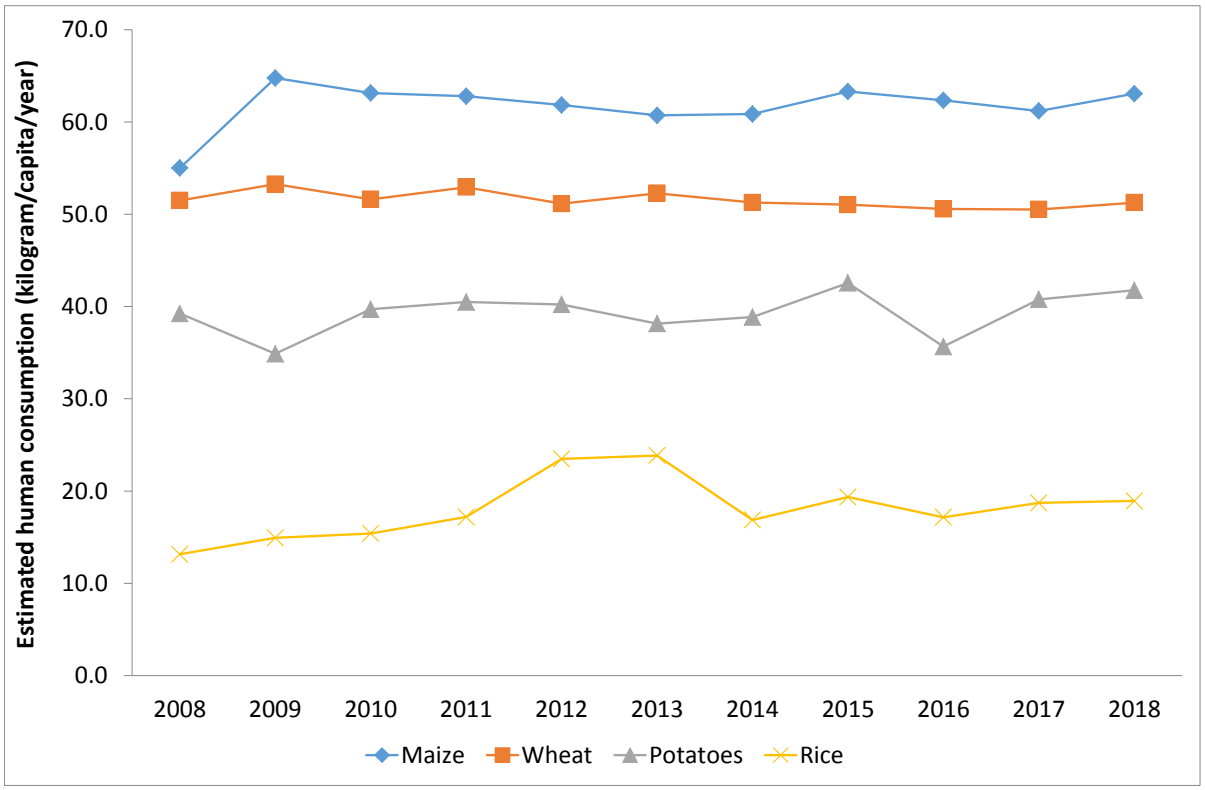

Figure 4.3: Estimated per capita human intake of maize, wheat, potatoes and rice in South Africa for the ten year period from 2008 to 2018 (Source: Own estimations based on the sources and methodology described in Section 4.3)

For wheat, Ronquest-Ross et al. (2015) showed that per capita intake of wheat had minimal growth of 1.8% from 1994 to 2009, based on an analysis of FAOSTAT Food Balance Sheets. BFAP (2018) projects some per capita consumption growth over the next decade, further emphasising the continued dependence on imported wheat which implies price fluctuations due to exchange rate variations. The projected growth in wheat consumption per capita is mainly attributed to economic and income growth in the projection period.

From 2008/2009 to 2017/2018 the per capita demand for rice and potatoes increased by approximately 11% and 34%, respectively (see Figure 4.3). For the next decade BFAP (2018) projects 1.2% growth per annum in per capita potato consumption, fuelled by modest economic and income growth. According to the OECD / FAO Agricultural Outlook (OECD, 2018a) the per capita intake of rice is expected to decrease slightly over the next ten years.

As mentioned in Section 4.1, the SA FBDG relating to starch-rich foods states as a general guideline that individuals older than 6 years, should consume ten SSUs on a daily basis (Vorster, 2013). The estimated annual per capita intake quantities of maize meal, bread, potatoes and rice (with ten year average values of 50.4 kg/capita, 25.8 kg/capita, 39.3 kg/capita and 18.6 kg/capita, respectively) were subsequently converted to the number of SSUs consumed per capita per day as illustrated in Figure 4.4.

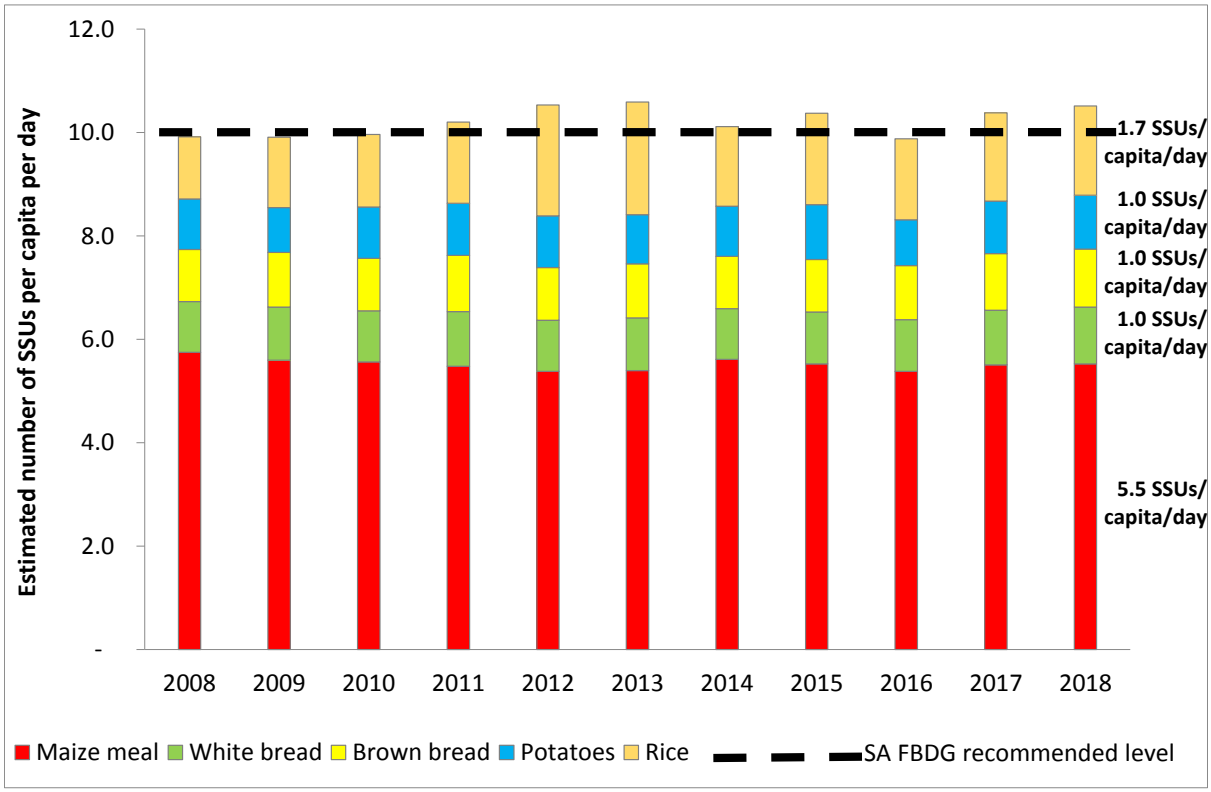

Figure 4.4: Estimated daily per capita intake of maize meal, bread, potatoes and rice in South Africa (2008 to 2018) expressed on a SSU basis (Source: Own estimations based on the sources and methodology described in Section 4.3)

Over the last decade the consumption of starch-rich staple foods was dominated by maize meal (5.5 SSUs/capita/day on average[67], contributing approximately 54% of daily SSUs from these products), followed by rice (1.7 SSUs/capita/day[68], 16% contribution), brown bread (1.05 SSUs/capita/day[69], 10% contribution), white bread (1.02 SSUs/capita/day on average, 10% contribution) and potatoes[70] (0.98 SSUs/capita/day, 10% contribution). The combined per capita daily SSUs consumed (considering maize meal, bread, rice and potatoes) were on average 10.2 SSUs/capita/day, which is 2% above the recommended typical guideline of 10 SSUs per day as specified in the SA FBDG (Vorster, 2013). These quantities represented 45% of a typical daily energy need of 8 500 kJ/capita/day, thus being below the FAO recommendation of 50% as mentioned above. However, keeping in mind that other less prominent starch-rich foods (like wheat flour, pasta and other processed starch-rich foods like breakfast cereals) also contribute to an individual's daily intake of starch-rich foods, it is likely that the total average intake of South African consumers is even higher and exceeds the recommendation of 10 SSUs per day.

Changes in the starch-rich staple food intake of consumers over time could be attributed to numerous factors such as purchasing power, tastes and preferences, as well as food retail price dynamics. As illustrated in Figure 4.5[71] super maize meal was generally the most affordable starch-rich staple option in South Africa from January 2013[72] to July 2019 (costing R0.22/SSU on average in 2018), followed by rice (R0.28/SSU), brown bread (R0.67/SS), white bread (R0.75/SSU) and potatoes (R1.20/SSU). The most affordable options (i.e. maize meal, followed by rice and brown bread, as evident from Figure 4.5) were also the most popular options as shown in Figure 4.4.

From January 2013 to July 2019 general upward inflation trends were evident for all the starch-rich food options under consideration. During this analysis period, prominent drivers of upward food prices were increasing administered input cost prices (e.g. electricity and labour), rising global oil prices, some exchange rate depreciation and finally the effects of the severe 2015/2016 drought which occurred in the summer rainfall regions of South Africa (BFAP, 2017). The impact of the drought is particularly evident when considering the price increases observed for maize meal from early 2016 to March 2017, and potatoes for which retail prices peaked in April 2016 (as shown in Figure 4.5).

[67] Maize meal: Estimated intake equivalent to 50.2 kg/capita/year, which is comparable to the three year average value of 49.6 reported by SAGIS (2019a) for the period 2016/2017 to 2018/2018.

[68] Rice: Estimated intake equivalent to 18.6 kg/capita/year, which is comparable to the most recently available FAOSTAT value of 17.4 kg/capita/year in 2013 (FAO, 2017).

[69] Bread: Estimated total bread intake equivalent to 26.4 kg/capita/year, which is comparable to the value of 26 kg/capita/year reported by SAGIS (2019c) for the period 2015/2016 to 2018/2019.

[70] Potatoes: Estimated intake equivalent to 35.8 kg/capita/year, which is comparable to the three year average value of 35.1 kg/capita/year reported in the 2019 Abstract of Agricultural Statistics for 2016 to 2019.

[71] Stats SA monitored urban food prices were selected for popular pack sizes: 2.5kg super maize meal, 700g loaf of white bread, 700g loaf of brown bread, 2kg rice and loose sell potatoes.

[72] Due to data limitations in terms of the urban food prices monitored by Stats SA the analysis was done for the period January 2013 to July 2019.

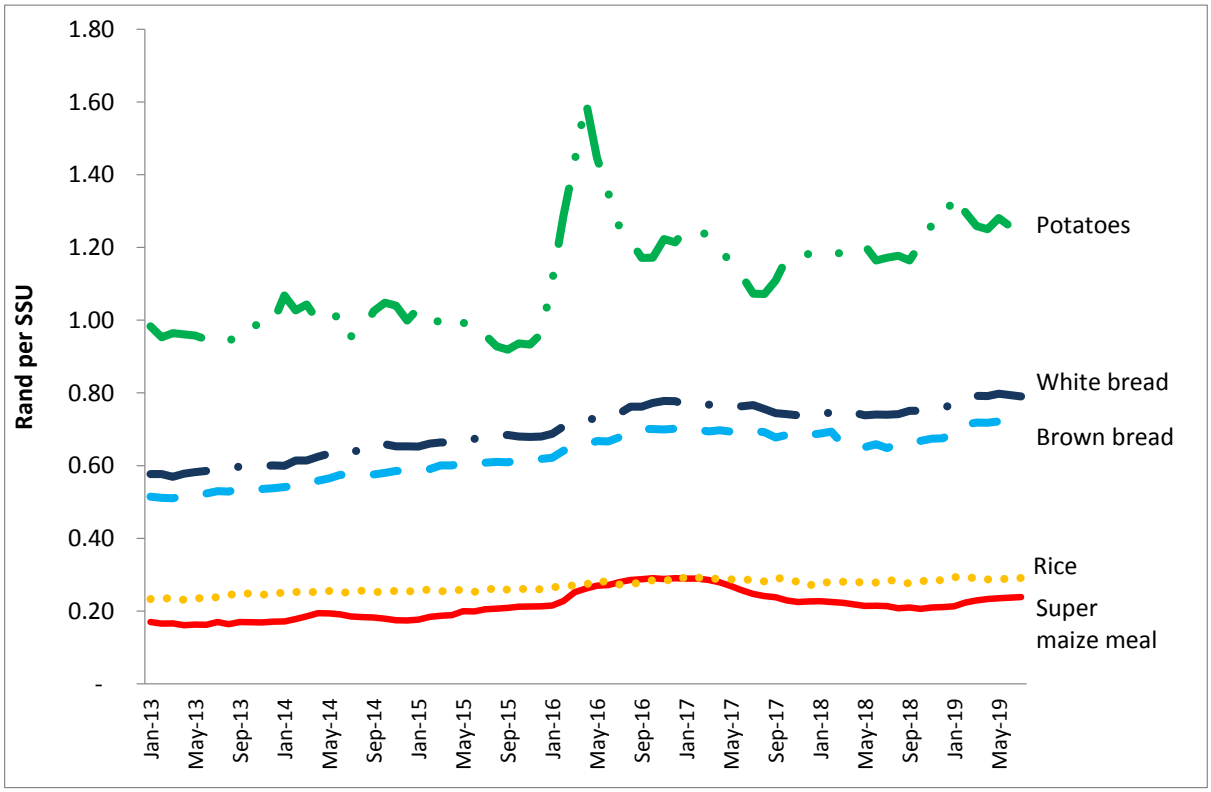

Figure 4.5: Monthly Stats SA monitored urban food retail prices for maize meal, bread, potatoes and rice monitored by Stats SA in urban areas for the period January 2013 to July 2019 expressed on a cost per SSU basis

Applying annualised monthly SSU costs to the intake quantities presented in Figure 4.4, it is evident that the cost of purchasing typical SSUs of maize meal, bread, rice and potatoes cumulatively increased by approximately 33%, from R3.49 in 2013 to R4.64 in 2017, followed by a 3% decrease to a value of R4.49 in 2018 (see Figure 4.6). The dramatic increase observed towards 2018 is linked to the factors described above, with particular emphasis on the impact of the 2015/2015 drought.

For a family of four (comprising of an adult male, an adult female, an older and a younger child) these typical intake quantities of maize meal, bread, rice and potatoes could have amounted to a cost of approximately R409 per month in 2014/2015. For the least affluent 50% of households in South Africa this would represent more than the share of food expenditure currently allocated to starch-rich foods as evaluated from Stats SA LCS 2014/2015 (Stats SA, 2017a).

Under normal market conditions it could be argued that facing a decision between maize meal and rice, many South African consumers generally prefer maize meal to rice, possibly driven by a preference for their main traditional staple food option based on taste considerations (Duvenage et al., 2010), traditional eating practices (maize porridge being the main traditional staple food of African cultural groups) and a potentially perceived higher satiety value associated with maize meal than with rice.

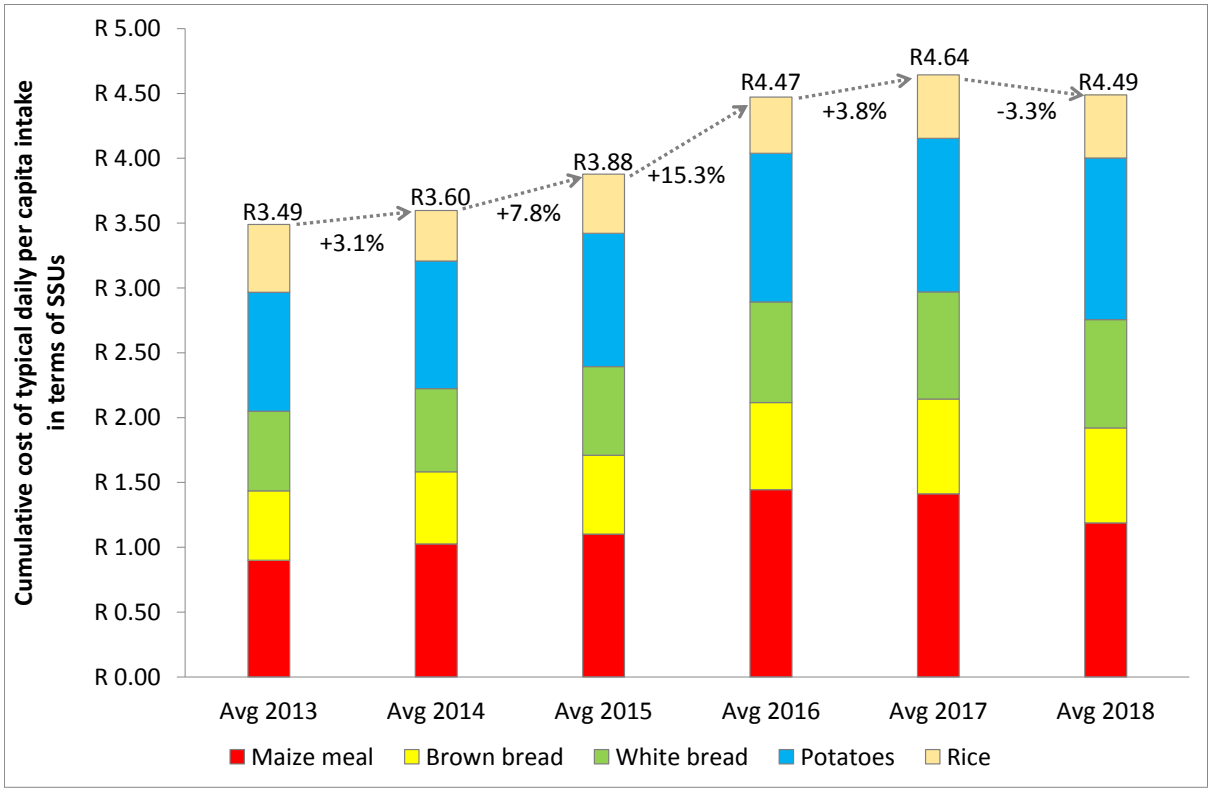

Figure 4.6: Total cost of the estimated daily per capita intake of maize meal, bread, potatoes and rice in South Africa (2013 to 2018) expressed on a SSU basis (Source: Own estimations based on the sources and methodology described in Section 4.3)

The satiety value of starch-rich food options (as measured by glycaemic index (GI), which is an indication of the rate at which carbohydrates are released into the body) vary depending on product type and format as illustrated by the following examples (Steenkamp, 2014; Van Heerden, 2008):

- Examples of slow release food carbohydrates (low GI): Long-grain parboiled rice, brown rice, sweet potato, cold (cooked) maize porridge;
- Examples of intermediate release food carbohydrates (medium GI): Basmati rice, baby potatoes;
- Examples of fast release staple carbohydrates (with a high GI): Potatoes, hot maize porridge, white bread, brown bread and whole-grain bread. Speciality low GI breads (with slow release food carbohydrates) often carry a significant price premium[73] above regular bread options.

From March 2016 to May 2017 the SSU costs of maize meal and rice were similar, following severe drought-induced maize meal price increases as mentioned above. In addition to similar affordability levels, rice has the added potential benefit of shorter cooking times compared to maize meal which could be an important consideration when facing rising energy costs in addition to rising food prices. The problem of rising energy costs is a reality

[73] As an example prices for a particular brand of bread was obtained on 5 November 2019 at a leading retailer in South Africa. The 'whole wheat low GI' options were up to 31% more expensive than the loaf of brown bread.

faced by South African consumers. The CPI for electricity and other fuels for the total country has increased by an estimated 169% from 2006 to 2016 (Stats SA, 2017b). Research by the Pietermaritzburg Agency for Community Social Action (PACSA) (2016) confirmed the behaviour of low-income households to favour food options requiring less energy when facing challenging economic conditions (e.g. favouring tinned baked beans to raw sugar beans).

From a nutritional perspective the increased intake of rice as a substitute for maize meal could have negative consequences as maize meal is fortified with micronutrients[74], whereas rice is not fortified. Thus, replacing some maize meal with rice could potentially reduce intake of critical micronutrients, such as vitamin A, B1, B2, B3, B6, B9, as well as iron and zinc by consumers. Even the slightest loss of micronutrient intake (e.g. replacing some maize with rice) could have adverse implications for the nutritional status of the South African population. According to the 2012 South African National Health and Nutrition Examination Survey (SANHANES-1) (Shisana et al, 2014), a significant 39.7% of the South African population experiences dietary inadequacy. In addition, the prevalence of anaemia (linked to iron deficiency) was found to be 10.7% while vitamin A deficiency affected 43.6% of the population (Shisana et al, 2014).

4.4.2 A socio-economically disaggregated perspective on the intake of starch-rich foods in South Africa

Estimated from household-level food expenditure data (Stats SA LCS 2014/2015) (Stats SA, 2017a), the contribution of starch-rich foods[75] to total food expenditure decreases with rising socio-economic status, varying from up to 38% for marginalised consumers, to as little as 12% for affluent households (see Figure 4.7). The estimated per capita expenditure on starch-rich food items increases significantly by approximately 88% from expenditure decile (ED)[76] 1 (lowest income level) to ED 7[77], followed by a slight decrease towards the wealthiest 10% of households (ED 10) (Figure 4.7).

Figure 4.8 presents an overview of the expenditure of households on particular starch-rich foods across the socio-economic spectrum, based on Stats SA LCS 2014/2015 data. For maize meal, brown bread and rice the expenditure share contributions generally decreased as the level of affluence increased, thus indicating that these food options are regarded as

[74] Food fortification can been defined as "the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups" (FAO, 1995). Since 2003 the mandatory fortification of the main staples in South Africa (including maize meal and wheat flour for white- and brown bread) has been enforced (Vorster, 2013). Given the observed increase in the consumption of cake flour at village level in the form of homemade bread (Food Advisory Consumer Service (FACS), 2017) the regulation was amended to include cake flour fortification (Department of Health, National Gazettes, No. 39776 of 03 March, 2016, as part of the Foodstuffs, Cosmetics and Disinfectants Act (54/1972): Regulations relating to the Fortification of certain Foodstuffs).

[75] Products included in category: bread, maize meal, rice, potatoes, wheat flour, pasta, samp, sorghum, sweet potatoes, maize rice and processed breakfast cereals.

[76] Each Expenditure Decile (ED) represents 10% of households in South Africa.

[77] ED 7 represents the start of the upper middle-income consumer segment.

inferior goods from a consumer economics perspective (Mansfield, 1994) (Figure 4.8). Starch-rich foods such as white bread, pasta and processed grain foods (e.g. breakfast cereals, rusks, crackers, biscuits, cakes, tarts, etc.) became relatively more popular as households became more affluent (Stats SA, 2012; Stats SA, 2017a) and could thus be described as normal goods from a consumer economics perspective (Mansfield, 1994).

The expenditure shares of potatoes and wheat flour were relatively constant across the socio-economic spectrum. From an expenditure perspective the dominant starch-rich foods for marginalised and lower middle-income households were maize meal, followed by brown bread, rice and white bread. For upper middle-income households brown bread exceeded maize meal in 2014/2015, followed by white bread and rice. Affluent households allocated the largest spending share on starch-rich processed grain foods (e.g. products such as breakfast cereals, rusks, crackers, biscuits, cakes and tarts), followed by brown bread, white bread, maize meal and rice.

Increased expenditure on more refined starch-rich food options is evident from the data presented in Figure 4.8. The total expenditure allocated to more refined carbohydrate-based foods such as white bread, breakfast cereals and baked goods is significantly higher for more affluent groups than groups in the lower-socio-economic spectrums.

Figure 4.9 presents the estimated per capita SSU intake of maize meal, bread, rice and potatoes for the ten EDs, derived from household-level expenditure data (Stats SA LCS 2014/2015). In 2014/2015 marginalised consumers (ED 1 to ED 3) relied mainly on maize meal (approximately 60% contribution to SSUs from the four sources), followed by rice (17%), brown bread (9%), potatoes (9%) and white bread (5%). Lower middle-income consumers (ED 4 to ED6) relied mainly on maize meal (approximately 56% contribution to SSUs from the four sources), followed by rice (20%), brown bread (8%), potatoes (8%) and white bread (7%). The estimated staple contribution shares were comparable for the marginalised and lower middle-income households. Upper middle-income consumers relied mainly on maize meal (46%), followed by rice (22%), white bread (12%), brown bread (10%) and potatoes (9%). Affluent consumers relied mainly on maize meal (35%), followed by rice (24%), white bread (16%), potatoes (13%) and brown bread (12%).

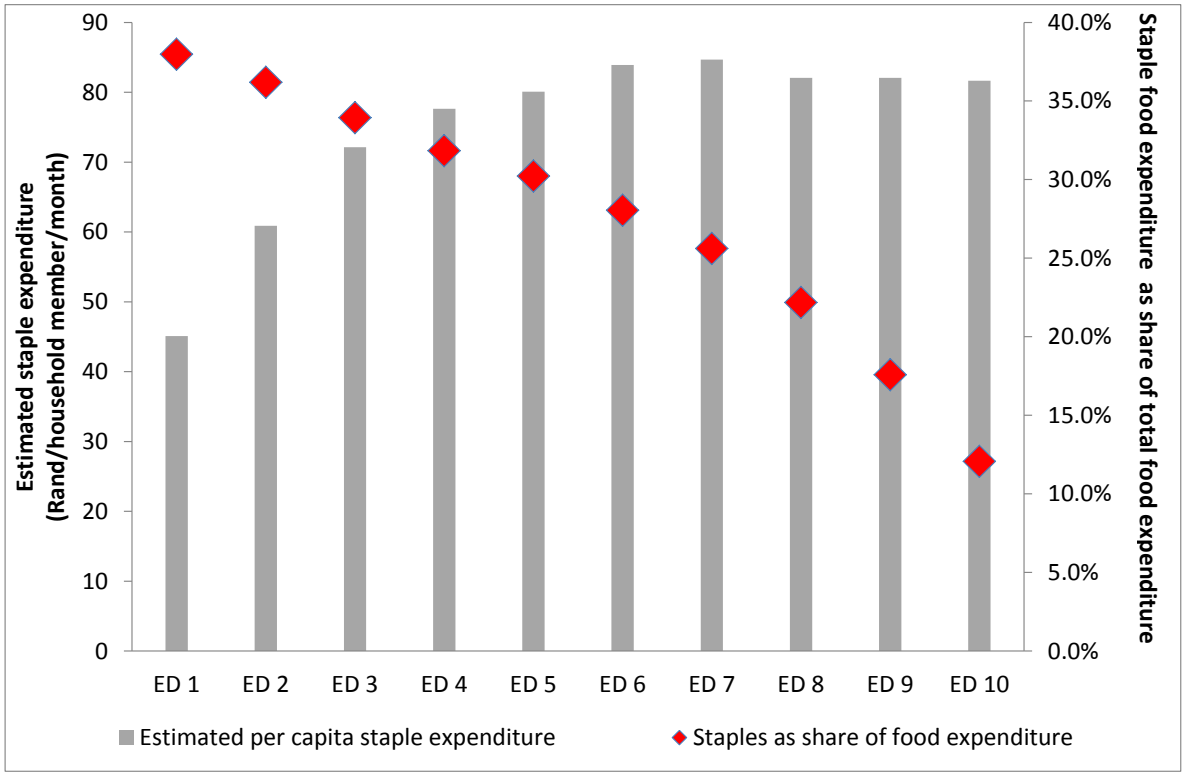

Figure 4.7: Staple expenditure across the socio-economic spectrum in South Africa (calculated from Stats SA LCS 2014/2015) (Stats SA, 2017a)

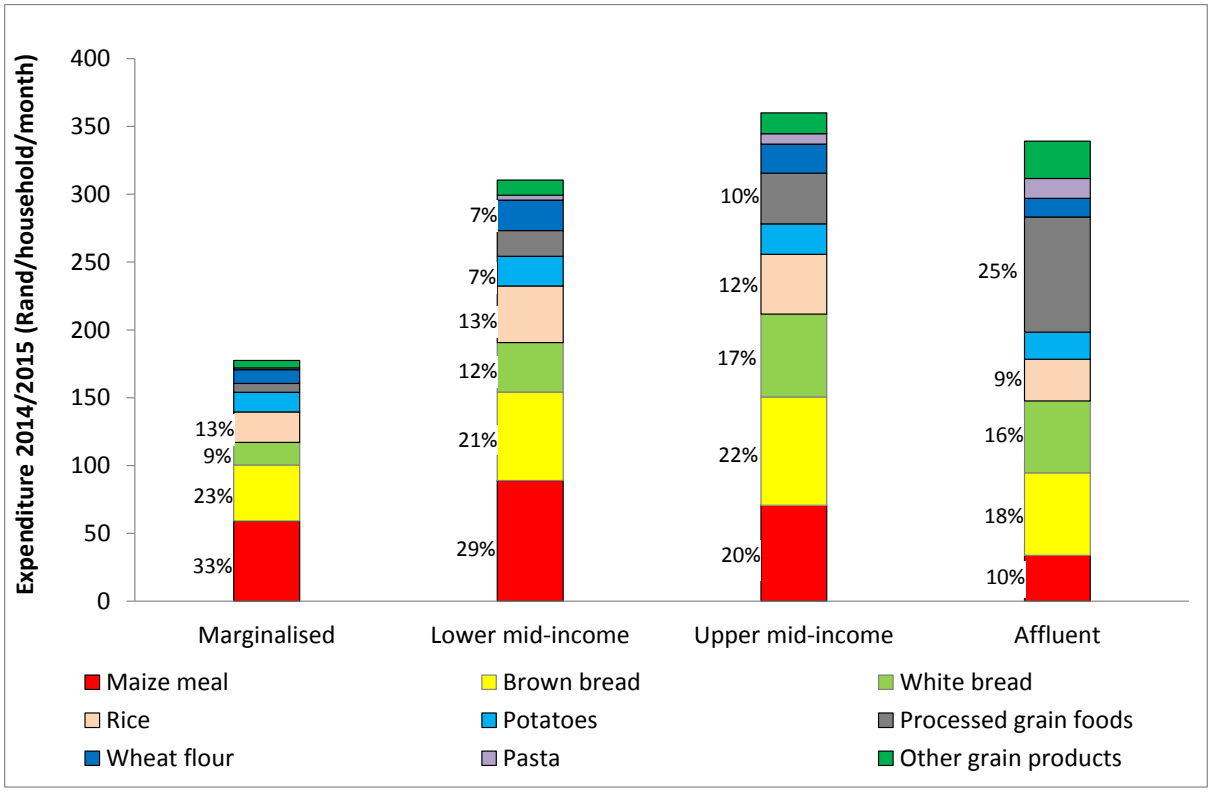

Figure 4.8: Socio-economically disaggregate view of the starch-rich food expenditure composition in South Africa (Sources: Own calculations based on Stats SA LCS 2014/2015)

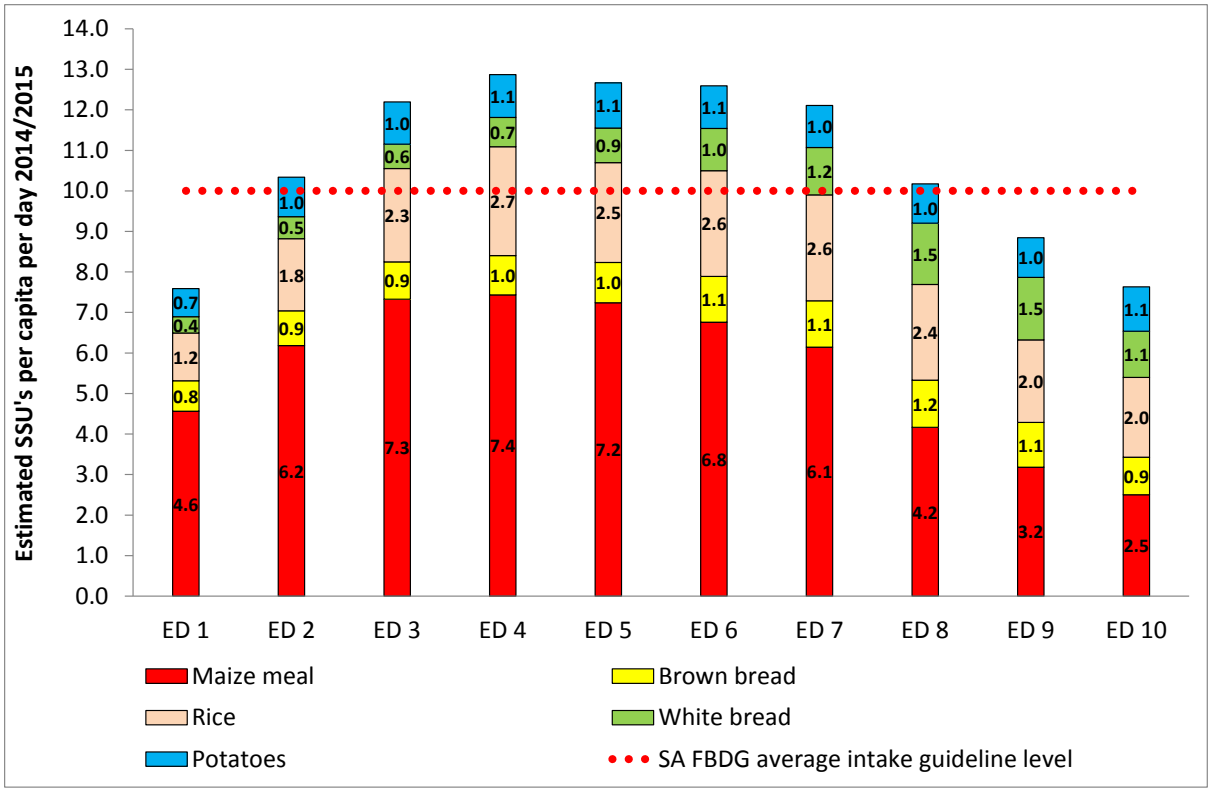

Figure 4.9: An estimation of the per capita SSU staple intake of the four main socio-economic sub-groups in 2014/2015 (Source: Own calculations based on the sources and methodology explained in Section 4.3)

Moving along the socio-economic continuum the following general trends are evident from the data presented in Figure 4.9:

- The per capita intake quantity of maize meal increased by approximately 63% towards the lower middle-income households, followed by a 66% decrease towards ED 10;
- The per capita intake of brown bread increased by 55% from ED 1 to ED 7 / ED 8, followed by a decrease of 20% towards ED 10;
- The per capita intake of rice increased by 128% from ED 1 to ED 6 / ED 7, followed by a decrease of 27% towards ED 10;
- The per capita intake of white bread increased by 280% from ED 1 to affluent households in ED 9, followed by a slight decrease towards ED 10;
- Potato intake was relatively constant among EDs with the exception of lower intake levels among ED 1 households.

In ED 1 to ED 6 (i.e. marginalised and lower middle-income households) brown bread was more popular than white bread. Among households in ED 6 and ED 10 (i.e. upper middle-income and affluent households) white bread was more popular than brown bread.

The results presented in Figure 4.9 indicate that in absolute terms the starch-rich food intake (derived from maize meal, bread, rice and potatoes) of households in ED 1 was 24% below the SA FBDG. As marginalised household spend only approximately 4% of total starch-rich food expenditure on other food options (see Figure 4.8) it is very likely that the total starch-rich food intake of ED 1 households is below the SA FBDG recommendation.

The starch-rich food intake of consumers classified in ED 2 to ED 8 (i.e. marginalised and middle-income segments) was above the SA FBDG recommendation level, being the highest for ED 4 and ED 5 (lower middle-income consumers). Spending up to 10% of total starch-rich food expenditure on processed grain foods and a further 13% on other starch-rich staple food options, the total starch-rich foods intake of these consumers could be even higher. The estimated starch-rich food intake of affluent consumers (ED 9 and ED 10) was up to 24% below the SA FBDG guideline level in 2014/2015. However, since these consumer segments spend up to 25% of total starch-rich food expenditure on processed grain foods (see Figure 4.8), their total intake of starch-rich foods is likely to be above the SA FBDG guideline level. It is, therefore, evident that almost the entire South African population has an excessive intake of starch-rich foods, potentially contributing to NCDs, overweight and obesity in South Africa.

4.4.3 Do South African consumers eat unrefined or minimally processed starch-rich foods as recommended in the SA FBDG?

As discussed in Section 4.1 of this chapter, the SA FBDG message pertaining to starch-rich foods has a strong focus on unrefined or minimally processed foods. Consequently, this section aims to investigate if the staple intake of South African consumers is focussed on unrefined or minimally processed starch-rich foods or on less-desirable, more refined alternatives.

Maize meal:

The estimated domestic consumption of maize meal for the 49-month period from July 2015 to July 2019[78] (SAGIS, 2019a) is dominated by highly refined super maize meal[79] (83.7% volume contribution on average), followed by special maize meal[80] (13.8%), sifted maize meal[81] (2.1%) and unsifted maize meal[82] (0.4%). Furthermore, from the 2015 to 2019 the share contribution of super maize meal has increased from 81.7% to 86.2% suggesting an increasing focus on refined super maize meal in the local market.

From July 2015 to July 2019 only 2.5% of local demand consisted of sifted and unsifted maize meal (i.e. the coarser maize meal option compared to super and special maize meal), indicating that the consumption of unrefined or less processed options is rare in South Africa. A barrier to the consumption of more unrefined maize meal relates to the shorter shelf life of these product options. The oils found in the germ of whole-grain maize meal (i.e.

[78] Domestic demand estimated as: (Maize products manufactured per month) PLUS (Maize meal imports) LESS (Maize meal exports).

[79] Super maize meal specifications: Fat content less than 2.0%; Fibre content less than 0.8%; "At least 90% shall pass through a 1.4mm sieve, and less than 90% shall pass through a 0.3mm sieve" (Department of Agriculture, Forestry and Fisheries, 2016).

[80] Special maize meal specifications: Fat content of 2.0% to less than 3.0%; Fibre content less than 1.2%; "At least 90% shall pass through a 1.4mm sieve" (Department of Agriculture, Forestry and Fisheries, 2016).

[81] Sifted maize meal specifications: Fat content of 3.0% to less than 4.0%; Fibre content less than 1.2%; "At least 90% shall pass through a 1.4mm sieve" (Department of Agriculture, Forestry and Fisheries, 2016).

[82] Unsifted maize meal specifications: Fat content of 3.5% to less than 4.5%; Fibre content between 1.2% and less than 2.5%; "At least 90% shall pass through a 1.4mm sieve" (Department of Agriculture, Forestry and Fisheries, 2016).

unsifted maize meal) could lead to product quality deterioration given product exposure to heat, light and moisture (Van de Vijver et al., 2009; Vulicevic et al., 2004). Possible solutions proposed by Vorster (2013) are for households to purchase smaller quantities of maize meal more often and to store these food items in airtight containers in a refrigerator under dry conditions. However, the purchasing of smaller quantities of less refined maize meal more often could increase product unit costs (i.e. the benefit from bulk discounts associated with larger pack sizes) and could increase food procurement costs (e.g. more travel costs and travel time to obtained food) for households who are already struggling with limited food budgets. Access to cold storage facilities could be an additional challenge for lower-income households, as an estimated 90% of households with no fridge occur in the least affluent 25% of the population according to the SAARF (South African Audience Research Foundation) AMPS (All Media and Products Survey) 2015 (SAARF, 2016).

Bread:

According to SAGIS data on the number of bread loaves manufactured per month for the period July 2015 to July 2019 (SAGIS, 2019c), approximately 50% of the bread consumed in South Africa is less refined (brown bread with a 49.1% weight contribution and whole-grain bread with a 1.3% contribution). The estimated contribution of white bread was 49.5% of total bread (kilogram basis). From the second half of 2015 to the first half of 2019 the growth in brown bread production (+18%) overshadowed the growth in white bread production (+15%), suggesting brown bread increased somewhat in popularity (relatively to white bread) over the analysis period. The increasing popularity of brown bread could partly be attributed to affordability considerations, as brown bread is less expensive than white bread[83].

When we consider bread intake quantities derived from household-level expenditure data (see Figure 4.12), the relative popularity of white bread decreased in favour of brown bread from 2005/2006 (Stats SA, 2008) to 2014/2015 (Stats SA, 2017a). However, according to SAGIS manufacturing data, whole-grain bread production showed a decreasing trend over time - implying a decrease in the popularity of the most unrefined bread options on the market. This could possibly be due to the price premiums associated with some whole-grain bread options in South African food retail outlets.

From a socio-economically disaggregated perspective[84] (see Figure 12) the relative importance of white bread generally increases in higher socio-economic segments. However, from 2005/2006 (Stats SA, 2008) to 2014/2015 (Stats SA, 2017a) the relative contribution of brown bread has increased over time for all socio-economic sub-segments, with the most prominent increase occurring among affluent households.

[83] From January 2008 to August 2019 the price of a 700g loaf of brown bread was on average 10.1% less than a 700g loaf of white bread (Stats SA urban food retail prices).

[84] Household level expenditure data obtained from Stats SA Income and Expenditure Surveys (IES) 2005/2006 (Stats SA, 2008) and 2010/2011 (Stats SA, 2012), as well as Stats SA LCS 2014/2015 (Stats SA, 2017a) aggregated to four socio-economic levels: Marginalised households (abbreviated as 'Marg') (least affluent 30% of households), lower middle-income households ('LMI') (30% of households), upper middle-income households ('UMI') (20% of households) and affluent households ('Aff') (most affluent 20% of households).

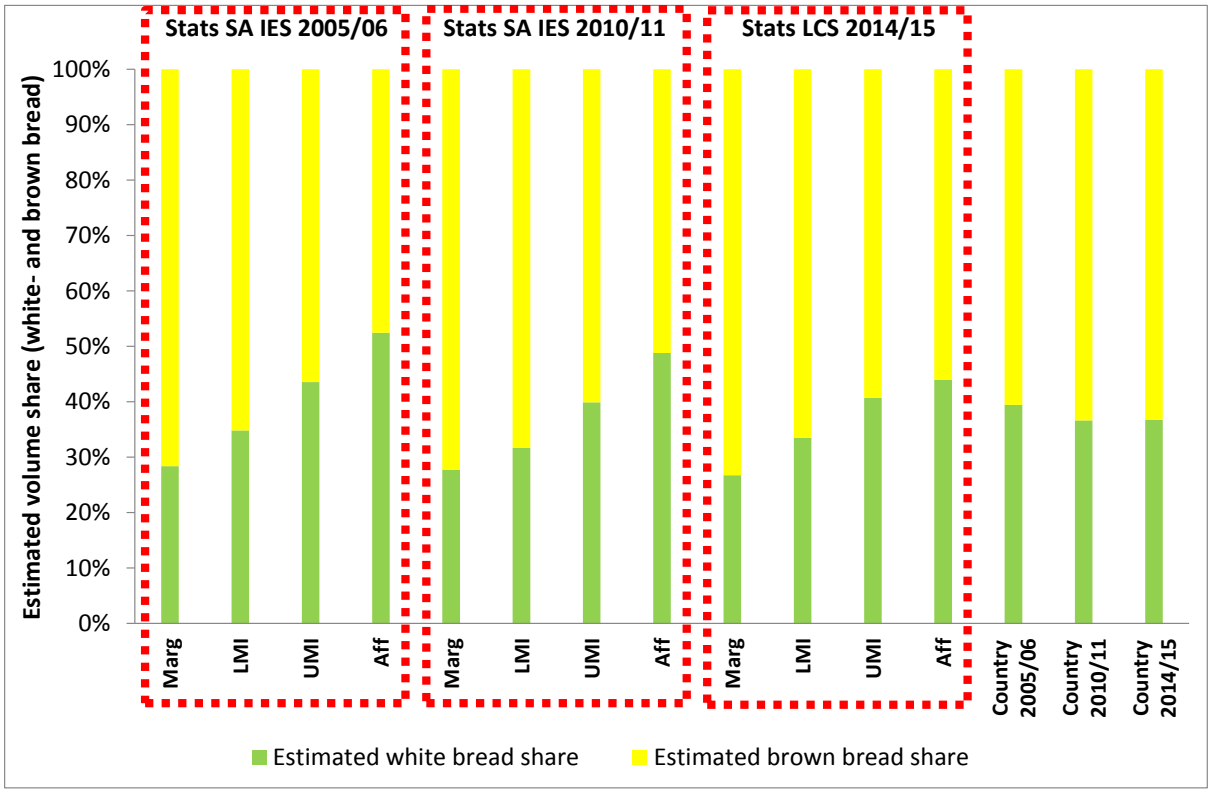

Figure 4.10: A socio-economically disaggregated view of the intake of white bread and brown bread in South African over time (Derived from Stats SA IES 2005/2006, IES 2010/2011 and LCS 2014/2015)

Potatoes:

In South Africa the fresh consumption of potatoes (in the formal and informal market) accounts for 70% of the potato market (BFAP, 2018), which seems positive from a 'less refined staple' perspective. According to consumer research commissioned by Potatoes SA among 600 respondents across the socio-economic spectrum in South Africa (Badenhorst, 2014), the most popular cooking methods used for potatoes, were: mashed (used by 79% of the total sample), in a stew (76%), fried chips (72%), potato salad (69%), roast potatoes (42%), baked potatoes (38%), baked chips (32%) and microwaved potatoes (14%). Considering the list of cooking methods, it is evident that the skin of potatoes is often removed during food preparation, increasing the level of refinement of this starch food and causing some loss in the fibre content of the final consumed product as the skin of a potato contains approximately half of the total dietary fibre (United States Department of Agriculture, Agricultural Research Service, 2018).

Rice: According to Trademap data (2013 to 2017), more refined rice (semi-milled or wholly milled rice) represented 96.4% of the total quantity of rice imported into South Africa, with husked brown rice only making up 0.1% of the total quantity imported (Trademap, 2019). Thus, based on import data, the rice intake of South African consumers predominantly consists of more refined rice options.

4.4.4 Do South African consumers give preference to traditional and/or indigenous starch-rich foods as recommended in the SA FBDG?

This section aims to investigate if intake of starch-rich foods by South African consumers is focussed on traditional and/or indigenous starch-rich foods (as recommended in the SA FBDG) or on highly processed alternatives. In the past, early African tribes in Southern Africa cultivated grain crops such as sorghum and millet, as well as maize (after the arrival of Europeans in Africa) (Malherbe & Hall, 1989).

Even though maize is still a dominant starch-rich staple food in the South African context (as discussed in Section 4.1), the preferred modern version of the product (i.e. refined super maize meal) is far removed from the coarse ground meal consumed by early African tribes (Malherbe & Hall, 1989). Figure 4.11 shows that the consumption of sorghum and millet in South Africa has declined over time, with food supply quantities at substantially lower levels than for maize and wheat. For example, in 2013, the food supply quantities for maize and wheat were estimated as 100 kg/capita/year and 60 kg/capita/year, respectively, compared to levels of 1.35 kg/capita/year for sorghum and 0.09 kg/capita/year for millet (FAO, 2017). According to the most recent Abstract of Agricultural Statistics, the quantity of sorghum processed for human consumption has decreased by approximately 17% from 1999/2000 to 2019, despite a population increase of approximately 34% over this period (Department of Agriculture, Forestry and Fisheries, 2019).

The discussion presented in this section suggests that traditional and/or indigenous grains do not play a significant role in the starch-rich food intake of South African consumers, with decreasing trends observed over time.

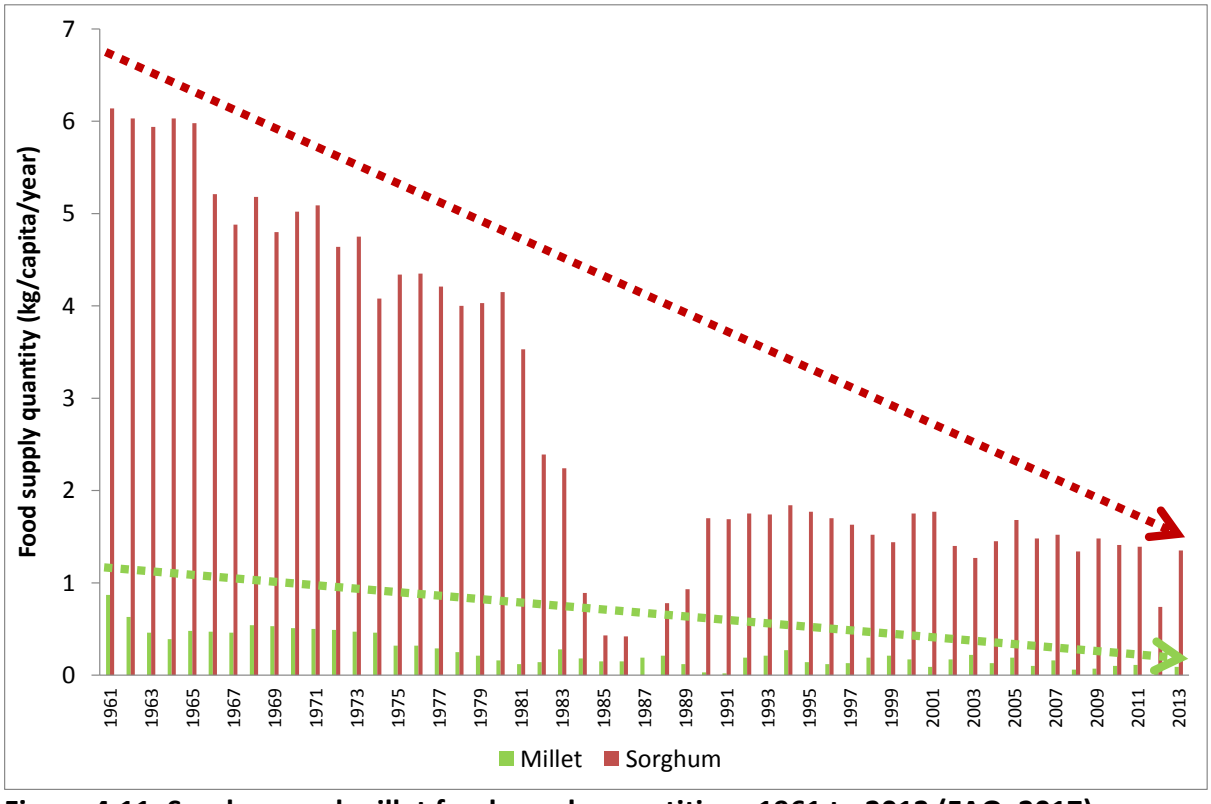

Figure 4.11: Sorghum and millet food supply quantities - 1961 to 2013 (FAO, 2017)

4.5 CONCLUSIONS

During the last decade (2008 to 2018) the starch-rich staple food intake in South Africa was dominated by maize meal (5.5 SSUs/capita/day, with an estimated 23% household-level expenditure contribution according to Stats SA LCS 2014/2015), followed by bread (2.1 SSUs/capita/day, approximately 36% expenditure contribution), rice (1.7 SSUs/capita/day, 12% expenditure contribution) and potatoes (0.98 SSUs/capita/day, 7% expenditure contribution). In the course of this decade, improved household income and living standards have been linked to a declining trend in the per capita consumption of maize meal, while the per capita intake of rice and potatoes increased. However, the close association between staple food intake patterns and the economic conditions faced by households is evident from the increased per capita intake of maize meal in recent years following slow economic growth since 2015 and major shedding of jobs. The main conclusions of this study are:

Main conclusion 1: Starch-rich food intake is above recommended SA FBDG levels

The study showed that the starch-rich food intake of South African consumers on average and across the socio-economic spectrum, is higher than the general recommendation of 10 SSUs/capita/day recommended in the SA FBDG (Vorster, 2013), with a ten year average intake of 10.2 SSUs/capita/day obtained from the four main starch-rich foods. Since approximately 22% of household-level expenditure on starch-rich foods is allocated to other foods[85] within this food group (Stats SA, 2017a), the total intake is expected to be even higher than the recommended 10 SSUs/capita/day.

Main conclusion 2: No prominent focus on whole-grain and/or minimally processes starch-rich foods as prescribed in the SA FBDG

With the exception of brown bread (representing approximately half of the total bread demand in South Africa), the study showed that South African consumers have a preference for refined starch-rich staple options like super maize meal, white bread and white rice. Furthermore rising socio-economic status was generally associated with an increased demand for certain refined starch-rich foods (such as white bread and white rice), as well as a pronounced increase in the expenditure on processed starch-rich foods such as breakfast cereals and baked goods. These observations point to the nutrition transition in South Africa which, among other things, is associated with the increased consumption of processed foods (Shisana et al, 2014).

Main conclusion 3: No prominent focus on traditional and/or indigenous starch-rich foods as prescribed in the SA FBDG

Traditional and/or indigenous grains, such as sorghum and millet, do not play a significant role in the starch-rich foods intake of South African consumers, with decreasing trends

[85] For example: wheat flour (cake and bread flour), pasta and other processed starchy foods, such as breakfast cereals and baked goods.

observed over time. For maize, the modern preference for refined super maize meal is far removed from the coarse ground meal consumed by early African populations.

Main conclusion 4: Significant variation observed in the SSU cost of prominent starch-rich staple food options

The study showed that the most affordable starch-rich staple food option from 2013 to 2018 was maize meal (R0.21/SSU on average from 2013 to 2018), followed by rice (R0.27/SSU), brown bread (R0.62/SSU), white bread (R0.69/SSU) and potatoes (R1.10/SSU). In the case of food price shocks, such as rising maize meal prices due to the impact of the severe 2015/2016 drought in South Africa, the analysis showed that consumers could potentially be driven to substitute fortified maize meal with rice (not fortified), which could lead to potential losses in micronutrient intake.

Final remarks

The analyses presented in this chapter, thus showed that in general, the starch-rich food intake of South African consumers, is characterised by excessive consumption and general preferences for more refined and non-traditional food options in this food group. This could result in limited access to the potential advantages linked to the adequate intake of minimally processed starch-rich foods. The adequate consumption of minimally processed grains and cereals, legumes and root vegetables contributes to protection against NCDs (such as cancer, diabetes and heart disease) through a variety of mechanisms[86] (WHO, 2003; Elia & Cummings, 2007; Mann et al., 2007; Van Dam & Seidell , 2007; Vorster, 2013). Furthermore, whole-grain and minimally processed starch-rich staples (e.g. grains and cereals) are also recognised as sources of dietary fibre. Diets rich in fibre, oligosaccharides and resistant starch have been shown to have a high satiety index, which could prevent excessive energy intake and overweight (WHO, 2003; Elia & Cummings, 2007). A higher dietary fibre intake also promotes bowel regularity (Yang et al., 2012) and may potentially prevent bowel disease. The intake of a refined starch-rich food diet could prevent the population from utilising these benefits, potentially contributing to the complex range of factors increasing the prevalence of overweight in South Africa, which is associated with the increased contribution of NCDs to mortality in South Africa (Shisana et al, 2014).

This chapter illustrated the need for public health policy interventions to bridge the gap between the recommended and actual starch-rich food intake in South Africa. Firstly consumer education through appropriate communication channels (including modern media such as social media) could be a powerful tool to increase balanced food intake. Furthermore particular emphasis should be given to policy interventions to promote the intake of more whole-grain and minimally processed starch-rich food options by improving

[86] For example, by replacing saturated fat in the diet; having beneficial effects on blood lipids (particularly the oligosaccharides, resistant starch and dietary fibre in these foods); lowering the GI of meals; protecting against insulin resistance; and stimulating fermentation in the colon which has positive impacts such as the growth of beneficial gut bacteria, regular stools, the metabolic production of butyric acid (potential protection against colon cancer), the absorption of calcium and immune system strengthening (WHO, 2003; Elia & Cummings, 2007; Mann et al., 2007; Van Dam & Seidell , 2007; Vorster, 2013).

the availability and affordability of these food options – particularly to lower-income consumers. From an affordability perspective, the impact of a larger discount on brown bread versus white bread should be investigated, as an incentive to motivate consumers to eat less refined bread. With low GI bread options generally being more expensive than conventional bread options (white, brown and whole-grain bread), government interventions to improve the affordability of low GI bread could stimulate consumer demand for low GI bread. This could protect consumers from the hyperglycaemic effects of high-GI breads, may be important to prevent NCDs, particularly type 2 diabetes. In order to inform policy actions, future research should investigate consumer understanding of GI in the context of bread, test their willingness to accept low GI bread, as well as determine the magnitude of the discount required to switch between 'regular' bread and low GI bread. The potential fortification of additional foods, such as rice should also be addressed in the future. More research is needed to better understand the factors affecting consumer food choices pertaining to whole-grain or more refined product alternatives, to inform policy intervention formulation.

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CHAPTER 5: CASE STUDY 2 - DOES ANIMAL-SOURCE FOOD INTAKE OF SOUTH AFRICAN CONSUMERS ADHERE TO THE FOOD-BASED DIETARY GUIDELINES?

5.1 INTRODUCTION

Chicken, beef, mutton/lamb, pork, fish and eggs are classified as animal-source foods. Animal-source foods are the dominant food group in South Africa from an expenditure perspective, accounting for 31% of household food expenditure according to Statistics South Africa (Stats SA) Living Conditions Survey (LCS) 2014/2015 (Stats SA, 2017a). The food budget allocated to these animal-source foods generally increases with rising socio-economic status, ranging from 25% for marginalised consumers, to 29% for lower middle-income consumers, 33% for upper middle-income consumers and 37% for affluent consumers. Household expenditure on animal-source foods is dominated by chicken (39% expenditure contribution in this food group), followed by beef (23%), pork (8%), fish (8%), eggs (7%) and mutton/lamb (5%) (Stats SA, 2017a).

Following the development of the food basket models to measure the cost of basic healthy eating in South Africa (Chapter 3), a second case study[87] was conducted. The results of the second study are described in this chapter. In this chapter the principles of the healthy food basket models are applied to evaluate whether the animal-source food intake of South African consumers adheres to the South African Food-based Dietary Guidelines (SA FBDG). Food products originating from animals generally include meat[88], offal, fish, eggs and dairy products (such as milk, cheese and yoghurt) (Schönfeldt et al., 2013a).

The SA FBDGs pertaining to animal-source foods state that "Fish, chicken, lean meat and eggs can be eaten daily" (Schönfeldt et al., 2013a) and "Have milk, maas or yoghurt every day" (Vorster et al., 2013). The main focus of this paper is on lean meat, chicken, fish and eggs. In South Africa 'lean' meat refers to minced- or processed meat products with a total fat content of 10% or less, while meat with a total fat content of 5% or less can be classified as 'extra lean' (DoH, 2010). Further SA FBDG recommendations pertaining to fish, chicken, lean meat and eggs are shown in Table 5.1. Protein foods (such as chicken, fish, lean meat and eggs) should ideally be consumed as part of a varied and balanced diet (Schönfeldt et al., 2013a).

The specific research objectives were to investigate adherence to the following aspects of the SA FBDG pertaining to lean meat, chicken, fish and eggs:

- Maximum daily intake of 90 grams (g) of lean meat (chicken, beef, pork and mutton/lamb);

[87] The first case study (Chapter 4) focused on the intake of starch-rich foods compared to the SA FBDGs.

[88] In South Africa, according to the Meat Safety Act (Act number 40 of 2000) (National Department of Agriculture (NDA), 2000) the term meat refers to "those parts of a slaughtered animal which are ordinarily intended for human and animal consumption and which have not undergone any processing other than deboning, cutting up, mincing, cooling or freezing, and includes meat which— (a) has been treated with a substance that does not substantially alter the original characteristics thereof; and (b) assumes its original characteristics after a substance referred to in paragraph (a) has physically been removed therefrom". Red meat includes the flesh of beef cattle, pigs, sheep, goat, venison and ostriches while white meat originates from the "flesh of poultry" (Schönfeldt et al., 2013a).

- Weekly intake of approximately four eggs per week;
- Weekly intake of two to three servings of fish;
- Fish intake with an emphasis on oily fish (e.g. mackerel, pilchards, sardines and tuna);
- Trimming of visible fat from red meat and chicken and preparing and serving meat with little or no added fat.

Table 5.1: Specific elements of the SA FBDG pertaining to fish, chicken, lean meat and eggs (Schönfeldt et al., 2013a)

Food type:	Recommendations:
Lean meat	"Trim the visible fat from red meat".
	"Remove the skin and fat from chicken".
	Daily consumption of a serving of lean meat, with a cumulative maximum quantity 90 g/day.
	Prepare "meat with little or no added fat and salt".
Eggs	Recommended intake of approximately four eggs per week.
Fish	Recommended intake of "two to three fish servings per week".
	Preferable fish options are oily fish (e.g. mackerel, pilchards, sardines and tuna - including the canned product formats of these fish options).

5.2 CASE STUDY MOTIVATION: WHY IS IT IMPORTANT TO QUANTIFY THE INTAKE OF MEAT, FISH AND EGGS IN SOUTH AFRICA?

Benefits:

If consumed in appropriate quantities and as part of a varied diet, animal-source foods can enhance the nutrient adequacy of the diet. Numerous nutritional benefits are associated with these foods, including the following:

- Protein: A source of high-quantity and high-quality protein due to the presence of proportionally-balanced essential amino acids (Millward, 1999; Schönfeldt et al., 2013a).
- Beneficial fatty acids: Meat contains beneficial fatty acids, contributing to dietary intake of linoleic acid, α-linolenic acid and polyunsaturated fatty acids (C20 and C22). From a food intake perspective, C20 and C22 polyunsaturated fatty acids can only be obtained by consuming meat from ruminants and oily fish (Uauy, 2011; Enser et al., 1998; Schönfeldt et al., 2013a).
- Micronutrients: Animal-source foods are a good source of certain micronutrients (Schönfeldt et al., 2013a) that have been found to be lacking in the general food intake of the population (National Food Consumption Surveys of 1999 and 2005), particularly vitamin A, vitamin B1, vitamin B2, vitamin B6, vitamin B12, niacin, iron and zinc (Labadarios et al., 2008). Compared to plant-source foods, animal-source foods have been shown to contain a higher concentration particularly of minerals such as iron and zinc, with the added benefit of nutrient quality and bioavailability applicable to these compounds in animal-source foods (Welch & Graham, 2005; Gibson, 1994; Schönfeldt et al., 2013a). With no vitamin B_{12} in plant-source foods, animal-source foods are an essential source of vitamin B_{12} (Murphy & Allen, 2003).

Despite the nutritional benefits associated with the intake of chicken, lean meat, fish and eggs, the consumption of animal-source foods has been subjected to increasing scrutiny over time. A wide range of factors can be used to motivate a reduced intake or the complete elimination of animal-source food intake (particularly meat). For example, health concerns, religious concerns and ethical concerns, which include animal welfare- and environmental concerns (Wyness et al., 2011; Richardson et al., 1994; De Backer & Hudders, 2014). In this Chapter, an attempt will be made to highlight some of the current prominent animal versus plant-source food debates. However, this is merely to present the facts and does not necessarily imply support of either view.

Concern 1: The role of animal-source foods in over-nutrition

The nutrition transition involves changes in dietary patterns and consequently nutrient intake, often caused by socio-economic development, urbanisation and acculturation (Vorster et al., 2011). It is characterised by an increased intake of animal-source foods that improves the intake of dietary protein and micronutrients (such as calcium and iron). However, the nutrition transition is also characterised by the intake of more saturated fat, total fat, sodium and added sugar, while the consumption of vegetables and legumes tends to decrease with subsequent decreased nutrient intake of specific nutrients such as dietary fibre and vitamin C. The nutrition transition is characterised by individuals consuming more convenience foods which are usually micronutrient-poor and high in fat and sodium, as well as foods and beverages with significant quantities of added sugar, such as sweetened carbonated beverages (Drewnowski & Popkin, 1997; Vorster, 2010; Chopra et al., 2002). Ultimately the nutrition transition has been associated with an increased risk of non-communicable diseases (NCDs) due to less-desirable food intake (Vorster et al., 2011; Schmidt et al., 2011).

According to World Health Organisation (WHO) estimates (WHO, 2018a), the global prevalence of obesity nearly tripled between 1975 and 2016, with 39% of adults (aged 18 years and older) classified as overweight – including obese individuals representing about 13% of the global population. Overweight and obesity levels are also increasing among children (NCD Risk Factor Collaboration, 2017). Along with the persistent prevalence of under-nutrition in South Africa, the prevalence of over-nutrition in the forms of overweight and obesity is rising to high levels:

- The incidence of overweight and obesity in children aged 1 to 6 years, increased from 15.1% in 2005 (according to the 2005 National Food Consumption Survey 2005 (Labadarios et al., 2008)) to 22.7% in 2012 (according to the 2012 South African National Health and Nutrition Examination Survey (SANHANES-1)) (Shisana et al, 2014));
- According to the 2016 Stats SA South African Demographic and Health Survey (SADHS), 67.6% of women and 31.3% of men were overweight or obese (Stats SA, 2017b), with increasing trends observed over time (Schönfeldt et al., 2013a). NCDs, such as type 2 diabetes, hypertension, and cardiovascular disease – which are linked to adult mortality and premature death (Vorster et al., 2013; Lee & Yoon, 2018; Millward, 1999).

The consumption of animal-source foods contributes to total fat intake, as well as the saturated fatty acids intake of individuals (Schönfeldt et al., 2013a). In response to consumer demand, the fat content of beef in South Africa has been reduced over a period of 40 years by a combination of breeding, farming techniques and butchering techniques (i.e. removal of visible fat from meat cuts), to less than 10 g per 90 g portion (Schönfeldt & Hall, 2012).

Concern 2: Hypertension and sodium intake

The intake of animal-source foods is linked to an increased risk of hypertension (high blood pressure), particularly in the context of dietary sodium intake (Schönfeldt et al., 2013a). Animal-source foods, such as unprocessed meat and milk, inherently contain very little sodium (Wolmarans et al., 2020; Schönfeldt & Hall, 2012), even though salt is usually added during meat preparation. Processed animal-source foods (such as Vienna sausages, smoked sausages and cheese) contain significantly higher levels of sodium (Wolmarans et al., 2010), which could increase the risk of hypertension (McNeill & Van Elswyk, 2012). However, as part of a strategic plan formulated to prevent NCDs, the South African Department of Health (DoH) formulated legislation to decrease the mean salt intake of the population to less than five gram per day (DoH, 2013a). The legislation[89] applies to bread; all breakfast cereals and porridges; all fat spreads and butter spreads; ready-to-eat savoury snacks; flavoured potato crisps; flavoured ready-to-eat savoury snacks and potato crisps; cured processed meat; uncured processed meat; raw-processed meat sausages; dry (non-instant) soup powders; dry gravy powders and dry instant savoury sauces; dry savour powders with dry instant noodles to be mixed with a liquid; and stock products (stock cubes, stock powders, stock granules, stock emulsions, stock pastes or stock jellies) (DoH, 2016). A two stage approach is specified in the legislation with initial sodium reduction targets coming into effect on 30 June 2016 and further reductions on most foods coming into effect on 30 June 2019. The legislation should help to reduce the potential hypertension risk associated with animal-source foods over time.

Concern 3: Cancer

Health concerns pertaining to meat also pertain to the association between meat (especially processed meat) intake and cancer (Goldbohm et al., 1994). According to the WHO (2018a), cancer is the second leading cause of death globally. Furthermore approximately 70% of cancer-related deaths occur in low-income and middle-income countries. In 2018 the International Agency for Research on Cancer (IARC) concluded that processed meat is "carcinogenic to humans" (Group 1), while red meat is "probably carcinogenic to humans" (Group 2A) (IARC, 2018).

Numerous factors are associated with increased cancer risk, including westernised lifestyle factors, such as high body mass index, inadequate physical activity, food intake behaviour

[89] DoH (2013). Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972), Regulations relating to the reduction of sodium in certain foodstuffs' (R.214), 20 March 2013.

(consuming more refined foods and less fruits and vegetables), alcohol intake and tobacco use (WHO, 2018a).

Concern 4: Animal welfare and environmental sustainability

Consumer concerns regarding the welfare of animals during production and the environmental impacts of modern-day livestock production systems have been increasing since the 1990s, e.g. Hughes (1995), Verbeke & Viaene (1999), Moss (1992) and Verbeke and co-workers (1999). From an environmental perspective consumer concerns include greenhouse gas emissions, land use and the water footprint – all within the context of the production of animal-source foods (Vinnari & Tapio, 2009). De Backer and Hudders (2014) found that Flemish consumers had a higher probability of avoiding meat when they had animal welfare concerns and environmental concerns pertaining to the production systems of animal-source foods. Dealing with the dietary changes to achieve healthy diets by 2050 the EAT-Lancet report (Willett et al., 2019) recommends that the global consumption of red meat (described as a 'less healthy food' in the report) should decrease by more than 50%, while the consumption of fruits, vegetables, legumes and nuts should double by 2050.

Usefulness of this study

Historical, recent and regularly updated quantitative data on the consumption of animal-source foods (specifically meat, fish and eggs) from a national per capita perspective, as well as a socio-economically disaggregated perspective, can contribute to a better understanding of numerous critical research questions, e.g.:

- Are South African consumers tapping into the benefits offered by animal-source foods by adhering to SA FBDG in terms of meat, fish and eggs?
- In view of the double burden of nutrition in South Africa: Which consumers are eating inadequate and excessive quantities of animal-source foods and what is the extent of under- and over-consumption?

The next section in this chapter focuses on contextualising the consumption of animal-source foods in South Africa in the global context, followed by a description of the research methodology that was used.

5.3 A GLOBAL PERSPECTIVE ON THE CONSUMPTION OF MEAT, FISH AND EGGS

According to the Food and Agricultural Organisation (FAO) of the United Nations (UN) the dominant animal-source foods in 2013 at a global level were pork (39.5% contribution to global food supply energy availability from meat, fish and eggs), poultry meat (18.8%), bovine meat (12.8%), eggs (11.5%) and fish / seafood (10.5%) (FAO, 2017) (Figure 5.1). Poultry meat dominated in North-America, Oceania, South America and South Africa (presented in order of per capita energy contribution). The largest per capita energy availability from pig meat is in Europe, followed by Asia, Northern America, Oceania and Central America. For bovine meat the largest per capita energy intake was in South America, followed by South Africa, Northern America and Oceania. The consumption composition of animal-source foods in South Africa was similar to South America and was dominated by chicken, followed by bovine meat (beef), pig meat and eggs. Overall, the total per capita

energy availability from meat and eggs was the highest in Oceania and Northern America, followed by Europe and South America – at higher levels than those of South Africa.

According to the Organisation for Economic Co-operation and Development (OECD) and FAO Agricultural Outlook (OECD/FAO, 2019), expectations are that the global per capita consumption of meat could increase by 1.2% over the next ten years to 35.1 kilogram (kg) (retail weight equivalent). Income growth is expected to support growth in the per capita demand for poultry[90], beef and sheep meat[91]. A declining trend is expected for pig meat.

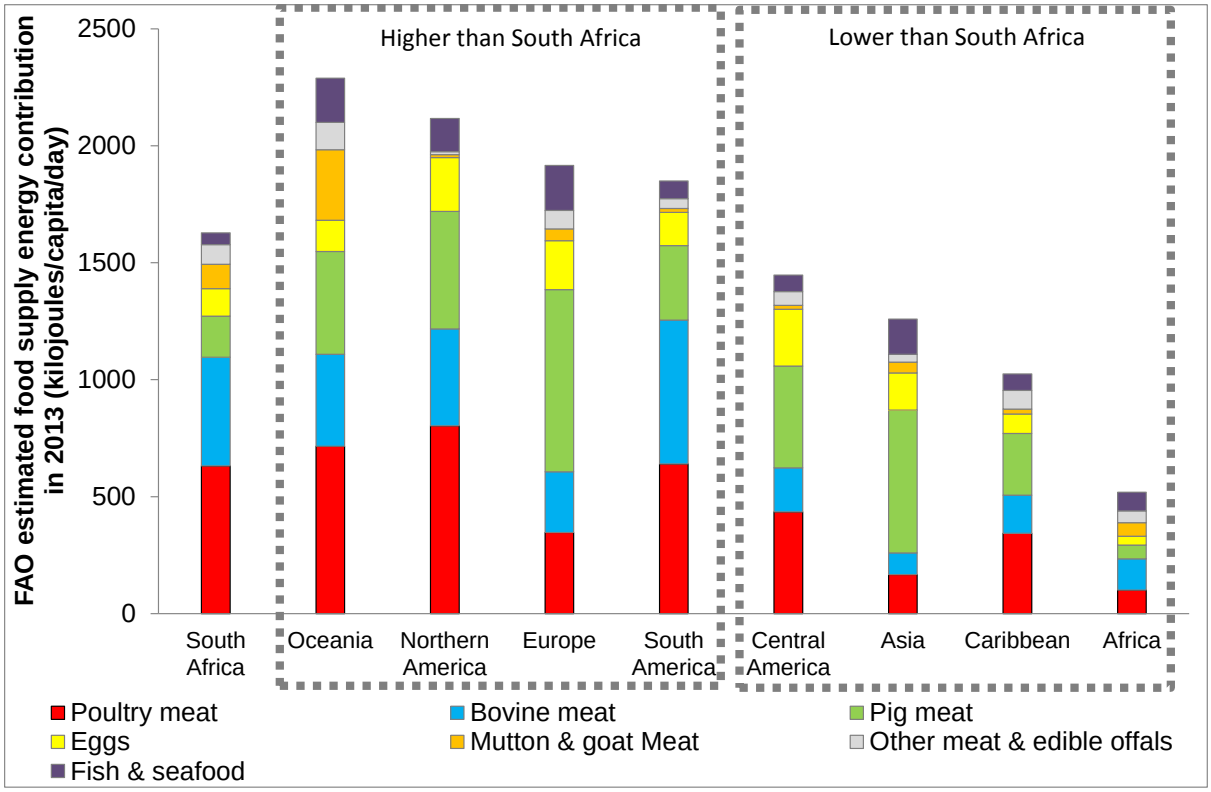

Figure 5.1: Animal-source food supply in South Africa versus other world regions in 2013 *(FAO, 2017)*

5.4 METHODOLOGY

5.4.1 National average meat consumption

Ideally data on the intake of animal-source foods should be obtained from official nationally representative food consumption survey data. However, in South Africa, there has never been a nationally representative dietary survey undertaken among adults (Steyn et al., 2015) and the 1999 National Food Consumption Survey (Labadarios et al., 2005) focused only on children aged 1 to 9 years. Even though chicken, eggs and full cream milk are among the most widely consumed food items by South Africans (Nel & Steyn, 2002; Tydeman-Edwards, 2012), no portion size data are available. Consequently this chapter had to utilise alternative data sources to estimate the intake of animal-source foods in South Africa.

[90] Affordability is a major factor in the popularity of poultry meat, especially in developing countries.

[91] Red meat (beef and sheep meat) per capita intake is expected to increase as consumers diversify their meat intake to include these more expensive meat options, with rising income levels.

The estimation of the per capita intake on the basis of a single serving unit (SSU) for the dominant animal-source foods in South Africa (chicken, beef, pork, mutton/lamb, fish and eggs as discussed in Section 5.1) was based on national aggregate figures of commodity quantities allocated for human consumption[92]. These annual data series for the last decade (2008 to 2018) were obtained from the BFAP (Bureau for Food and Agricultural Policy) partial equilibrium sector model (BFAP, 2019), which is based on data sourced from industry organisations[93], combined with consultation between BFAP and the particular industries to yield the most accurate possible aggregate national consumption figures.

The annual aggregate food supply figures for beef, mutton/lamb, pork and chicken are based on the post-abattoir carcass mass (head, feet, tail and offal[94] removed). In addition to a lean meat component, these figures thus also include bone, fat, and skin (e.g. for chicken). To estimate the intake of lean raw meat from these figures, South African carcass composition information was utilised (confirmed by meat experts in South Africa as the most reliable references (Strydom, 2018; Van Heerden, 2018)):

- Beef carcass lean meat (muscle including inter-muscular fat) share: 79.1%[95] (Strydom et al., 2000), with a comparable value (80.1%) reported by Schönfeldt (1998)[96];
- Pork carcass lean meat share: 62.6%[97] (Pieterse et al., 2009);
- Lamb carcass lean meat share: 76.2%[98] (Strydom et al., 2009);
- Chicken carcass lean meat share: 50.5%[99] (Schönfeldt et al., 1998).

By applying these carcass meat shares, raw lean meat intake quantities were estimated and then divided by SA population numbers[100] to obtain per capita raw lean meat intake figures.

[92] With informal consumption quantities usually based on estimations by industry organisations, the over or under-estimation of informal sector meat consumption could affect the estimation results.

[93] For example, the South African Red Meat Producers Organisation (RPO), Pork Producers Organisation (SAPPO), The Red Meat Abattoir Association (RMAA) and the South African Poultry Association (SAPA)).

[94] According to Regulation R1055 (of 8 August 2002) of the Foodstuffs, Cosmetics and Disinfectants Act, 1072 (Act No. 54 of 1972), "Edible offal means in the case of food, animals other than poultry, blood plasma, brains, cowheels, diaphragm, gut (casings), washed head, kidneys, omentum, pancreas, pluck (oesophagus, trachea, lungs, heart, pericardium, associated lymph nodes, pillars of the diaphragm and liver or part thereof without the gallbladder), rind and skin, spleen, tail, thymus, tongue, cleaned tripe, trotters and udder in the case of a heifer; in the case of poultry "edible offal" means giblets (heart, clean, stripped gizzard and the liver without the gallbladder".

[95] Values apply to a 240kg A2 Bonsmara beef carcass. Total fat: 16.0%; Bone: 15.3%; Lean meat: 68.7%; Meat (with inter-muscular fat included): 79.1% (Strydom et al., 2000).

[96] Schönfeldt (1998): Meat 80.1%, muscle 70.5%, bone 13.4%, sub-cutaneous fat 6.55%. Observations for age A, B and C carcasses were weighted by RMAA slaughtering statistics for 2017 (RMAA, 2017): age A 77.2%, age B 3.9%, age C 13.4%.

[97] Values apply to pigs slaughtered at 135kg live weight (control values obtained). Total fat: 21.7%; Bone: 10.9%; Skin: 4.2%; Lean meat: 62.6% (Pieterse et al., 2009). More recently Strydom and Hope-Jones (2018) found that the bone share in a P class 75kg pork carcass (excluding head, feet, kidneys, kidney fat and tail) was 12%.

[98] Values apply to lamb carcasses of fat classes 1 to 5, as estimated by (Strydom et al., 2009), weighted by RMAA slaughtering statistics for 2017 (in 2017 the contribution of the various fat scores to the total mass share of lamb / mutton slaughtered in South Africa were: fat score 1 (5.7%), fat score 2 (73.4%), fat score 3 (17.1%), fat score 4 (2.1%), fat score 5 (0.4%) and fat score 6 (0.5%) (RMAA, 2017)). Lean meat refers to muscle and inter-muscular fat.

[99] Raw chicken carcass composition according to research conducted by the Agricultural Research Council from 1997 to 1999 (Schönfeldt et al., 1998): meat 50.5%, skin 13.8%, dissectible fat 1.6% and bone 33.4%.

To investigate adherence to the SA FBDG for the selected animal-source foods, it was essential to rework per capita lean meat intake to SSU quantities. According to the SA FBDG, a SSU of cooked lean meat or fish is defined as 90g (Schönfeldt et al., 2013a). However, different meat species vary in terms of physical carcass composition (i.e. lean meat, fat, bone, skin), nutritional composition (Table 5.2) and cooking yield factors. Yield factors were applied to account for non-edible components and cooking loss[101]:

- Chicken: approximately 0.80 (chicken breast, pan fried) (Bognár, 2002);
- Beef: approximately 0.69 (low fat ground beef) (USDA, 2012);
- Pork: approximately 0.75 (roast pork fillet) (Bognár, 2002);
- Mutton/lamb: approximately 0.67 (roasted, boneless leg, shoulder) (Bognár, 2002).

These values compare well with a raw (bone-in) to cooked conversion of approximately 66.7% proposed by the DoH (2001) for the various meat options (beef, mutton/lamb, pork and chicken). Table 5.3 presents a summary of SSU quantities (raw and cooked) for lean meat and fish used for the calculations.

5.4.2 Meat consumption from a socio-economically disaggregated perspective

In the absence of nationally representative food intake data, nationally representative household-level expenditure data (specifically the Stats SA LCS 2014/2015) was used as the basis to estimate the intake of chicken, beef, pork, sheep meat, fish and eggs across the socio-economic spectrum. Stats SA food expenditure data are gathered for animal-source food categories with high levels of product aggregation (Stats SA, 2012; Stats SA, 2017a), thus not allowing for analysis of specified cuts within species. Four socio-economic population segments were considered:

- Marginalised consumers: least affluent 30% of households in South Africa (Stats SA expenditure decile (ED) [102] 1 to 3);
- Lower middle-income consumers: lower 30% of middle-class segment (ED 4 to ED 6);
- Upper middle-income consumers: upper 20% of middle-class segments (ED 7 to ED 8);
- Affluent consumers: wealthiest 20% of households in South Africa (ED 9 and ED 10).

The food expenditure data reported in household-level expenditure studies such as Stats SA LCS 2014/2015 are known to be under-reported due to the particular food diary methodology employed to gather the data (Stats SA, 2017a). Consequently all estimations were subjected to adjustment factors based on the difference between intake quantities estimated from expenditure data for the country on average and national aggregate per capita intake quantities for 2014/2015 derived from total demand.

Average household sizes in the various EDs and urban food retail prices monitored by Stats SA[103] from October 2014 to October 2015 (the data gathering period of LCS 2014/2015)

[100] Sourced from the BFAP sector model (BFAP, 2019), which is based on data from Stats SA, the International Monetary Fund and the United Nations Population Prospects.

[101] The applied conversion factors did not account for food waste due to potential food spoilage or "plate loss".

[102] Each ED contains 10% of the households in South Africa, with affluence level affluence increasing towards ED 10 (Stats SA, 2017a).

were considered to estimate intake quantities per capita across the socio-economic spectrum.

To account for differences in the consumption patterns of different socio-economic groups, the weightings of retail prices in the various socio-economic groups were based on a combination of typical expenditure data sourced from LCS 2014/2015 and primary consumer research.

Primary consumer research to investigate the meat behaviour and perceptions of South African consumers, was conducted for the South African red meat industry among consumers in Gauteng (2012/2013) and the Western Cape (WC) provinces (2016/2017)[104] . The study focused on adult consumers responsible for food purchasing and preparation in households from marginalised-, middle-income and affluent consumer groups. The survey questionnaire was based on questionnaires applied in previous studies[105]. Quota sampling was applied to reflect the characteristics of the South African population pertaining to socio-economic group, age category and ethnic groups. Geographically the samples were selected from random areas in Johannesburg, Tshwane and Cape Town. Sample recruitment and interview facilitation was done by a professional consumer panel recruitment agency and the duration of a typical consumer interview was between 90 minutes and two hours, mostly conducted in the respondents' homes. Participants received a small monetary participation incentive (R200 (US$ 13.50)[106] per respondent). In Gauteng, the sample consisted of 164 marginalised households, 171 middle-income households and 249 affluent households (total sample n=584). In the Western Cape, the sample consisted of 250 marginalised households, 250 middle-income households and 250 affluent households (total sample n=750). Refer to Table 5.4 for more detail on the sample characteristics. Ethical clearance for the study was obtained through the University of Pretoria (Ethical Clearance certificate: EC 11118/072) (see Addendum A). Data capturing and analyses were done using Microsoft Office Excel 2007 and SPSS (Statistical Package for the Social Sciences) versions 21.0 to 25.0.

Table 5.5 presents an overview of the dominant options or cuts of the different species purchased by the different socio-economic groups from an expenditure perspective. Data from the above mentioned primary consumer research were also used to investigate the tendency of consumers to reduce the fat content of the meat they eat by trimming and other actions. Estimated intake quantities of meat and fish, per socio-economic sub-group, were converted to lean meat intake estimations by applying the ratios, cooking yields and other assumptions as explained earlier in the methodology section.

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[103] Food retail price data was sourced from the official Stats SA dataset of monitored food retail prices gathered by Stats SA on a monthly basis for Consumer Price Index (CPI) calculations (Stats SA, 2019a).

[104] Funded by Red Meat Research & Development SA (RMRD SA).

[105] E.g. the Meat Board Quantitative Survey, 1996; Protein survey, 1996; Quantitative survey, 1997 and South African Pork Producers Organisation (SAPPO), 2000 study (Nielsen, 2003; Nielsen, 2000; The Meat Board, 1996; Market Research Africa, 1997).

[106] Exchange rate R14.81 = US$1.

Table 5.2: The composition of selected animal-source foods per 100g edible portion

Nutrient:	**Chicken**[1] (with skin, frozen, boiled)	**Chicken**[1] (without skin, frozen, boiled)	**Beef**[1] (fillet, cooked, not trimmed)	**Beef**[1] (topside lean mince, cooked moist)	**Lamb**[2] (loin, cooked, untrimmed)	**Mutton**[1] (leg & shoulder, lean, meat only, braised)	**Pork**[1] (loin, lean, meat only, braised)	**Eggs from chickens**[1] (boiled)
Energy (kJ)	923	668	803	913	1171	899	814	616
Protein (g)	26.8	29.4	30.9	30.4	23.5	33.7	29.8	12.6
Fat (g)	12.6	4.6	7.5	10.7	20.9	8.8	8.3	10.3
Vitamin B_1 (mg)	0.08	0.08	0.24	0.22	-	0.07	0.82	0.11
Vitamin B_2 (mg)	0.15	0.16	0.19	0.19	-	0.24	0.23	0.38
Vitamin B_6 (mg)	0.17	0.2	0.44	0.47	-	0.12	0.401	0.04
Vitamin B_{12} (µg)	0.3	0.3	2.3	2.1	-	2.7	0.5	1.6
Iron (mg)	0.8	0.7	2.5	2.6	2.87	2.8	1.1	1.8
Zinc (mg)	1.78	1.92	7.45	4.6	3.11	6.58	2.26	1.15

[1] (SAFOODS, 2017); [2] (Schönfeldt et al., 2011)

Table 5.3: Estimated raw and cooked SSU of lean meat (beef, lamb, pork, chicken), fish and eggs

Meat type:	**SA FBDG recommended cooked lean meat (boneless) SSU size:**	**Yield factor:**	**Estimated raw SSU size: (as purchased format)**
Beef	90g[1]	±0.69[3]	130g
Lamb	90g[1]	±0.67[4]	134g
Pork	90g[1]	±0.75[4]	120g
Chicken	90g[1]	±0.80[4]	113g
Fish	90g[1]	±0.83[4]	150g
Eggs	100g[2]	±0.9[4]	Two smaller size large eggs (size range of large eggs is 51g to 59g per egg) (Department of Agriculture, Forestry and Fisheries, 2011)

Sources: [1] Schönfeldt et al. (2013a); [2] DoH (2013); [3] USDA (2012) (yield factor applies to low fat (<12% fat) ground beef); [4] Bognár (2002).

Table 5.4: Summary of the demographic characteristics of the Gauteng and Western Cape samples in terms of Living Standards Measure (LSM®) segment, age category and ethnicity

Sub-segment:	Variable:	Levels of variable:	Gauteng actual: Share of sub-group:	SA population (2012):	WC actual: Share of sub-segment sample:	WC characteristics:[3] (AMPS 2014AB)
Marginalised consumers (n=165)	LSM® segment	LSM® 2	9.7%	17.5%[1]	28.8%	17.9%
		LSM® 3	26.1%	26.7%[1]		
		LSM® 4	64.2%	55.7%[1]	71.2%	82.1%
	Age category	Younger than 35	57.3%	53.2%[1]	60.0%	45.4%
		35 and older	42.1%	46.8%[1]	40.0%	54.6%
	Ethnicity	Black	98.8%	77.9%[2]	63.6%	33.6%
		Coloured	0.6%	3.5%[2]	36.4%	47.9%
		Indian	0.6%	2.9%[2]	-	1.0%
		White	-	15.7%[2]	-	17.4%
Middle-income consumers (n=171)	LSM® segment	LSM® 5	17.0%	28.6%[1]	7.6%	10.9%
		LSM® 6	38.6%	37.9%[1]	37.6%	38.5%
		LSM® 7	22.8%	19.2%[1]	34.8%	29.0%
		LSM® 8	21.6%	14.4%[1]	19.2%	21.6%
	Age category	Younger than 35	42.1%	51.2%[1]	43.6%	45.4%
		35 and older	57.9%	48.8%[1]	56.4%	54.6%
	Ethnicity	Black	75.4%	77.9%[2]	42.4%	33.6%
		Coloured	9.4%	3.5%[2]	47.6%	47.9%
		Indian	1.8%	2.9%[2]	2.0%	1.0%
		White	12.3%	15.7%[2]	7.6%	17.4%
Affluent consumers (n=249)	LSM® segment	LSM® 9	52.6%	60.9%[1]	66.4%	67.4%
		LSM® 10	47.4%	39.1%[1]	33.6%	32.6%
	Age category	15–24	34.5%	43.4%[1]	38.0%	45.4%
		25–34	65.5%	56.6%[1]	62.0%	54.6%
	Ethnicity	Black	27.3%	77.9%[2]	8.8%	33.6%
		Coloured	4.4%	3.5%[2]	47.2%	47.9%
		Indian	4.4%	2.9%[2]	1.6%	1.0%
		White	63.5%	15.7%[2]	41.6%	17.4%

[1] Source: SAARF (2013) based on data from SAARF AMPS 2012.
[2] Source: Stats SA (2012) Census 2011 Municipal Report Gauteng.
[3] Source: All Media and Products Survey (AMPS) 2014 AB – Western Cape data

Table 5.5: Socio-economically disaggregated view of the dominant product options purchased (presented in order of importance)

Main product:	Marginalised consumers:	Middle-income consumers:	Affluent consumers:
Beef[1]	Stew, mince, Boerewors, offal	Stew, mince, Boerewors, steak	Steak, mince, stew, Boerewors
Sheep meat[1]	Stew, offal, chops	Chops, stew, roast, ribs	Chops, stew, roast, ribs
Pork[1]	Stew, chops, offal	Chops, stew, roast	Chops, roast, stew
Chicken[1]	Frozen chicken, fresh pieces, offal	Fresh pieces, frozen chicken	Fresh pieces, frozen and whole chilled chicken
Fish[2]	Canned pilchards	Canned pilchards, fish (fresh, frozen, processed)	Fish (fresh, frozen, processed), canned pilchards, canned tuna

[1] *Source: Primary consumer research in Gauteng and Western Cape.*
[2] *Source: Stats SA LCS 2014/2015* (Stats SA, 2017a).

5.4.3 Egg consumption

To investigate whether South African consumers adhere to the SA FBDG of eating approximately four eggs per week, data were generated on the number of eggs consumed per capita per week. Per capita egg intake for the period 2008 to 2018 was estimated based on data of annual domestic use of eggs (BFAP, 2019; SAPA, 2018) divided by South African population figures (BFAP, 2019). To enable comparison with SA FBDG recommendations, the per capita egg consumption figures (expressed as kg/capita/year) were reworked to the number of eggs consumed per capita per week by applying the typical weight of an egg in South Africa and the number of weeks per year. According to SAPA (2018) the average weight of an egg in South Africa for 2016/2017 was 59.50 grams. A yield factor of 0.9 is used to convert raw eggs to an edible portion (Bognár, 2002).

Socio-economically disaggregated per capita egg consumption was estimated by considering household-level egg expenditure data (Stats SA LCS 2014/2015) (Stats SA, 2017a), average household sizes per ED, average egg retail prices from October 2014 to October 2015 (i.e. the data gathering period of LCS 2014/2015), under-reporting factors, the typical size of an egg in South Africa and the number of weeks per annum.

5.4.4 Fish consumption

To investigate whether South African consumers adhere to the SA FBDG of eating approximately two to three fish servings per week, data were generated on the number of fish servings consumed per capita per week. National aggregate annual food supply from fish for the period 2008 to 2018 was obtained from the OECD / FAO Agricultural Outlook for 2019 (OECD/FAO, 2019). Daily per capita fish intake (edible portion) was calculated by applying a yield factor of 0.83 to account for cooking loss, bone and plate waste (Bognár, 2002) and to facilitate comparison with the SA FBDG recommendations as related to fish.

The SA FBDG relating to fish, also recommends an emphasis on oily fish such as sardines, pilchards, tuna, anchovies and mackerel (including the tinned versions of these fish options). Adherence to this guideline was explored by considering information on seafood

consumption composition in South Africa by utilising data published by the World Wildlife Foundation (WWF, 2014), as well as household-level food expenditure data obtained from Stats SA LCS 2014/2015 (Stats SA, 2017a).

5.4.5 The affordability of dominant animal-source foods over time

The affordability of chicken, beef, pork, mutton/lamb, fish and eggs was investigated by calculating the cost per SSU for these foods, based on historical food retail prices as monitored by Stats SA in urban areas.

5.5 RESULTS AND DISCUSSION

5.5.1 Do South African consumer eat a maximum of 90 gram lean meat per day?

As mentioned in Section 5.1, the SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) recommends that a 90 gram serving of cooked lean meat can be eaten daily. Figure 5.2, Figure 5.3 and Table 5.6 present the estimated per capita national raw and cooked lean meat intake from chicken, beef, pork and lamb in South Africa for the period 2008 to 2018.

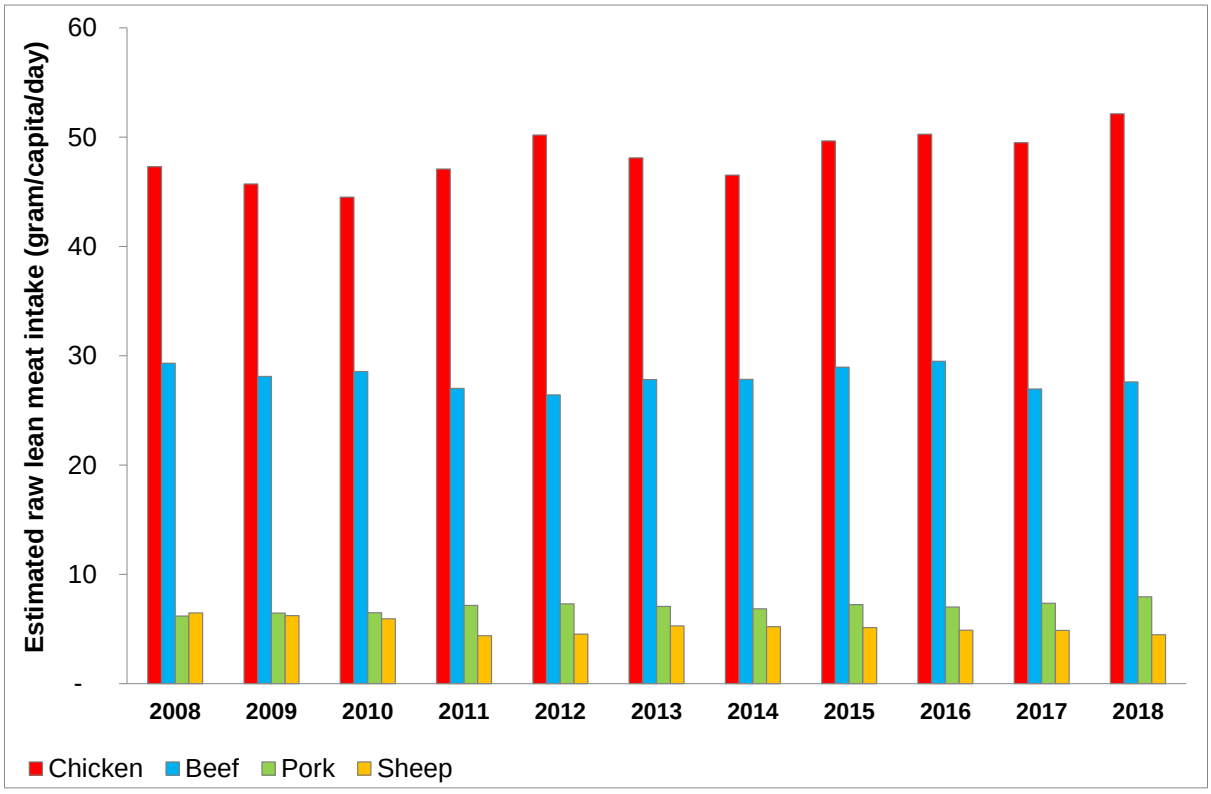

Figure 5.2: Estimated per capita intake of raw lean chicken, beef, pork and mutton /lamb for the period 2008 to 2018 (Source: Calculations as explained in the methodology section)

Over the last decade the ten-year average raw lean meat intake from chicken dominated (48.3 g/capita/day or 34.9 kg/capita/year on a carcass mass basis), followed by beef (28.0 g/capita/day or 12.9 kg/capita/year on a carcass mass basis), pork (7.0 g/capita/day or 4.1 kg/capita/year on a carcass mass basis) and mutton / lamb (5.2 g/capita/day or 2.5 kg/capita/year on a carcass mass basis) (see Figure 5.2).

From a cooked lean meat perspective, chicken was the dominant meat option consumed in South Africa over the last decade, contributing 57.7% to daily cooked meat intake, followed by beef (29.0%), pork (7.9%) and sheep meat (5.3%) (see Figure 5.3). From an energy intake perspective[107] the total estimated energy intake from chicken, beef, pork and mutton/lamb from 2013 to 2018 consisted (on average) of approximately 49% chicken, 33% beef, 11% pork and 7% mutton/lamb. These values compare well with FAOSTAT data for 2013 (FAO, 2017)reporting the energy contributions as follows: chicken 46%, beef 34%, pork 13% and mutton/lamb 8% (when considering only chicken, beef, pork and mutton/lamb).

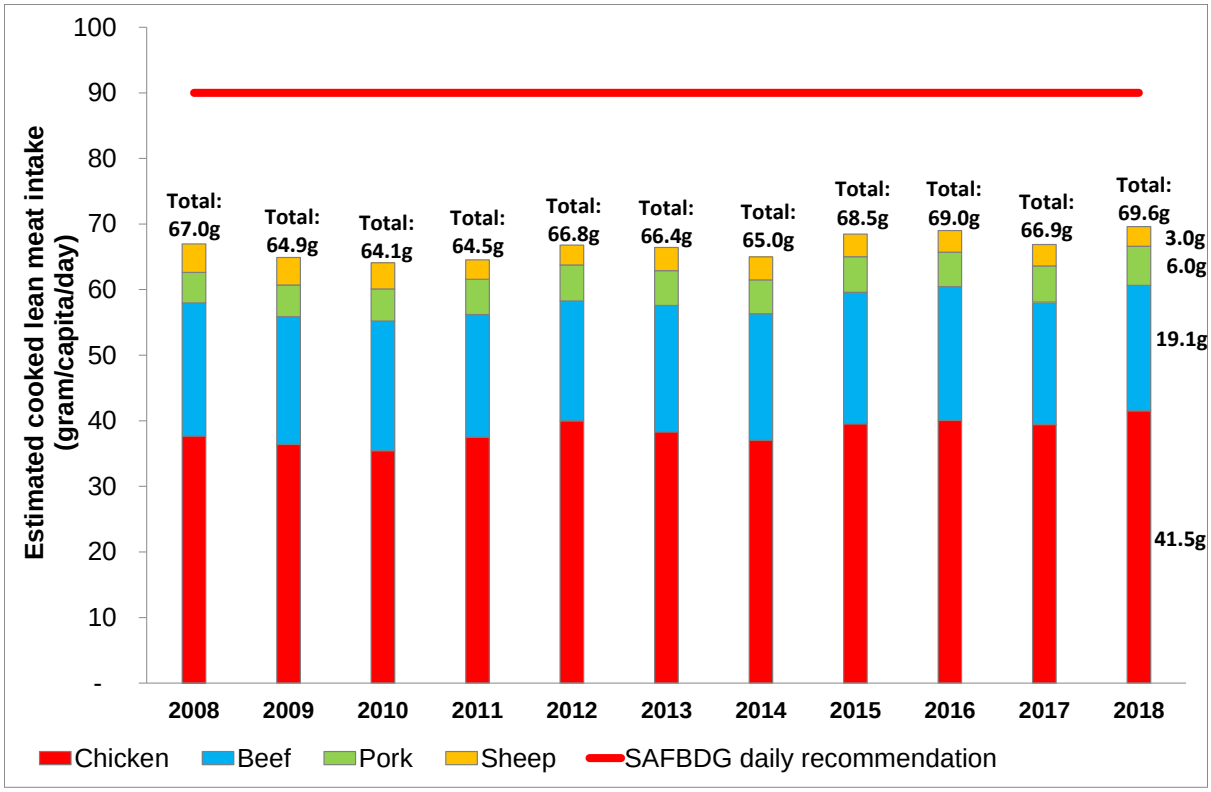

Figure 5.3: Estimated per capita intake of cooked lean chicken, beef, pork and lamb for the period 2008 to 2018 (Source: Calculations as explained in the methodology section)

The dominance of chicken in South Africa was confirmed by Mchiza and co-workers (2015). In a review of dietary surveys undertaken among the adult South African population (2000 to 2015), they found that chicken was the only meat option among the top ten most widely consumed foods by South Africans, implying that chicken is the most preferred source of protein in the country. Other animal-source foods also included among the top ten food items were eggs and milk, even though milk intake quantities were less than the recommended portions.

The daily 10-year average cooked meat intake from these meat sources (see Table 5.6), was 67 g/capita/day which is 26% below the recommended level of 90 g/capita/day as set out in the SA FBDG. Despite an increasing trend observed in total daily per capita lean meat intake

[107] Estimated by applying the energy values presented in Table 5.2 to the results presented in Figure 5.3.

(particularly from 2010 to 2018)[108] lean meat intake in South Africa was thus consistently below the SA FBDG recommendation level.

Table 5.6: Overview of the national average per capita intake of chicken, beef, pork and sheep meat over the last decade

Meat type:	Estimated average national per capita daily intake 2008 to 2018 (gram):		Estimated share of daily cooked meat quantity consumed:	% change over last decade[109]:
	Lean, raw meat	Lean, cooked meat		
Chicken	48.3g	38.5	57.7%	+13.7%
Beef	28.0g	19.4g	29.1%	-3.7%
Pork	7.0g	5.3g	7.9%	+24.7%
Sheep meat	5.2g	3.5g	5.3%	-28.0%
Total	88.5g	66.6g	-	-

Comparing intake estimates for meat with data from food consumption surveys (Table 5.7) the edible portion estimate from this study compared well –somewhat higher than values reported in food consumption surveys. Variation could be attributed to numerous factors such as under- or over-estimation of national carcass figures, the accuracy of population number estimates, magnitude of conversion yield factors applied, reporting accuracy of consumption survey intake values and product loss (e.g. from spoilage or other waste sources on the consumer level).

Table 5.7: A comparison of estimated consumption data for meat[1] based on national aggregate carcass-based intake figures and data from food consumption surveys (2010/2011)

National demand estimates[2]:		Summary of food consumption surveys[5]	
Raw slaughtered product:	Edible portion[4]:	Children younger than 9 years:	Adults
90.7 g/day[3]	64.3 g/day	58 g/day	44-60 g/day

[1] Meat includes red meat, white meat, meat products and offal
[2] Based on carcass recordings, thus also includes bone, fat and in some cases skin
[3] Source: BFAP (2018) and various industries, based on carcass recordings as explained in the methodology section
[4] Calculated by applying conversion factors (Bognár, 2002), as explained in methodology section
[5] Source: Van Heerden *et al.* (2012) and Schönfeldt *et al.* (2013a)

Over the last decade (comparing 2018 with 2008) the per capita intake of chicken meat and pork increased by 10.2% and 28.6% respectively. The growth was mainly driven by the relative affordability of these meat options, as well as urbanisation, economic growth and social class mobility driving lifestyle changes and boosting consumer demand for a more diversified diet with more animal-source foods – with fresh meat options benefitting in particular (BFAP, 2018; Euromonitor, 2014). Ronquest-Ross and co-workers (2015) also confirmed the significant increase in the per capita intake of chicken and pork from 1994 to 2009, with significant growth of 46% in processed meat during the same period[110]. High and continued rising retail prices caused a 30.8% decrease in the per capita intake of sheep meat over the last ten years (BFAP, 2019)[111].

[108] Growth in chicken and pork consumption mainly drove the increase in lean meat intake (BFAP, 2019).
[109] Comparing 2018 to the average values for 2008 to 2010.
[110] Based on FAOSTAT Food Balance Sheets.
[111] Refer to Section 5.5.5 for more detail on meat, fish and egg affordability in the South African context.

Projections for the next decade towards 2028 indicate continued growth in meat demand, fuelled by anticipated income and population growth (BFAP, 2019). Total beef, pork and chicken meat demand is expected to increase the most by 23%, 22% and 20%, respectively, while sheep meat is expected to expand by only 10% over the next decade.

5.5.2 A socio-economically disaggregated perspective on the intake of meat in South Africa

The characteristic socio-economic diversity of the South African consumer landscape necessitated an exploration of meat intake for different socio-economic sub-groups to develop a more disaggregated view of adherence to the SA FBDG of 90 grams of lean meat per day. In the absence of official food intake data, the meat intake of different socio-economic groups was estimated based on household-level expenditure data (Stats SA LCS 2014/2015) and officially monitored Stats SA retail prices (as explained in the methodology section). Table 5.8 and Figure 5.4 present a socio-economically disaggregated view of the consumption of chicken, beef, pork and sheep meat in South Africa.

Table 5.8: Socio-economically disaggregated view of the consumption of chicken, beef, pork and sheep meat in South Africa

Attribute:		**Marginalised consumers:**	**Lower middle-income consumers**	**Upper middle-income consumers**	**Affluent consumers**
Share of sample consuming meat type[1]:	Chicken	G: 99.4%; WC: 98.4%	G:98.8%; WC: 99.2%		G and WC: 100.0%
	Beef	G: 96.3%; WC: 99.2%	G: 97.7%; WC 100.0%		G: 99.6%; WC: 100.0%
	Pork	G: 43.6%; WC: 79.2%	G: 55.6%; WC: 87.6%		G: 74.3%; WC: 82.8%
	Mutton/ lamb	G: 66.7%; WC: 93.2%	G: 75.4%; WC: 98.4%		G: 74.3%; WC: 88.8%
Contribution of sub-group to total expenditure on species[2]:	Chicken	±15%	±31%	±27%	±27%
	Beef	±7%	±20%	±27%	±47%
	Pork	±7%	±20%	±25%	±48%
	Mutton/ lamb	±3%	±9%	±26%	±63%
Typical consumption frequency[1]:	Chicken	Few times per week to once a month	Few times per week to once a month		Few times per week to once a month
	Beef	Once a week to occasionally	Twice per week to three times per month		Twice per week to three times per month
	Pork	Few times per month to occasionally	Once a week to occasionally		Twice a week to occasionally
	Mutton/ lamb	Few times per month to occasionally	Twice per week to monthly		Twice a week to monthly

[1] *Primary consumer research among consumers in Gauteng (G) 2012/2013 (n=164, n=171, n=249 respectively) and Western Cape (WC) 2016/2017 (n=250 per sub-group).*

[2] *Estimated from household-level food expenditure data per ED from Stats SA LCS 2014/2015* (Stats SA, 2017a).

In 2014/2015 marginalised households (ED 1 to ED 3) contributed approximately 10% to total expenditure on meat, fish and eggs in South Africa (Stats SA, 2017a). The dominant meat options of these households are chicken followed by beef, which were respectively contributing approximately 77% and 17% to per capita meat intake. Among low-income rural consumers in Limpopo, allocating between 55% and 70% of total expenditure to food, De Cock and co-workers (2013) confirmed the role of chicken as a main meat choice. In an evaluation of South African meat demand through the estimation of econometric short term demand elasticities, Delport and co-workers (2017) found that poultry products were classified as luxury products according to estimated expenditure elasticities (even though chicken was expected to be a normal good from an economic perspective when we consider the affordability of the product). The authors argued that even though chicken was the most affordable meat option in South Africa, lower income consumers considered chicken meat as a luxury relative to alternative products such as starches and pulses.

In 2014/2015 lower middle-income households (ED 4 to ED 6) and upper middle-income households (ED 7 and ED 8), respectively, contributed approximately 24% and 26% (with a combined contribution of 50%) to total expenditure on meat, fish and eggs in South Africa (Stats SA, 2017a). Chicken dominates the meat intake of middle-income households, contributing 67% and 57% to per capita meat intake of lower and upper middle-income households. Beef is in the second position contributing 25% and 31% to per capita meat intake of lower and upper middle-income households, respectively.

In 2014/2015 affluent households (ED 9 to ED 10) contributed approximately 40% to total expenditure on meat, fish and eggs in South Africa (Stats SA, 2017a). The meat intake of affluent households is dominated by chicken (42% contribution to per capita intake), but closely followed by beef (38% contribution to per capita intake).

It is evident from Figure 5.4 that the typical daily per capita intake of all meat types increases with rising socio-economic level. Compared to a person in ED 1, the estimated per capita cooked lean meat intake for a person in ED 10 was 3.3 times higher for chicken, 14.8 times higher for beef, 19.1 times higher for pork and 51.1 times higher for mutton/lamb. The estimated combined per capita cooked lean meat intake values for chicken, beef, pork and mutton/lamb ranged from 21.5 to 134.5 g/capita/day from ED 1 to ED 10.

In 2014/2015 the total cooked lean meat intake of chicken, beef, pork and mutton/lamb was below the SA FBDG recommended level of 90 g/capita/day for the least affluent 80% of the population (ED 1 to ED 8), varying from 76% below the recommended intake level for ED 1 to 5% below the recommended intake level for ED 8. The estimated cooked lean meat intake of affluent consumers was above the 90g level recommended by the SA FBDG, thus 15% and 49% higher than 90g for ED 9 and ED 10, respectively.

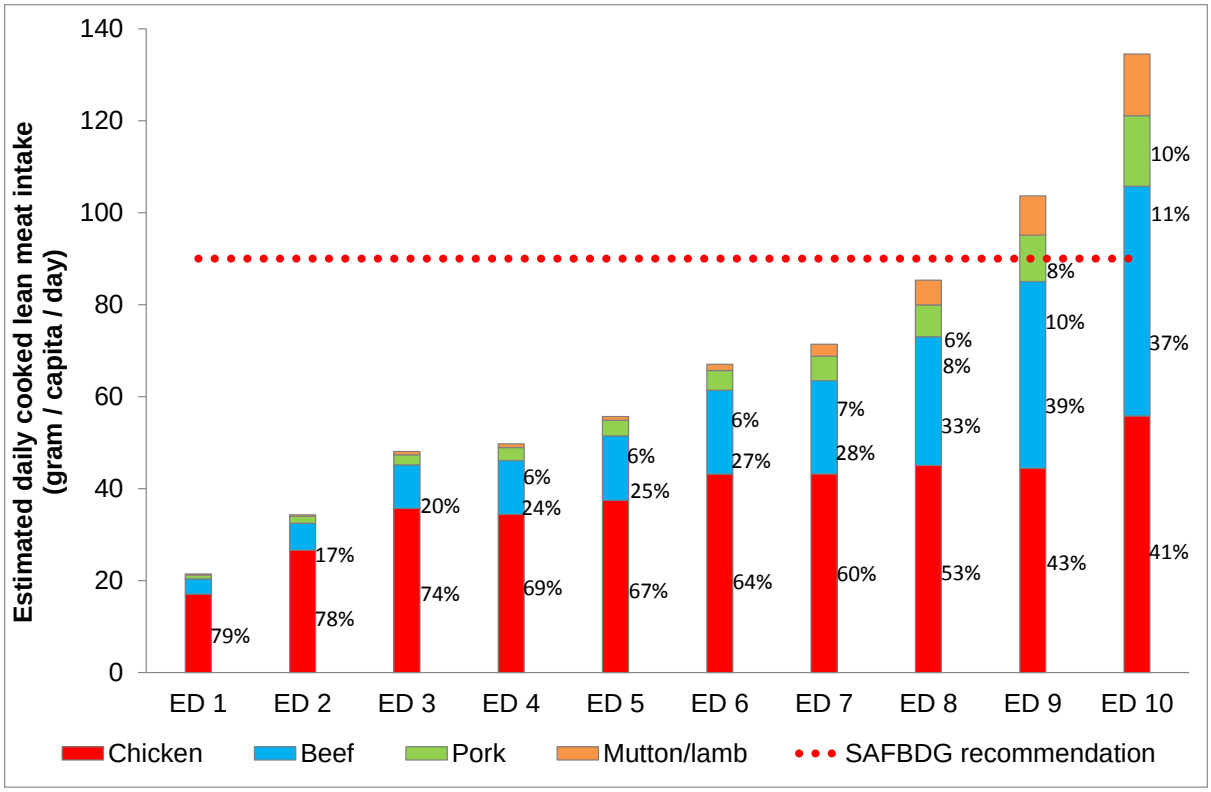

Figure 5.4: Socio-economically disaggregated view of the estimated daily cooked lean meat per capita intake in 2014/2015* (Source: Own calculations)

** Percentages next to bars in the graph indicate the contribution of the particular species to total cooked lean meat intake within the group of chicken, beef, pork and mutton/lamb.*

5.5.3 Do South African consumers eat four eggs per week?

The SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) recommends the intake of approximately four eggs per week, implying a daily per capita intake of 0.57 eggs. Figure 5.5 depicts the national average weekly per capita consumption of eggs for the period 2008 to 2018 (expressed in terms of the number of 59.5 gram eggs consumed) compared to the recommended SA FBDG intake level. Over the past decade the per capita intake of eggs in South Africa amounted to 2.46 eggs/capita/week, thus 38.6% below the SA FBDG recommendation of 4 eggs per week. The average egg intake from 2008 to 2018, expressed on an edible basis, amounted to 18.8 g/capita/day, generally comparable to the value of 16.5 g/capita/day reported by Van Heerden and co-workers (2012) (based on food consumption survey data for the period 2000 to 2010).

Ronquest-Ross *et al.* (2015) reported an increase of 56% in per capita egg consumption from 1994 to 2009[112]. Regarding the last decade, per capita egg consumption fluctuated, increasing from 2.30 eggs per capita per week in 2008/2009 to a high level of 2.74 eggs per capita per week in 2012, followed by a decline to 2.26 eggs per capita per week in 2017/2018.

[112] Based on FAOSTAT Food Balance Sheets and Euromonitor International Passport data.

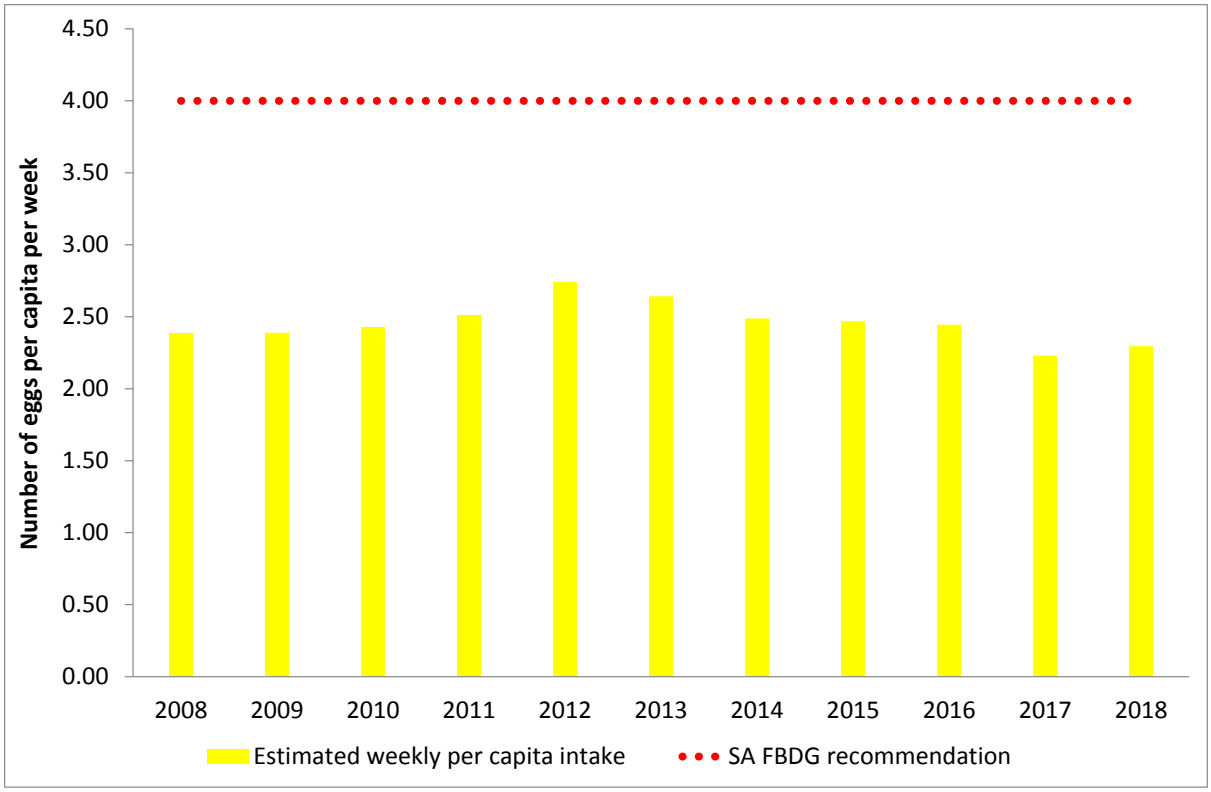

Figure 5.5: Weekly per capita intake of eggs (annual figures) compared to the SA FBDG recommendation for the period 2008 to 2018 ***(Source: Own estimations based on the sources and methodology described in Section 5.4)***

The Avian Influenza (AI) outbreak in South Africa during the second half of 2017 led to elevated producer and retail prices for eggs (due to severe culling of affected flock) with subsequent lower intake levels observed at consumer level (BFAP, 2018; South African Poultry Association, 2018). Food safety fears among consumers also might have contributed to lower per capita egg intake during and after the AI outbreak in South Africa.

Over the next decade the per capita intake of eggs is projected to grow by approximately 6% towards 2028 (BFAP, 2019), initially affected by high egg prices following the avian influenza outbreak in South Africa during the second half of 2017 and recovering in later years to benefit from expected improved economic performance (BFAP, 2018). Thus, per capita egg intake could reach a level of approximately 2.46 eggs/capita/week by 2028 – which would still be below the recommended upper intake level of four eggs per week.

From a socio-economically disaggregated perspective, Table 5.9 presents an overview of egg consumption behaviour across the socio-economic spectrum. The share of the various sampled households (in Gauteng and the Western Cape combined) eating eggs varied from 97.6% to 99.6%, with one to four times a week observed as the most typical intake frequency, indicating the importance of eggs in the animal-source food group. The share of consumers selecting eggs among the top three animal-source foods consumed in the largest quantities decreased with rising income, varying from 71.3% for marginalised consumers, to 67.8% for middle-income consumers and 43.8% for affluent consumers.

The estimated per capita weekly egg intake values varied substantially from least affluent consumers in ED 1 (1.09 eggs/capita/week) to the most affluent consumers in ED 10 (4.39 eggs/capita/week). According to these estimations, 90% of the households in South Africa consumed fewer eggs than recommended in the SA FBDG, with an estimated intake of 72.7% below the SA FBDG recommendation for ED 1, up to 20.1% below the SA FBDG recommendation for ED 9). Only the wealthiest 10% of households (i.e. ED 10), consumed 9.63% more than the SA FBDG recommendation.

The potential consumption of eggs received as gifts or own-produced eggs is not included in household-level expenditure data and could potentially increase the estimated intake values reported in Table 5.9. However, no data could be found to estimate the intake of own-produced eggs by households.

Table 5.9: An overview of egg consumption across the socio-economic spectrum

	Marginalised consumers:	**Middle-Income consumers:**	**Affluent consumers:**
Share of sample consuming eggs[1]	G: 97.6%; WC: 99.6%	G: 98.8%; WC: 99.2%	G: 99.6%; WC: 98.4%
Contribution of group to total egg expenditure (Stats SA LCS 2014/2015)	±14%	±55%	±31%
Typical consumption frequency[1]**:**	1 to 4 times/week	1 to 4 times/week	1 to 4 times/week
Estimated weekly per capita intake[2]	ED 1: 1.1 eggs ED 2: 1.4 eggs ED 3: 1.6 eggs	ED 4: 2.0 eggs ED 5: 2.1 eggs ED 6: 2.4 eggs ED 7: 2.9 eggs ED 8:3.0 eggs	ED 9: 3.2 eggs ED 10: 4.4 eggs

[1] *Primary consumer research among consumers in Gauteng (G) 2012/2013 (n=164, n=171, n=249 respectively) and Western Cape (WC) 2016/2017 (n=250 per sub-group).*

[2] *Intake quantities were estimated from household-level food expenditure data per ED from Stats SA LCS 2014/2015 and Stats SA monitored food retail prices* (Stats SA, 2017a).

5.5.4 Do South African consumers eat two to three fish servings per week with a particular focus on oily fish options?

The SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) recommends the intake of two to three fish servings per week. Taking into consideration fish quantities allocated to human consumption (OECD/FAO, 2019), South African population figures (as explained in the methodology section and a conversion factor of 0.83 for fish (to account for cooking loss, bone, fat and plate waste) (Bognár, 2002), calculations indicated that on average for the last decade the per capita intake of fish in South Africa amounted to 1.36 servings per week (90 grams per cooked serving) (Table 5.10) with a maximum value of 1.57 servings per week observed for 2012.

Ronquest-Ross and co-workers (2015) indicated an increase of 27% in per capita fish consumption from 1994 to 2009[113], with a further increase of 4.1% observed from 2008/2009 to 2017/2018 (OECD/FAO, 2019). Thus, from an 'edible component' perspective, the per capita intake of fish over the last decade was approximately 32% to 55% below the SA FBDG recommendation of two to three fish servings per week. According to the OECD/FAO agricultural outlook 2019 the per capita intake of fish in South Africa is expected

[113] Based on FAOSTAT Food Balance Sheets and Euromonitor International Passport data

to increase by approximately 1% over the next ten years (OECD/FAO, 2019). This implies an estimated edible component intake of 1.47 servings per capita per week in 2027 – which is still significantly below the SA FBDG recommended level of two to three servings per week. While it is important to grow fish intake in South Africa to the levels recommended in the SA FBDG, policy interventions should also pay attention to sustainability considerations as the majority of the fish consumed in South Africa comes from the ocean (World Wildlife Foundation (WWF), 2014).

Table 5.10: National per capita fish consumption in South Africa for the period 2008 to 2018

	Allocated to human consumption[1] ***(raw kg/capita/year)***	**Edible component**[2] ***(g/capita/day)***	**Edible component**[3] ***(number of servings/capita/ week)***
2008	7.03	16.0	1.50
2009	5.21	11.8	1.11
2010	5.95	13.5	1.27
2011	5.72	13.0	1.22
2012	7.39	16.8	1.57
2013	6.38	14.5	1.36
2014	7.27	16.5	1.55
2015	6.60	15.0	1.41
2016	6.10	13.9	1.30
2017	6.05	13.8	1.29
2018	6.69	15.2	1.42
Average	***6.40***	***14.5***	***1.36***

[1] Source: OECD-FAO Agricultural Outlook (Edition 2019), OECD Agriculture Statistics (database) reworked to per capita figures by applying South African population numbers as explained in the methodology section.
[2] Applying a fish conversion factor of 0.83 (Bognár, 2002) to account for aspects such as cooking loss, fish bone and plate waste.
[3] Serving size of 90 grams applied as specified in the SA FBDG for fish (Schönfeldt et al., 2013a).

In 2000/2001 and 2010/2011 the estimated edible fish and seafood portions were 13.3 and 14.6 grams/capita/day respectively. These values compare relatively well with food consumption survey data for 2000/2001 and 2010/2011 estimating the intake of fish and seafood for younger children at 7 to 10 grams/day and older children and adults at 12 to 15 grams/day (Van Heerden et al., 2012; Schönfeldt et al., 2013a).

Table 5.11 presents an overview of fish consumption across the socio-economic spectrum. Stats SA monitored food retail prices, average household sizes in the various EDs and primary consumer research results. From an 'edible component' perspective, the per capita intake of fish increased with affluence level ranging from 0.72 servings per capita per week for marginalised consumers in ED 1, to 2.34 servings per capita per week for affluent consumers in ED 10. Thus, the estimated fish intake levels of 90% of the population (ED 1 to ED 9) were 64% (ED 1) to 22% (ED 9) below the lower level recommended of two servings per week as specified in the SA FBDG.

The SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) also recommends that fish intake should preferably focus on oily fish such as sardines, pilchards, tuna, anchovies, salmon and mackerel) (Schönfeldt et al., 2013a). According to the World Wildlife Foundation (WWF, 2014) the estimated seafood consumption composition of South Africa in 2010 was: Pilchards 42.9%, hake 28.5%, mackerel 13.7%, snoek 5.1%, tuna 4.0%, prawns 1.9%, linefish (excluding snoek) 1.4%, squid 1.2%, salmon 1.1%, kingklip 0.9% and other seafood option 0.3%. Thus oily fish options (pilchards, mackerel, tuna and salmon) represented an estimated 61% of the total quantity of seafood consumed in South Africa in 2010, suggesting that South African consumers do tend to prefer relatively oily fish options.

Table 5.11: An overview of fish consumption across the socio-economic spectrum

	Marginalised households:	**Middle-Income(MI) households:**	**Affluent households:**
Share of sample consuming fish[1]	G: 93.3%; WC: 92.0%	G: 99.4%; WC: 99.2%	G: 96.0%; WC: 98.0%
Contribution of group to total fish expenditure (Stats SA LCS 2014/2015)	±13%	Lower MI: ±24% Upper MI: ±22%	±41%
Typical consumption frequency[1]	Once or twice a week to few times a month	Few times a week to once a month	Twice a week to once a month
Estimated purchase quantity[2] ***(raw kg/capita/year)***	4.75	Lower MI: 5.99 Upper MI: 6.88	11.01
Edible component ***(g/capita/day)***	10.7	Lower MI: 13.6 Upper MI: 15.7	25.03
Edible component ***(number of cooked servings/capita/week)***	ED 1:0.72 ED 2: 0.85 ED 3: 0.94	ED 4: 0.99 ED 5: 1.08 ED 6: 1.11 ED 7: 1.24 ED 8: 1.19	ED 9: 1.55 ED 10: 2.34

[1] *Primary consumer research among consumers in Gauteng (G) 2012/2013 (n=164, n=171, n=249 respectively) and Western Cape (WC) 2016/2017 (n=250 per sub-group).*

[2] *Intake quantities were estimated from household-level food expenditure data per ED from Stats SA LCS 2014/2015 and Stats SA monitored food retail prices* (Stats SA, 2017a).

From a household-level food expenditure perspective, canned pilchards are particularly important for marginalised and middle-income consumers, as canned pilchards represent approximately 65% of the total fish and seafood expenditure (and an estimated 83% of total quantity of fish / seafood consumed) among the least affluent 70% of households in South Africa according to Stats SA LCS 2014/2015 (Stats SA, 2017a). This could be based on cost considerations (the SSU cost of canned pilchards is comparable to Individually Quick Frozen (IQF) chicken pieces (Figure 5.6)), as well as convenience or cooking energy savings (canned pilchards are pre-cooked and canned in sauce).

5.5.5 The affordability of meat, fish and eggs over time

The importance of product price and affordability to meat consumers is evident when analysing the factors considered by consumers when purchasing beef, mutton/lamb and chicken meat sourced from the primary consumer research conducted in Gauteng and the

Western Cape. When purchasing red meat certain factors were important across the socio-economic spectrum in both provinces[114]:

- Affordability (price);
- Food safety (including food safety, expiry date, clean meat with no blood);
- Appearance (appearance in general, visual appeal, colour of meat, colour of fat);
- Organoleptic appeal (taste, flavour, eaten by all in the family, tenderness, juiciness);
- General quality (quality guarantee);
- Fatness (fat-to-meat ratio);
- Convenience (easy to prepare).

Euromonitor (2018) confirmed the dependence of meat consumption on price. Even though product price and thus affordability was important to all socio-economic groups, the relative importance of price decreased as income levels rose (also confirmed by Botha and co-workers (2012)) and was slightly less pronounced for chicken. The relative importance of more complex purchase factors, such as nutritional value, genetically modified animal feed and hormones used in production, tended to increase with rising income levels. For the more luxurious red meat cuts (such as beef steak and mutton/lamb chops) affluent consumers presented with the highest perceived importance levels for meat taste. Taljaard and co-workers (2006) pointed out that non-economic factors (such as convenience, safety, quality, health, animal welfare and environmental considerations) were of increasing importance in more recent times among South African consumers.

Figure 5.6 presents data on the estimated average annual cost for a SSU of various animal-source foods from 2013 to 2018 (with serving sizes[115] defined in Table 5.3) based on Stats SA monthly retail prices.

When we consider the average annual cost per SSU from 2013 to 2018 (Figure 5.6) the most affordable animal-source foods (in order of importance) as summarised in Table 5.12, during this period were polony[116], eggs, frozen chicken portions and canned pilchards. Even though the Avian Influenza outbreak in 2018 cause upward pressure on egg prices (BFAP, 2019), eggs can still be considered as one of the most affordable animal-source source foods for South African consumers.

[114] More detail on the factors considered by consumers when purchasing red meat is presented in the published journal article forming part of Chapter 6.

[115] Single serving definitions not included in Table 5 (DoH Directorate Nutrition, 2001): milk 200ml, polony 80g.

[116] Polony is an affordable, ready-to-eat cold meat option sold in South Africa, usually made from finely ground pork or chicken. The dominant product format is a large diameter sausage enclosed in a plastic casing and polony is usually coloured pink with added colouring. According to South African legislation (Department of Agriculture, Forestry and Fisheries, Agricultural Product Standards Act, 1990 (Act no. 119 of 1990) Regulations regarding the classification, packaging and marketing of processed meat products intended for sale in the Republic of South Africa, Regulation number R. 1283, 4 October 2019) polony is classified as an emulsified, comminuted, cured and heat treated product and should contain a minimum total meat equivalent of 60%, a minimum total meat content of 25%, a minimum lean meat content of 15%, a maximum fat content of 30%, a maximum added pork rinds of 15%, a maximum added de-feathered chicken skin content of 40% and no added gelatin.

Products such as polony, canned pilchards and eggs also present an energy saving advantage to consumers as they are either ready-to-eat or have a short cooking time, e.g. eggs. Rising energy costs are a reality South African consumers are faced with, with the CPI for electricity and other fuels for the country increasing by an estimated 174% from September 2008 to September 2018 (Stats SA, 2018a). Compared to frozen chicken, beef mince and pork chops were approximately double the cost per SSU in the period 2013 to 2018. During the first half of 2018 pork prices were subject to downward pressure till mid-2018, following a Listeriosis outbreak in South Africa – this improved the affordability of fresh pork for consumers (National Agricultural Marketing Council (NAMC), 2018).

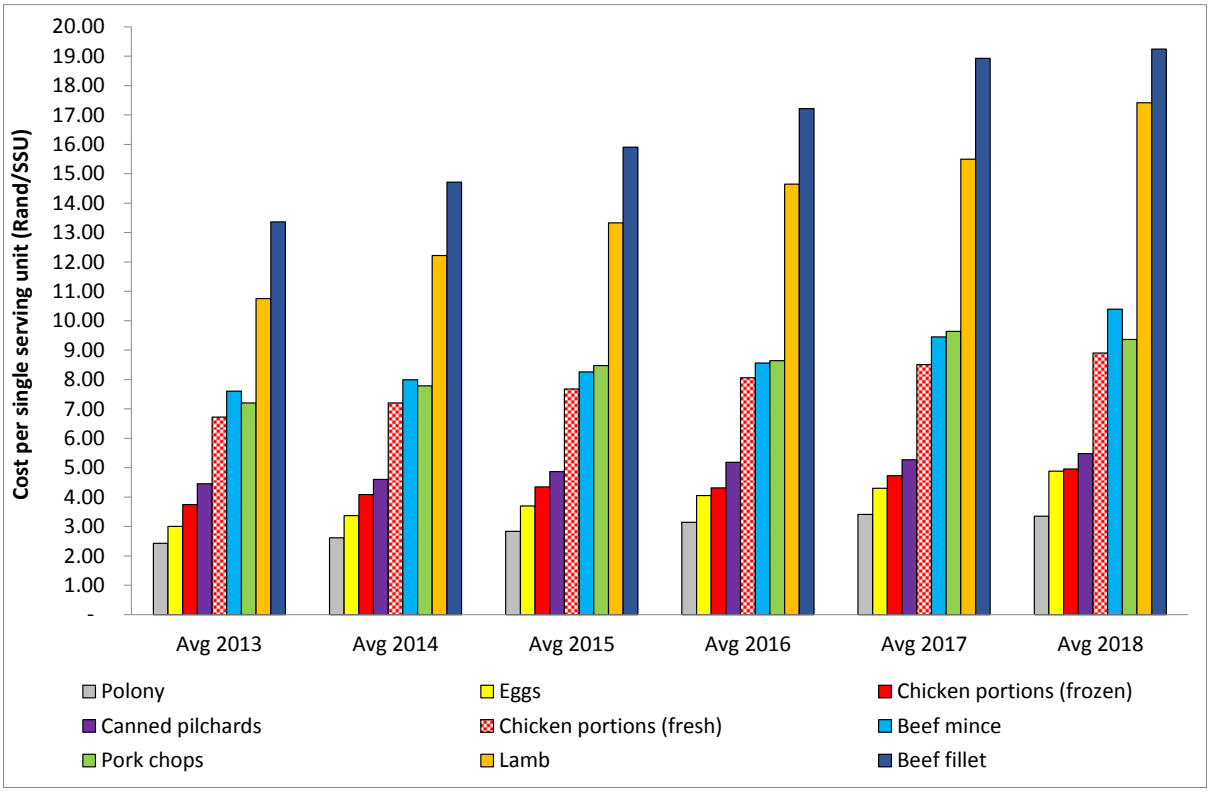

Figure 5.6: Cost per SSU for a selection of animal-source foods in South Africa for the period 2013 to 2018 (Calculated from officially monitored Stats SA food retail prices)

Table 5.12: Overview of the most affordable animal-source foods (Calculated from officially monitored Stats SA food retail prices)

Position[1]:	Food option:	Average SSU cost 2018:	Price increase 2013 to 2018:	Affordability relative to frozen chicken (2018):
1	Polony	R3.35	+38.2%	32% lower
2	Eggs	R4.88	+62.4%	1% lower
3	Frozen chicken portions	R4.95	+32.3%	N/A
4	Canned pilchards	R5.48	+23.0%	11% higher
5	Fresh chicken portions	R8.90	+32.3%	110% higher
6	Beef mince	R10.39	+36.7%	80% higher
7	Pork chops	R9.36	+30.0%	89% higher

[1] *Position 1 = most affordable option*

5.5.6 Do South African consumers engage in actions to reduce the fat content of meat?

The SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) recommends that the preparation of meat should include pre-cooking fat reduction actions such as the trimming of visible fat from red meat and the removal of fat (and skin) from chicken. The consumer survey[117] described in the methodology (Section 5.4.2), investigated whether consumers engaged in certain actions to reduce the intake of fat from meat (beef, mutton/lamb and chicken specifically), particularly the removal of all visible fat before cooking, the removal of some visible fat before cooking the meat and the serving of 'pan drippings' with the meat dish[118,119]. Figure 5.7 and Table 5.13 present these results.

In the total sample, approximately two thirds of consumers removed some or all of the visible fat from meat before cooking. Middle-income and affluent consumers were more likely to remove the visible fat from meat before cooking, with more than 60% of these groups removed some or all of the visible fat (depending on meat species), compared to approximately half of marginalised consumers.

The tendency to remove all visible fat from meat before cooking applied to approximately 25% of the total sample and increased with affluence levels, applicable to less than 6% of marginalised consumers and up to 40% and 43% of middle-income and affluent consumers. The economic loss implied by the removal of visible fat at home could partially explain this result, as the primary consumer research revealed that the expensive nature of red meat was the dominant concern in the minds of consumers when thinking about red meat – even more so amongst marginalised consumers. A potential lower awareness of the association between the fat content of meat and health among lower socio-economic groups might also play a role in this regard, but should be verified with future research.

The tendency to remove some of the visible fat from meat before cooking applied to approximately 43% of the total sample and decreased with affluence levels. Marginalised and middle-income consumers revealed a greater tendency to remove some visible fat than to remove all visible fat.

If a consumer removes visible fat and avoids serving 'pan drippings' with meat, it would indicate that such a consumer is making a maximum effort to minimise the intake of animal fat and thus adhere to the SA FBDG pertaining to the control of fat quantity in meat dishes. Among middle-income and affluent consumers up to 40% and 44% respectively engaged in such extreme 'fat minimising' behaviour. The extreme 'fat minimising' sub-group among marginalised consumers constituted approximately 30% when preparing red meat, but only approximately 8% when preparing chicken. Thus, extreme 'fat minimising' behaviour in adherence to the SA FBDG applied to approximately a third of the total sample of consumers across the socio-economic spectrum.

[117] The consumer research only involved consumers in the Western Cape Province, but a more geographically diverse view (i.e. data from various provinces in South Africa) would be more ideal.

[118] The consumption of 'pan drippings' could have a negative impact on the leanness of a meat dish.

[119] The surveys did not enquire whether consumers removed the skin of chicken before cooking.

On the other hand, a consumer not trimming visible fat and serving 'pan drippings' with meat could possibly not be aware of the health benefits of reducing the fat content of meat. Consumers not engaging in fat reduction behaviour could be regarded as non-compliant with the SA FBDG pertaining to the control of fat quantity in meat dishes. This behaviour applied predominantly to marginalised consumers (up to 35%), followed by affluent consumers (up to 14%) and middle-income consumers (up to 9%). Dietary education could potentially improve this situation. Among marginalised consumer the limited fat reduction behaviour could be strongly associated with the severe budget constraints faced by these households and a possible decision not to throw away energy-rich food (in the form of fat).

Some consumers engaged in 'mixed efforts' as related to reducing the fat content of meat. Approximately 26% of consumers removed some or all of the visible fat from meat before cooking, but served pan drippings with the meat. A further 25% of consumers did not remove any fat from meat prior to cooking, but did not reveal a tendency to serve 'pan drippings' with the meat dish. The motivational factors affecting the fat reduction behaviour of consumers was not investigated, but could be a focus for future research.

Consumer demand for leaner meat has driven a reduction in the total fat content of red meat over time, with for example beef carcass fat levels decreasing from 32% in 1949 to 13% in 1991 (Naude, 1994), attributed to a combination of breed changes, feed changes and more recently the trimming of fat before and after purchasing (Schönfeldt & Hall, 2012). Progressively leaner red meat carcasses have also been observed internationally, as illustrated by the example of New Zealand beef, where the fat content deceased from 23% in 1981 to 7% in 1997 (European Food Information Resource (EuroFIR), 2008).

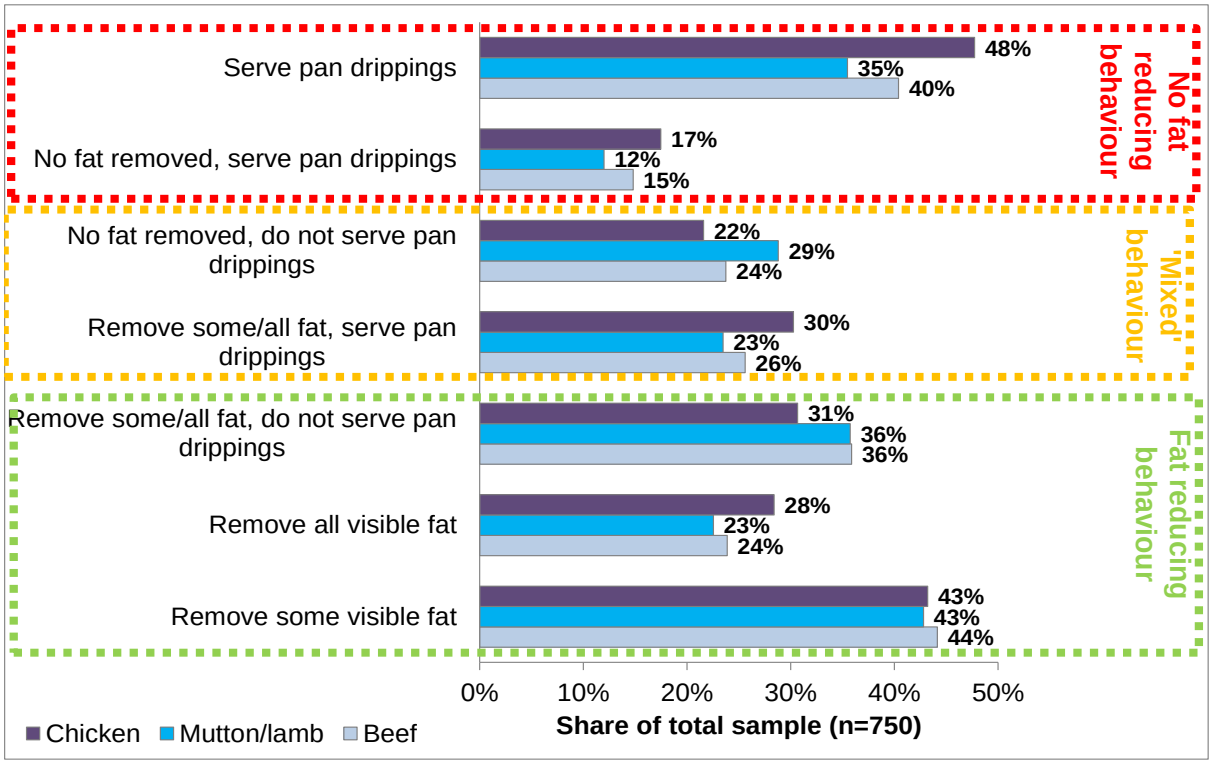

Figure 5.7: Overview of actions taken by consumers in the Western Cape (2017/2018) to reduce fat during meat preparation (Source: Consumer survey results)

The reduced fat content of red meat over time could have potentially contributed to the reduction of the need for fat trimming at home, while a potential increase in health awareness among consumers could have increased the trimming of red meat fat at home. Unfortunately no historical data could be obtained on the trimming of red meat fat in the South African context. There is however supporting evidence that consumers have become more positive about the leanness of some meat options over time, e.g. the share of South African consumers perceiving beef as fatty / not lean decreased from 91% in 1996 (The Meat Board, 1996) to 83% in 2003 (The Meat Board, 2003) to 66% in 2012/2013 according to the primary consumer research conducted in Gauteng as part of this research study. For sheep meat the share of South African consumers perceiving sheep meat as fatty / not lean decreased from 97% in 1996 (The Meat Board, 1996) to 87% in 2003 (The Meat Board, 2003) to 66% in 2012/2013.

Table 5.13: Actions taken to reduce the fat content of meat among marginalised, middle-income and affluent consumers in the Western Cape (Source: Consumer survey results)

	Beef			Mutton/lamb			Chicken		
	Marginalised (n=250)	Middle-income (n=250)	Affluent (n=250)	Marginalised (n=250)	Middle-income (n=250)	Affluent (n=250)	Marginalised (n=250)	Middle-income (n=250)	Affluent (n=250)
Remove all visible fat	3.2%	31.2%	37.2%	5.6%	28.0%	34.0%	2.0%	40.4%	42.8%
Remove some visible fat	54.0%	46.0%	32.4%	50.8%	44.8%	32.8%	49.2%	47.2%	33.2%
Serve pan drippings	52.0%	33.6%	35.6%	35.6%	34.4%	36.4%	77.2%	32.0%	34.0%
Remove some/all fat, serve pan drippings	27.2%	24.4%	25.2%	22.4%	25.2%	22.8%	42.0%	26.4%	22.4%
Remove some/all fat, do not serve pan drippings	29.2%	40.4%	38.0%	31.6%	37.2%	38.4%	8.4%	40.0%	43.6%
No fat removed, serve pan drippings	24.8%	9.2%	10.4%	13.2%	9.2%	13.6%	35.2%	5.6%	11.6%
No fat removed, do not serve pan drippings	18.8%	26.0%	26.4%	32.8%	28.4%	25.2%	14.4%	28.0%	22.4%

Note: These questions were not included in Gauteng surveys.

5.5.7 Do South African consumers prepare meat with little or no added fat?

The SA FBDG for lean meat, chicken, fish and eggs (Schönfeldt et al., 2013a) recommends that meat should be prepared with little or no added fat (Schönfeldt et al., 2013a). In general, from a lean meat perspective, cooking methods such as baking, grilling, roasting and microwave cooking are viewed as 'leaner' meat cooking methods, while frying tends to increase the fat content of the meat dish (USDA, 2014). Cooking methods, such as roasting and stewing, could also deliver an end product with a higher fat content if the meat is brushed with fat / oil before cooking or browned in fat / oil before stewing. In general cooking methods such as barbeque, grilling and roasting have the advantage that some of the remaining fat in lean meat melts, potentially delivering a leaner meat dish. Based on the results obtained in the primary consumer research, the most popular cooking methods for

the various meat options (applied by 40% or more of the total sample across socio-economic groups) are summarised in Table 5.14[120].

Stewing was the most popular cooking method for beef and sheep meat, followed by frying and barbeque cooking. For chicken, stewing and frying were the most popular cooking methods applied, while fish preparation involved mainly frying. Nationally representative consumer research conducted in 1996 revealed similar results with beef and sheep meat mainly prepared through stewing, following by frying and barbeque cooking, while chicken meat preparation relied mainly on frying, stewing and roasting. The frying of fish was also dominant in 1996 (The Meat Board, 1996).

Frying can be regarded as the most likely cooking method to add additional fat / oil to meat. Frying was used by up to two thirds of red meat consumers and was even more popular when cooking chicken and fish (applied by more than 75% of chicken eaters and 85% of fish eaters in the sample). In view of the dominance of chicken in relation to the meat intake of South African consumers (BFAP, 2018), the significant popularity of fried chicken is problematic. Fried chicken has a high fat content which can contribute to the severe over-nutrition problems, such as obesity, in South Africa (Shisana et al, 2014).

Table 5.14: Summary of most popular cooking methods applied when preparing beef, mutton/lamb, chicken and fish (Source: Consumer survey results)

Meat type:	**Most popular cooking method(s):** *(share of total sample eating particular meat type applying particular cooking method)*		
Beef (n=1320)	Stew (87.7%)	Fry (66.2%) Barbeque (59.8%)	Roast (46.5%) Grill (42.0%) 'Potjiekos'[121] (41.3%)
Mutton/ Lamb (n=1201)	Stew (85.0%)	Barbeque (58.1%) Fry (52.9%)	Roast (45.0%) 'Potjiekos' (44.5%) Grill (44.0%)
Chicken (n=1328)	Stew (79.2%) Fry (77.7%)	Roast (66.3%) Grill (56.6%)	Barbeque (50.1%)
Fish (n=1110)	Fry (85.0%)		Barbeque (42.3%) Grill (40.4%)

5.6 CONCLUSIONS

During the past decade (2008 to 2018), the average animal-source food intake (with a specific focus on meat, fish and eggs) in South Africa was dominated by chicken (38.4 g/capita/day, with an estimated 42% household-level expenditure contribution according to Stats SA LCS 2014/2015), followed by beef (19.4 g/capita/day, approximately 23% expenditure contribution), eggs (20.1 g/capita/day, 7% expenditure contribution), fish (14.6 g/capita/day, 8% expenditure contribution), pork (5.3 g/capita/day, 5% expenditure contribution) and mutton/lamb (3.5 g/capita/day, 4% expenditure contribution). During this decade improved household income and living standards have been linked to increasing

[120] The primary consumer research did not enquire whether consumers used additional fat or oil when preparing meat by means of stewing, barbeque cooking, roasting, grilling or 'potjiekos' which could potentially increase the fat content of meat dishes.

[121] 'Potjiekos' refers to a stew of meat and vegetables cooked in a round cast-iron pot over an open fire.

trends in the per capita consumption of chicken and pork meat (+9% and +21% growth from 2008/2009 to 2017/2018), with the affordability of chicken also influencing trends. Fluctuating per capita consumption was observed for beef, fish and eggs, while the intake of mutton/lamb decreased by 26% from 2008/2009 to 2017/2018 due to affordability constraints. The following main conclusions can be made from this study:

Main conclusion 1: The intake of lean meat is below the recommended SA FBDG level for most of the South African population

Despite increasing by 3.5% from 2008/2009 to 2017/2018, the estimated average per capita daily cooked lean meat intake (chicken, beef, pork and mutton/lamb) remained below the recommended cumulative level of 90 g/capita/day – with a ten-year average value of 66.6 g/capita/day and an average value of 67.8 over the last five years. Taking into consideration expected future growth in meat demand, the per capita intake could reach a level of approximately 84 g/capita/day in 2028, i.e. 7% below the SA FBDG recommended level. However, rising costs, increasing poverty and the effect of climate change could dampen future growth expectations.

Estimated values for per capita cooked lean meat intake across the socio-economic spectrum revealed a combination of under- and over-nutrition in relation to meat for different socio-economic groupings. The lean meat intake of the least affluent 80% of the population was approximately 76% (for ED 1) to 5% (for ED 8) below the SA FBDG recommendation of 90 gram / capita / day, varying from 22 g/capita/day to 85 g/capita/day. Affordability is one of the most significant constraints limiting meat intake among lower income consumers in South Africa (BFAP, 2018). Among these consumers the lower than recommended intake levels of animal-source foods could potentially deprive consumers of the valuable nutritional benefits associated with the consumption of animal-source foods (Schönfeldt et al., 2013b). Potential negative consequences include “a diet that is low in protein, iron, zinc, vitamin A and vitamin B_{12}, which might lead to anaemia, vitamin A deficiency and poor physical and cognitive development” (Schönfeldt et al., 2013a).

At the upper-end of the socio-economic spectrum the lean meat intake of the wealthiest 20% of the population was approximately 15% (for ED 9) to 49% (for ED 10) higher than 90 grams per day and reached an estimated level of 135 grams per day for ED 10. As mentioned earlier in this paper, the nutrition transition involves changing dietary patterns and nutrient intake, often caused by socio-economic development, urbanisation and acculturation (Vorster et al., 2011). The increased consumption of meat is clearly evident from the results that were presented in Figure 5.3 with total meat intake increasing by more than 500% from the least affluent to the most affluent consumer groups. The increased meat intake could benefit consumers through the intake of micronutrients such as calcium and iron. However, there is an increased risk of obesity, coronary heart disease and other NCDs associated with the overconsumption of energy dense animal-source foods with high levels of saturated fat (Schönfeldt et al., 2013a). Increased sodium intake (either added to meat during preparation or in processed meat products could also increase the risk of hypertension.

Main conclusion 2: The intake of eggs is below the recommended SA FBDG level for most of the South African population

The national average per capita egg intake over the last decade amounted to 2.5 eggs/capita/week, thus 39% below the SA FBDG recommendation of four eggs per week. As in the case of meat, significant variation was observed in egg intake across the socio-economic spectrum, varying from 1.1 eggs/capita/week for marginalised consumers in ED 1, to 4.4 eggs/capita/week for affluent consumers in ED 10. The majority of the South African population (90%) ate fewer eggs than recommended in the SA FBDG – thus not potentially yielding the full benefits of eggs as an affordable high quality protein source, with a short cooking time, providing micronutrients such as vitamin B2, vitamin B5, zinc and iron (SAFOODS, 2017). The wealthiest 10% of the population consumed approximately 10% more eggs than the recommendation – keeping in mind that these consumers also consumed 49% more meat than recommended.

Main conclusion 3: The intake of fish is below the recommended SA FBDG level for most of the South African population

The national average per capita lean cooked fish intake over the last decade amounted to approximately 1.36 servings/capita/week, thus 32% to 55% lower than the SA FBDG recommendation of two to three fish servings per week. The majority of the South African population (90% - ED 1 to ED 9) eat less fish than the two to three fish servings per week recommended in the SA FBDG, with weekly intake ranging from approximately 0.7 servings per week for least affluent consumers to 1.6 servings per week for consumers in ED9. Only the wealthiest 10% of the population had a fish intake level above two (2.3 fish servings per week), which is in line with the recommendation. The under-consumption of fish could potentially deprive individuals of—a valuable source of quality protein and several micronutrients (e.g. phosphorus, selenium, potassium, iodine, zinc, magnesium, vitamin B_2, vitamin B_{12} and vitamin D and calcium (in the case of tinned sardines / pilchards)), as well as omega-3 fatty acids (Ruxton , 2011).

Main conclusion 4: South African consumers have a preference for more oily fish options as recommended in the SA FBDG

According to the WWF oily fish options (e.g. pilchards, mackerel, tuna and salmon) represented an estimated 61% of the total quantity of seafood consumed in South Africa in 2010 (WWF, 2014), suggesting that South African consumers do tend to prefer the intake of relatively more oily fish options as recommended in the SA FBDG.

Main conclusion 5: Many South African consumers do engage in actions to reduce the fat content of meat as recommended in the SA FBDG

Consumer demand has driven a reduction in the total fat content of red meat over time by means of breed changes, feed changes and trimming of fat before consumer purchasing (Naude, 1994; Schönfeldt & Hall, 2012). To further enhance the intake of lean meat, the SA FBDG (Schönfeldt et al., 2013a) recommends that the preparation of meat should include pre-cooking fat reduction actions such as the trimming of visible fat from red meat.

Based on the behaviour of consumers in the Western Cape (primary consumer research), it was found that approximately two thirds of consumers trimmed some or all of the visible fat on meat before cooking, with the lowest tendency observed among marginalised consumers. Extreme fat reducing behaviour (i.e. trimming of visible fat and avoiding the serving of 'pan drippings' with meat) applied to approximately a third of consumers, especially among middle-income and affluent consumers. At the other extreme, approximately a fifth of the sample (with an emphasis on marginalised consumers) did not engage in any actions to reduce the fat content of meat or to avoid the serving of 'pan drippings'.

There is a significant research gap in terms of understanding the behaviour and motives of South African consumers in the context of meat fat reduction during meat preparation and serving. Future research should expand the fat trimming and pan dripping research to other parts of the country where the populations have different. Furthermore future research should also investigate the effectiveness of consumer education methods and messages, focusing on meat fat reduction techniques and health motivations, to facilitate the construction of effective intervention strategies. Future consumer education could also include messages pertaining to the tasty preparation of meat with little or no added fat, despite fat trimming and the avoidance of 'pan drippings' when serving meat.

To further reduce the fat content of meat dishes the SA FBDG recommends that meat should be prepared with little or no added fat (Schönfeldt et al., 2013a). The most popular cooking method for beef, mutton/lamb and chicken was stewing (applied by 80% and more of consumers). Ideally little or no added fat should be added to meat when preparing a stew, but some consumers might brown meat in fat at the start of the cooking process when preparing a stew. Frying is the most likely cooking method to add additional fat / oil to meat. This method of meat preparation applied to up to two thirds of red meat consumers in Gauteng and the Western Cape, and it was even more popular for cooking chicken and fish. In view of the dominance of chicken, in South African consumer meat intake, as found in this study, the significant popularity of fried chicken is a problem because of the severe over-nutrition that characterises the South African population (Shisana et al, 2014). There is a need for consumer education on how to prepare tasty meat dishes with little or no added fat. Future research should ideally test consumer responsiveness to marketing messages in this regard.

As discussed in Section 5.2, the consumption of animal-source foods (such as meat, fish and eggs) is often associated with negative health implications. The awareness of the potential contribution of animal-source foods to fat intake, excessive energy intake and subsequent obesity is rising at a global level. Despite evidence of the nutrition transition in South Africa (Vorster et al., 2011), as well as increasing animal-source food intake over time (Ronquest-Ross et al., 2015), the results presented in this chapter imply that excessive animal-source food intake does not apply to the largest proportion of the South African population. This observation raises a question regarding the extent of the contribution of animal-source foods to the prevalence of overweight in South Africa. However, factors such as inadequate

trimming of visible fat before cooking and the popularity of frying as a meat cooking method in South Africa could contribute towards increased energy intake of individuals. Essentially future research should focus on studying total protein intake in the diet of South African consumers comprehensively, and should also evaluate additional sources of protein such as grains, dairy foods, as well as legumes.

Final remarks

As mentioned in Section 5.2, the EAT-Lancet report (Willett et al., 2019) recommends that the global consumption of fruits, vegetables, legumes and nuts (viewed as healthy food in the report) should double towards 2050, while the consumption of red meat (viewed as less healthy food in the report) should decrease by more than 50%. However, the research presented in this chapter showed that a dominant share of the South African population does not have excessive animal-source food intake, thus raising questions regarding the applicability of meat reduction policies in the developing country context of South Africa.

Considering the complex dynamics and issues pertaining to the intake of animal-source foods on a global level and in South Africa specifically, the ultimate challenge is to achieve a delicate balance where the quantities and composition of animal-source food intake will ensure that diets are healthy, nutritionally adequate and environmentally sustainable (Schönfeldt et al., 2013a).

From a data availability perspective there is a significant need for regularly updated, nationally representative and socio-economically disaggregated detailed food intake data (including meat, fish and eggs), food composition data and raw-to-cooked conversion factors for South Africa specifically – to facilitate accurate analyses which will form the basis for food consumption and nutrition analyses and policy making.

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CHAPTER 6: A CONSUMER PERSPECTIVE OF THE SOUTH AFRICAN RED MEAT CLASSIFICATION SYSTEM

6.1 INTRODUCTION

Keeping the focus on meat, this chapter enriches the research presented in Chapter 5, to present primary consumer research pertaining to consumer concerns regarding red meat, consumer associations with red meat quality and consumer purchase consideration attributes for beef and mutton/lamb comparing the three main socio-economic sub-segments in South Africa. This chapter was published in the South African Journal of Animal Science in 2015[122]. The above-mentioned research results were embedded in the article (see Addendum B) with a dominant focus on a consumer perspective on the South African red meat classification system. Sections 6.1 to 6.4 in Chapter 6 present background arguments to illustrate the impact of red meat classification on red meat prices.

The case study presented in Chapter 5 dealt with, among other aspects, the critical importance of price as a limiting factor on meat intake for many (particularly less affluent) consumers in South Africa. An improved understanding of consumer perceptions of red meat classification is important in the context of price, taken into account the association between red meat classification and carcass price discussed on Section 6.4.

The South African Food Based Dietary Guideline (SA FBDG) (Schönfeldt et al., 2013) has a strong focus on the intake of lean meat. Considering the association between red meat classification and fat content (see Section 6.2) an improved understanding of consumer perceptions regarding red meat classification further enhances the case study presented in Chapter 5.

6.2 BACKGROUND ON THE SOUTH AFRICAN RED MEAT CARCASS CLASSIFICATION

The South African carcass classification system for lamb, mutton and beef (in use since June 1992) is based on the Agricultural Product Standards Act, 1990 (Act No. 119 of 1990) No. R. 342 - Regulations Regarding the Classification and Marking of Meat (National Department of Agriculture (NDA), 1990). The carcass classification system could be viewed as a universally understood language for all role players in the value chain. It is an essential part of efficient animal production, playing a role in meat price determination, forming a basis for the utilisation of price differences and assisting industry in maximising consumer satisfaction through more consistent and more specifically defined meat quality (Webb, 2015; The South African Meat Industry Company (SAMIC), 2018; Strydom et al., 2015). From a consumer perspective the red meat classification system enables consumers to select meat aligning to own needs and preferences according to the characteristics within a specific meat class (Lamb and Mutton South Africa, n.d.).

The South African carcass classification system for lamb, mutton and beef involves the recording of carcass mass, animal age, fat content of the carcass, carcass conformation, damage to the carcass and the gender of the animal in the case of bulls in the B and C

[122] Vermeulen H, Schönfeldt HC & Pretorius B. 2015. A consumer perspective of the South African red meat classification system. *South African Journal of Animal Science*, 45(3): 339 – 354.

grades (NDA, 1990). The classification based on the age of the animal and fatness of carcass is summarised in Table 6.1. According to Strydom and co-workers (2015) "animal age provides a fairly accurate description of expected eating quality in regard to tenderness", generally ranging from A being most tender, to AB (tender), to B (less tender), to C (least tender) (SAMIC, n.d.). Some studies have indicated some variation in the association between animal age and tenderness, such as Frylinck and co-workers (2015) who found that the most tender meat originated from age AB feedlot animals, followed by B-age pasture and A-age feedlot animals, while A-age pasture animals produced the least tender meat.

Table 6.1: The classification of beef, lamb and sheep meat based on animal age and fatness of carcass within the South African red meat classification system (SAMIC, 2018)

Attribute:	Class:	Class definition:	Visual indication on carcass:
Age of animal	A	No teeth. Meat from a young animal.	Purple AAA roller mark
	AB	One to two teeth. Meat from a slightly older animal.	Green ABAB roller mark
	B	Three to six teeth. Meat from an older animal.	Brown BBB roller mark
	C	More than six teeth. Meat from an old animal.	Red CCC roller mark
Fatness of carcass	0	No visible fat	000 roller mark
	1	Very lean	111 roller mark
	2	Lean	222 roller mark
	3	Medium fat	333 roller mark
	4	Fat	444 roller mark
	5	Over-fat	555 roller mark
	6	Excessively fat	666 roller mark

6.3 THE POPULARITY OF DIFFERENT RED MEAT CLASSES IN SOUTH AFRICA

Figure 6.1 and presents data on the popularity of beef and mutton/lamb classes in South Africa for 2016 and 2017, estimated from Red Meat Abattoir Association (RMAA) slaughtering statistics on a carcass-weight basis (RMAA, 2018)[123]. A similar pattern can be observed for beef and mutton/lamb. For beef and mutton/lamb A2-class meat was the most popular option indicating a dominant consumer preference for lean meat from young animals, followed by A3-meat (medium-fat meat from young animals) and C2-class meat (lean meat from old animals).

[123] No data was provided by RMAA for AO and A1 beef.

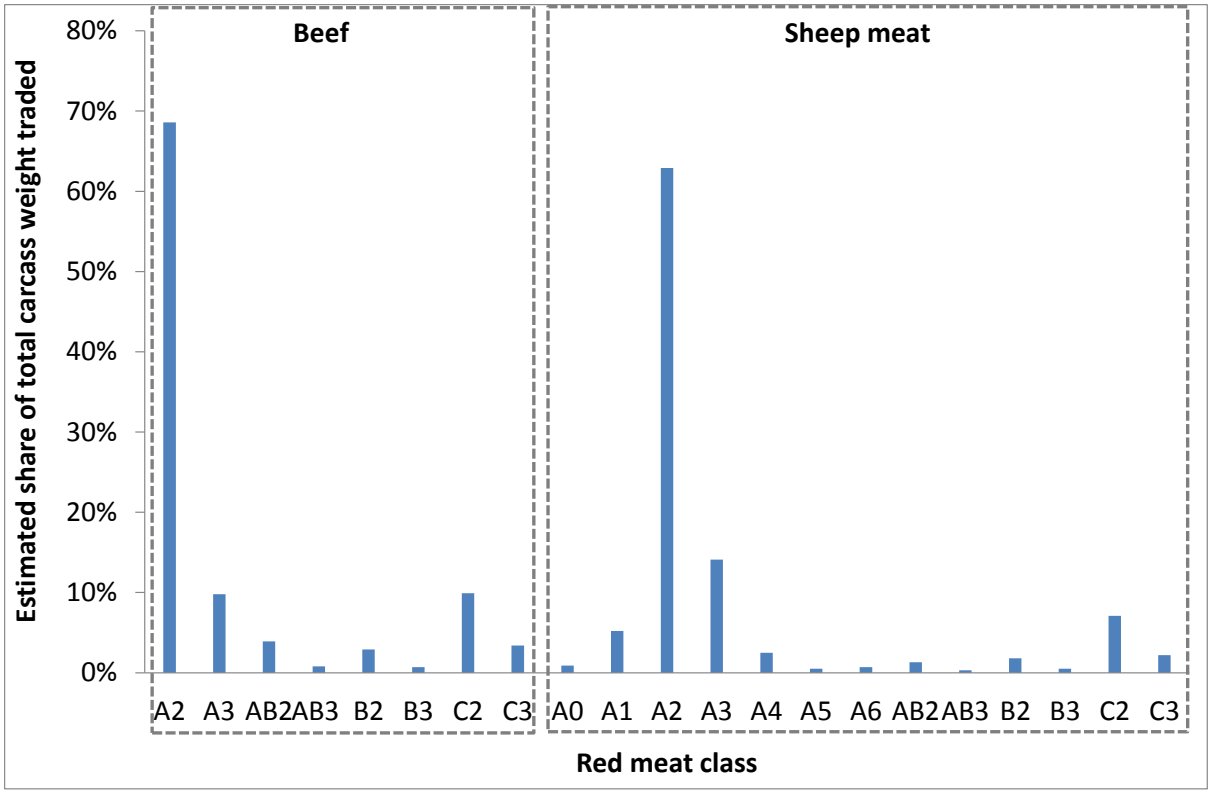

Figure 6.1: The popularity of beef and mutton/lamb classes in South Africa (2016/2017) (RMAA, 2018)

6.4 THE ASSOCIATION BETWEEN RED MEAT CLASS AND PRICE IN SOUTH AFRICA

In relation to the association between red meat classification and price, Table 6.2 presents an overview of the average carcass selling prices (in Rand per kilogram) for the range of classes for beef and mutton/lamb, estimated from RMAA slaughtering statistics for 2016 and 2017 (RMAA, 2018). Statistically distinct price groupings were observed for both beef and mutton/lamb, with the lowest prices generally associated with C-class meat and the highest prices with A-class meat. Thus, the most popular carcass class for both beef and mutton/lamb (being A2-class meat) were in the price group with the highest carcass prices.

Nutrient-dense foods (including meat) are generally the more expensive components in consumers' potential food offering (Temple & Steyn, 2009; Drewnowski & Darmon, 2005). Given this association between red meat classification and price, the importance attached by consumers to price and affordability when purchasing meat (as discussed in Chapter 5), as well as the larger research focus of this study on food affordability, this chapter (see Addendum A for the published journal article) presents an investigation of South African red meat consumer knowledge, usage and perceptions regarding beef and sheep meat classification and related quality parameters among marginalised (low-income) consumers, middle-income consumers and affluent consumers in the Gauteng province of South Africa.

Table 6.2: The average carcass selling prices (Rand/kg) for the range of classes for beef and mutton/lamb for 2016 and 2017 (RMAA, 2018)

	Beef			Mutton/lamb		
	Class	**2016***	**2017****	**Class**	**2016*****	**2017******
Price level 1: *(lowest)*	C3	R 31.17	R 39.45	C3	R 44.35	R 53.67
	C2	R 31.40	R 38.84	C2	R 44.78	R 54.44
				A6	R 44.88	R 54.83
				A5	R 45.85	R 56.42
Price level 2:	B2	R 33.18	R 40.94	B3	R 47.08	R 56.21
	B3	R 33.25	R 40.77	B2	R 47.96	R 57.50
				A0	R 48.26	R 59.45
Price level 3:	AB2	R 36.19	R 44.23	A4	R 51.34	R 61.32
	AB3	R 36.33	R 44.10	AB3	R 51.45	R 60.60
				AB2	R 52.15	R 62.55
Price level 4: *(highest)*	A2	R 37.67	R 45.41	A1	R 57.79	R 69.96
	A3	R 37.78	R 45.74	A3	R 58.70	R 69.11
				A2	R 58.97	R 70.07

*Statistically significant differences (ANOVA): * F=106.045, df=7, p<0.000; ** F=38.218, df=7, p<0.000*
*Statistically significant differences (ANOVA): *** F=105.843, df=7, p<0.000; **** F=50.743, df=7, p<0.000*

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CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

In numerous countries around the globe the affordability of healthy eating has been receiving increasing attention in research and policy interventions to promote the consumption of healthier food choices (Lee et al., 2013). Food prices and food affordability have an influence on consumer food choices, consequently affecting food intake patterns, nutritional status, food security status and health (Lee et al., 2013; James et al., 1997; Beydoun & Wang, 2008). According to the World Health Organisation (WHO) a healthy diet encompasses a diverse combination of foods in adequate quantities and nutritional quality to provide an individual with energy and nutritional requirements (WHO, 2015). Consuming a healthy diet promotes health by preventing under-nutrition, as well as over-nutrition and its consequences, such as overweight and non-communicable diseases (NCDs) (WHO, 2015; WHO, 2018; Drewnowski & Darmon, 2005).

In the South African context the critical need to understand and monitor the affordability of healthy eating has been increasing in recent years, affected by a number of pressure factors that have been manifesting in the country such as:

- High and rising food prices (Statistics South Africa (Stats SA), 2019a; Bureau for Food and Agricultural Policy (BFAP), 2018a; OECD, 2019);
- A combination of low positive and negative growth in real household disposable income in recent years (South African Reserve Bank, 2019);
- A high inequality rate (e.g. income-based Gini-coefficient of 0.68 in 2015 (World Bank, 2018));
- A significant proportion of the South African population living under the World Bank International Poverty Line (World Bank, 2015) (e.g. approximately 40% in 2014/2015 as estimated from Stats SA Living Conditions Survey 2014/2015 (Stats SA, 2017a));
- The prevalence of child under-nutrition (e.g. the most recent 2015 South African Demographic and Health Survey indicated that 27% of children below 5 years of age were stunted and 10% were severely stunted (Stats SA, 2017b))
- The prevalence of over-nutrition (e.g. according to the 2016 Stats SA South African Demographic and Health Survey 68% of women and 31% of men in South Africa were overweight or obese (Stats SA, 2017b);
- The prevalence of food insecurity (e.g. in 2015, 56% of people were not able to afford adequate quantities of food and non-food items (Stats SA, 2017c).

In the South Africa context no existing models to measure the cost of basic healthy eating over time at a national level were found. Consequently, the research presented in this thesis developed and applied models of basic healthy (nutritionally balanced) eating to monitor the cost and affordability of healthy eating in South Africa over time from a nationally aggregated as well as from a socio-economically disaggregated perspective.

Due to the dominance of starch-rich staple foods and animal-source foods in South Africa, these food groups were the focus of application case studies used in this study. The

principles of the model of basic healthy (nutritionally balanced) eating were applied to determine whether the intake of these food groups adhere to healthy guidelines, i.e. the recommendations set out in the South African Food-based Dietary Guidelines (SA FBDG).

7.2 THESIS PRESENTATION

Chapter 1 introduced the research focus of this thesis, by describing the study justification and research objectives. **Chapter 2** addressed the first research objective through a literature overview of the dynamic and diverse characteristics of the South African consumer landscape to provide the socio-economic context of the thesis. The exploration of the South African consumer landscape was executed on a national level as well as on a socio-economically disaggregated level. The second chapter also addressed the second research objective of this study by presenting a socio-economically disaggregated view of food expenditure patterns in South Africa based on the food groups specified in the SA FBDG.

In **Chapter 3** the development and application of the Thrifty Healthy Food Basket (THFB) and the Moderate-cost Healthy Food Basket (MHFB) were presented. This chapter addressed the third main objective of the thesis, i.e. to develop models of basic healthy (nutritionally balanced) eating in the South African context to enable the regular (monthly) measurement of the cost and affordability of healthy eating.

Starch-rich foods and animal-source foods (specifically meat, fish and eggs) dominate the food expenditure of the average household in South Africa. In Chapters 4 to 6 the principles of the model of basic healthy eating were applied to investigate whether the intake of starch-rich foods (**Chapter 4**) and animal-source foods (**Chapters 5 and 6**) adhere to the recommendations set out in the SA FBDG. These chapters also explored the discrepancies between actual intake and more ideal intake for the selected food groups. The final chapter of the thesis (**Chapter 7**) presented a summary of the study, as well as recommendations and conclusions.

7.3 OVERVIEW AND MAIN FINDINGS

South Africa has a diverse and dynamic consumer landscape. The people in South Africa are often described as a 'rainbow nation' referring to the cultural diversity of the country. The cultural diversity is, for example, evident from the eleven official languages recognised by the Constitution of the Republic of South Africa (1996): Afrikaans, English, isiNdebele, isiXhosa and isiZulu, Sepedi, Sesotho, Setswana, siSwati, Tshivenda and Xitsonga.

During the last decade the South African population has increased by approximately 16% to 57.7 million people (Stats SA, 2018a). A slower growth rate of 9% is projected for the next decade, i.e. 2019 to 2029 (BFAP, 2019a). Simultaneously, the average household size in South Africa has decreased over time to 3.5 persons per household in 2016 / 2017 (Stats SA, 2018b).

South Africa has a young but ageing population with the median population age increasing from 23 years in 2001 (Stats SA, 2015)) to between 25 and 26 years in 2017 (Stats SA, 2018b). In 2018, approximately 48% of the population was part of the working-age

population (25 to 64 years old) which grew at a faster rate than the overall population over the last decade – implying pressure on employment opportunities. The official unemployment rate in South Africa had increased over the past decade, with a value of 27.1% reported in the last quarter of 2018 (Stats SA, 2019b). Continued urbanisation is a reality in South Africa, with the urban proportion of the population increasing from 58% in 2001 (Stats SA Census 2001) to about 70% in 2018 (The Broadcast Research Council of South Africa (BRC), 2018)[124].

Despite evidence of positive nominal growth in household disposable income over the last decade, real household disposable income barely kept track with inflation. Several factors caused pressure on household income such as high levels of unemployment (Stats SA, 2019b), rising debt (National Credit Regulator, 2018) and a large number of young people (Stats SA, 2018a) who have to be supported in the financial structures of households.

From a socio-economically disaggregated perspective, the study focused on four segments: marginalised consumers (poorest approximately 30% of the population), lower middle-income consumers (30% of the population), upper middle-income consumers (20% of the population) and affluent consumers (wealthiest 20% of the population). Rising socio-economic class is generally associated with higher household income levels, increasing urbanisation, higher education levels, lower unemployment and a smaller share of total expenditure allocated to food (ranging from approximately a third of total expenditure for marginalised consumers to 6% for the wealthiest 10% of households in South Africa in 2014/2015) (Stats SA, 2017a). The reality of upward class mobility is a continuum with mobility towards middle-income groups followed by affluent groups, which are particularly prominent (BFAP, 2018a).

From a food intake perspective class mobility has a profound impact on food expenditure and food choices, particularly observed in higher household income levels. The typical food expenditure patterns across the socio-economic spectrum in South Africa based on the food groups specified in the SA FBDG, were explored. This served as an important indication of the food preferences of South African consumers, which was an essential input for the development of the balanced food basket model. In 2014/2015 households with higher affluence levels generally had a decreasing share contribution to total food expenditure for starch-rich foods, fats / oils and legumes. Wealthier consumers had a much larger expenditure on more expensive and nutritionally diverse foods, such as animal-source foods (meat, fish, eggs and dairy) as well as fresh produce. The dominant (top ten) food items for the four main socio-economic sub-segments, presented in order of importance from a food expenditure perspective were:

- Marginalised households: Chicken, maize meal, brown bread, high-sugar foods / beverages, rice, granular sugar, beef, edible oil, white bread, potatoes (representing approximately 63% of total within-group food expenditure);

[124] The abbreviation 'BRC' refers to the Broadcast Research Council of South Africa.

- Lower middle-income households: Chicken, maize meal, brown bread, beef, high-sugar foods / beverages, rice, granular sugar, white bread, milk, edible oil (representing 59% of total within-group food expenditure);
- Upper middle-income households: Chicken, beef, brown bread, maize meal, high-sugar foods / beverages, white bread, milk, rice, granular sugar, eggs (representing 53% of total within-group food expenditure);
- Affluent households: beef, chicken, milk, high-sugar foods / beverages, mutton/lamb, brown bread, fish, white bread, cheese, pork (representing 46% of total within-group food expenditure).

In general rising affluence levels were associated with an increased importance of animal-source foods (e.g. beef, milk, mutton/lamb, fish, cheese and pork) and the decreased importance of starch-rich staples. Chicken has universal importance across the socio-economic spectrum in South Africa, and is well-established as the dominant animal-source food. The presence of high-sugar foods and beverages among the top-ten food expenditure items of all the socio-economic segments presents a health concern.

The THFB and the MHFB were developed as models of basic healthy (nutritionally balanced) healthy eating in the South African context to enable the regular (monthly) measurement of the cost and affordability of healthy eating. The THFB and MHFB models were based on the "Guidelines For Healthy Eating" of the South African Department of Health (DoH) (DoH, 2013a), with the methodology also taking into consideration typical household characteristics (household size, composition and income levels), food preferences, single serving unit (SSU) specifications and nationally representative food retail prices. The healthy food baskets consisted of 25 food items[125]: starch-rich foods (super maize meal, brown bread, white rice, potatoes and wheat flour), vegetables (tomatoes, onions, cabbage, carrots and pumpkin), fruit (apples, bananas and oranges), legumes (dried beans and baked beans in tomato sauce), animal-source foods (individually quick frozen (IQF) chicken pieces, lean beef mince, large eggs, canned pilchards in tomato sauce, cheddar cheese and low-fat milk), fats / oils (sunflower oil, margarine and peanut butter) and white sugar. Over the past few years the healthy food basket models have been presented at various national and international conferences[126], and tested and refined in terms of critical aspects such as the items included in the baskets as well as the specification of SSUs.

[125] The selection of food items included in the healthy baskets was limited by the items monitored by Stats SA on a monthly basis in urban areas. The more limited list of items monitored by Stats SA in rural areas prevented the costing of the healthy baskets in rural areas. The selection of food items was based on the typical food preferences of lower-income households in South Africa, motivated by the thrifty focus of the study.

[126] For example: The South African Nutrition Conference, Somerset-West, Cape Town, South Africa, 3 September 2016; The 3rd International Conference on Global Food Security, Cape Town, South Africa, 3-6 December 2017.

From January 2013 to January 2019 the cost of the THFB[127] for the four-person reference family increased by 32.6% to R2 515 per month. The cost of the MHFB[128] increased by 33.6% to R3 642 per month, during the same period. On average, the MHFB was 43.6% more expensive than the THFB over this period. In general, the annual monthly Consumer Price Index (CPI) food inflation rate was lower than the inflation rate on the healthy baskets, implying pressure in terms of the affordability of healthy eating.

Exploring different household composition and income scenarios, the THFB was affordable (with a food expenditure share of 35%[129] or lower) for an adult male earning a minimum wage, a female pensioner, a two-member household (one adult male and female) earning two minimum wages and the four-member reference family (adult male, adult female, older child and younger child) earning two minimum wages. Additional support in the form of child support grants, an old age pension (where applicable) and children receiving the benefit of school feeding helped to improve the affordability of the THFB. The MHFB was only affordable to a single adult male and the 2-member household consisting of an adult male and female earning two minimum wages.

In 2018, the reference family of four required a monthly household income of approximately R7 400 and R10 150 to afford the THFB and MHFB respectively (assuming a maximum food expenditure share of 35%). Thus, only the most affluent 50% of households can afford the THFB, reducing to 40% for the MHFB. From 2013 to 2018 Stats SA Food Poverty Line (FPL) values were lower than the monthly cost per capita of the THFB, implying that the national FPL is too low to enable individuals to purchase sufficient food to provide them with an adequate diet. The analyses also showed that child support grants were too low to even purchase the THFB.

In 2014/2015, starch-rich foods and animal-source foods (chicken, meat, fish and eggs[130]) dominated the food expenditure of the average South African household with expenditure contributions of approximately 25% and 31% respectively (Stats SA, 2017a). Having measured the affordability of basic healthy eating in the South African context, the focus then shifted to these two dominant food groups to determine whether the typical consumption of starch-rich foods and animal-source foods (chicken, meat, fish and eggs) can be deemed 'healthy' – i.e. adhering to the recommendations set out in the SA FBDG. The national average per capita consumption of the dominant starch-rich foods (maize meal, bread, potatoes and rice) and animal-source foods (chicken, beef, pork, mutton/lamb, fish and eggs) were estimated from national aggregate figures of commodity quantities allocated for human consumption (BFAP, 2019a). Various aspects were taken into

[127] For the THFB the dominant cost contributions came from animal-source foods, followed by vegetables, starch-rich staple and liquid dairy.

[128] The higher dietary diversity of the MHFB resulted in dominant cost contributions by animal-source foods, followed by vegetables, liquid dairy and fruit.

[129] Affordability was evaluated by applying a maximum food expenditure share of 35% (as deduced from Stats SA Income and Expenditure Survey 2010/2011 and LCS 2014/2015).

[130] It is acknowledged that liquid milk and dairy products are also included in the animal-source foods groups, even though the research focused on meat, fish and eggs specifically.

consideration to convert commodity quantities allocated to human consumption to raw and edible per capita SSU quantities (to facilitate comparison with the SA FBDG recommendations), for example: non-edible components[131], manufacturing conversion factors[132], lean meat carcass shares, raw-to-cooked conversion factors[133], SSU quantity definitions and South African population figures. Socio-economically disaggregated per capita consumption of the dominant starch-rich foods and animal-source foods was estimated from household-level food expenditure data[134] (Stats SA Living Conditions Survey (LCS) 2014/2015), official food retail prices monitored by Stats SA, raw-to-cooked conversion factors (where applicable) and SSU quantity definitions.

In South Africa the consumption of starch-rich foods (which is dominated by maize meal, bread, potatoes and rice) is higher than other more and less developed regions around the globe (FAO, 2017). Over the last decade the consumption of starch-rich foods in South Africa on average was approximately 2.2% higher[135] than the general SA FBDG recommendation of 10 SSUs per day. The intake was dominated by maize porridge (5.5 SSUs/capita/day on average), followed by rice (1.7 SSUs/capita/day on average), brown bread (1.0 SSUs/capita/day on average), white bread (1.0 SSUs/capita/day on average) and potatoes (0.98 SSUs/capita/day on average). Over the last decade, an increasing trend in the total combined intake of maize meal, rice potatoes and bread was observed.

In general, maize meal is the most affordable starch-rich food in South Africa (costing R0.22/SSU on average in 2018), followed by rice (R0.28/SSU), brown bread (R0.67/SS), white bread (R0.75/SSU) and potatoes (R1.20/SSU). The critical importance of price as a determinant of consumption of these foods is evident from the observation that the most affordable options (i.e. maize meal, followed by rice and brown bread) were also consumed in the largest quantities on a per capita basis. From 2013 to 2019 the most severe food price inflation[136] was observed for maize meal, followed by brown bread, white bread and potatoes.

Across the socio-economic spectrum the intake of these starch-rich foods was higher than the SA FBDG recommended level for expenditure decile (ED) 2 to ED 8 – with particularly high intake levels observed among lower middle-income consumers (ED 4 to ED 6). In 2014/2015, other starch-rich foods (such as wheat flour and processed starch-rich foods like pasta, breakfast cereals and baked goods) contributed approximately 22% to average total household food expenditure in South Africa – ranging from 10% for ED 1 to 50% for ED 10

[131] For example: maize chop (the by-product of maize meal manufacturing), wheat bran used for animal feed, non-edible carcass components (such as bones and skin) and the shells of eggs.

[132] In the case of white and brown bread.

[133] For animal-source foods (beef, chicken, pork, mutton / lamb and fish) international raw-to-cooked conversion factors as reported by Bognár (2002) were applied. However, ideally raw-to-cooked conversion factors in the South African context should be developed.

[134] In the absence of recent nationally representative food intake data in terms of quantitative food intake.

[135] This research component considered the main starch-rich foods, i.e. maize meal, bread, potatoes and rice.

[136] Examples of factors that drove upward food inflation included: rising input costs, rising global oil prices, exchange rate depreciation and climate pressure (i.e. the effects of the severe 2015/2016 drought in South Africa (BFAP, 2017).

and increasing by a factor of 17 between ED 1 and ED 10. Thus, total intake of starch-rich foods was higher than the recommended 10 SSUs/capita/day.

When we consider the focus of the SA FBDG on wholegrain and minimally processed starch-rich foods it was concluded that South African consumers have a preference for more refined starch-rich foods such as super maize meal, white bread and white rice. Brown bread is an exception, since brown bread represents about half of the total bread consumed in South Africa. However, it was shown that the popularity of white bread increased with rising socio-economic status, i.e. white bread was more popular than brown bread among the most affluent 40% of the population. Traditional and/or indigenous grains, contribute very little to the total intake of starch-rich foods showing declining trends over time.

Global animal-source food intake is dominated by pork (followed by poultry, bovine meat, eggs and fish) (FAO, 2017). The intake of this food group in South Africa is dominated by chicken (followed by beef, pork, eggs, mutton/lamb and fish) with cumulative lower intake in South Africa compared to values reported for more developed regions such as Oceania, North-America and Europe. Over the last decade the consumption of lean meat foods in South Africa was on average approximately 26% lower than the general SA FBDG recommendation of a cumulative cooked lean meat intake of 90 gram/capita/day, despite increasing by 3.5% from 2008/2009 to 2017/2018. Meat intake was dominated by chicken (cooked lean meat intake of 38 gram/capita/day on average for the last decade and 42 gram/capita in 2018), followed by beef (19 gram/capita/day on average and in 2018), pork (5 gram/capita/day on average for the last decade and 6 gram/capita in 2018) and mutton/lamb (4 gram/capita/day on average for the last decade and 3 gram/capita in 2018). The calculated values compared well with those reported in the literature (Schönfeldt et al., 2013).

Primary consumer research revealed that price is a critical determinant of consumer meat choices, together with aspects such as food safety and the various dimensions of sensory acceptability. In 2018 (based on monthly food prices) the most affordable cluster of animal-source foods were polony (R3.72/SSU), eggs (R4.60/SSU), frozen chicken portions (R4.92/SSU) and canned pilchards (R5.80/SSU). The second cluster consisted of fresh chicken portions (R9.22/SSU), pork chops (R9.33/SSU) and beef mince (R10.43/SSU). The most expensive product cluster consisted of canned tuna (R14.47/SSU), lamb (R17.40/SSU) and beef fillet steak (R18.54/SSU). From 2013 to 2018 the most severe food price inflation was observed for eggs and lamb, followed by beef (fillet, mince) and polony. Additional price pressure on selected animal-source foods originated from incidents such as the Listeriosis outbreak in the processed pork industry and Avian Influenza in the poultry industry (BFAP, 2019a).

From a socio-economically disaggregated perspective the lean meat intakes of the least affluent 80% of the population were 76% (for ED 1) to approximately 5% (for ED 8) below the SA FBDG recommendation of 90 gram/capita/day, while the lean meat intakes of consumers in ED 9 and ED 10 were estimated at levels that were 15% and 49% higher than the SA FBDG recommendation. Thus the analysis revealed a combination of under- and

over-nutrition of meat by different socio-economic groupings. The majority of South African consumers eat less eggs and fish than recommended in the SA FBDG, even though consumers did reveal a preference for oily fish options as recommended in the SA FBDG. Many consumers engage in some behaviour to reduce the fat content of meat such as trimming visible fat and / or avoiding the serving of 'pan drippings'. The application of these actions increased with higher socio-economic status.

Primary consumer research showed that price or affordability is an important limiting factor in relation to meat intake for many (particularly less affluent) consumers in South Africa. As red meat classification is related to product price, as well as the fat content of meat, consumer perceptions of red meat classification were explored. Despite limited understanding of red meat classification across the socio-economic spectrum, approximately half of the middle-income and affluent consumers (but very few marginalised consumers) indicated that they check classification when purchasing beef or mutton/lamb. The study concluded that an improved understanding of the South African red meat classification system combined with an appropriate front-of-pack labelling system to communicate red meat classification to consumers could potentially help consumers to make more informed red meat decisions, including the selection of leaner meat cuts.

7.4 LIMITATIONS OF THE STUDY

The food items included in the healthy food baskets:

Most healthy food baskets contain more items, e.g. 34 items in the PACSA basket (PACSA, 2018) and 44 food items in the Adelaide (Australia) basket (Tsang et al., 2007). The items that are included in the healthy food baskets in this thesis (THFB and MHFB) (25 food items in total) are limited by the food items for which Stats SA monitor national food prices in urban areas of South Africa. A much wider variety of foods (e.g. fruit, vegetables, dairy and whole-grain foods[137]) should ideally be included to improve the nutritional diversity of the sample healthy baskets and to move potentially closer to the satisfaction of consumer taste preferences. An expansion of the items monitored by Stats SA or dedicated price observation surveys can potentially solve this limitation – even though the latter can be challenging due to cost implications.

The sample food intake patterns specified in the DoH "Guidelines For Healthy Eating", which formed the nutritional backbone of the healthy food baskets which were developed in this study, exclude miscellaneous foods used in meal preparation (e.g. spices, seasonings, condiments, baking supplies) and beverages (e.g. coffee and tea). The nutritious food basket developed in Ontario (Canada) (Ministry of Health Promotion Ontario, 2010) mitigated this constraint by adding 5% to their healthy basket cost. According to household-level expenditure data from Stats SA LCS 2014/2015 (Stats SA 2017a) items such as sauces, spices, baking aids, coffee, tea and other hot beverages contributed 4.5% to the total food

[137] Based on informal retail prices observed on 1 June 2019 (Pick 'n Pay online shopping, www.pnp.co.za) the premium associated with selected whole-grain food options was identified, e.g. bran flakes were 40% more expensive than corn flakes; whole wheat bread 10% more expensive than white bread; and brown rice 62% more expensive than white rice.

expenditure of the average household in South Africa (i.e. comparable to the 5% premium suggested by the Ontario nutritious food basket mentioned above). From a cautionary perspective the intake of food seasonings and sauces should be limited in view of the potential role these items play in increasing salt intake (and fat in the case of some sauces) in the diet (DoH, 2013a). Even though the intake of coffee and tea can contribute to the daily water balance in individuals, potential disadvantages of over consumption include the diuretic effects (due to the caffeine in some of these beverages), increasing sugar intake (if coffee or tea is sweetened with granular sugar) and the negative impact of compounds such as tannins and caffeine on micronutrient absorption (Van Graan et al., 2013; Temple & Steyn, 2013; Schönfeldt et al., 2013).

Household income data:

To evaluate the affordability of healthy eating, the food basket costs were compared to typical household income levels. The preferred data sources on nationally representative household income were the Stats SA household-level income and expenditure studies, presenting income and expenditure per ED. Unfortunately these surveys are only done every few years (e.g. Income and expenditure surveys done in 2005/2006 and 2010/2011; LCS done in 2014/2015). As an additional data source, the annually updated household income data of the SEM (socio-economic measurement) segments of the Broadcast Research Council of South Africa (www.brcsa.org.za), were utilised. Both data sources were applied in the research to facilitate a more comprehensive view on food affordability.

Annually updated data on household income and expenditure per ED can be extremely valuable to enable more accurate evaluations of the affordability of healthy eating in the South African context. Regularly updated socio-economically disaggregated household income data can also help to anticipate changes in the food intake of various socio-economic groups.

Food waste:

One of the assumptions of the healthy food basket models which were developed in this study was that none of the purchased food ends up as household-level food waste. In developing countries the most significant food waste occurs from the farm to the retailer, with a lesser contribution of consumer waste (FAO, 2019). In contrast consumer-level food waste has a dominant contribution in first world countries (FAO, 2019).

However, according to the World Wildlife Foundation (WWF) (2017) total food waste in South Africa is estimated at 10 metric tons per annum (approximately 33% of average annual production), with the largest proportion of waste occurring from the farm to the retailer. Household-level food waste (representing the focus of this study) only contributed an estimated 5% to total food waste in the value chain (WWF, 2017). Critical thinking and appropriate future research is needed on the relevant intervention levels in value chains and potential intervention strategies to curb food waste effectively in the South African context.

When we consider total food waste from 'farm to fork', fresh produce (fruit and vegetables) accounted for a dominant 44% of waste, followed by cereals (26%), meat and dairy (15%) and roots, tubers and oilseeds (13%) (WWF, 2017). The significant waste proportion attached to fruit and vegetables is a serious concern, when we consider the general inadequate consumption of fresh produce in the South African context (Mchiza et al., 2015). Food waste at household-level can potentially increase the cost of basic healthy eating as the wasted food has to be replaced. In a wider perspective, food waste also leads to the waste of natural resources in food production systems. The issue of food waste can also cause potential over-estimation in the per capita consumption calculations. A possible solution to address the limitation of food waste is to add a certain percentage to the cost of the healthy food baskets for selected waste-prone categories. This would hopefully account for the potential cost impact of food waste.

Different types of food retail outlets:

An improved understanding of the food purchasing habits of South African consumers (for different food types and socio-economic groups) as well as food price differences between different types of retail outlets can contribute to the development of sound advice to consumers on how to maximise their household-level food budgets to achieve basic healthy eating. However, even though the food price data released by Stats SA is based on food price observations obtained from a variety of retail outlet types (e.g. supermarkets, convenience stores, specialty shops, e.g. butcheries, greengrocers and markets) (Stats SA, 2017d), the food prices are not released per shop type. Primary research of the prices and availability of food at different food shopping outlets will probably be needed to address this limitation. In the South Africa context 'spaza shops' and street traders should also be included in such food price monitoring efforts. Block and Kouba (2006) argued that community food systems (including the available selection of food retail outlets in a community) should be viewed as a determinant of food security – affecting consumer ability to obtain food.

Geographical disaggregation:

Differences in both the food inflation rates in the various provinces in South Africa, as well as in the typical food expenditure patterns in the provinces, suggest the need to refine the healthy food basket models at a provincial level. This can be useful to investigate the affordability of healthy eating in South Africa on a geographically disaggregated level (taking into account province-specific food intake patterns, food prices and household income characteristics). At present the Stats SA average retail prices are only available at a national level.

The importance of estimating food baskets for specific geographical areas was stated by Tsang and co-workers (2007), as calculations based on average values tend to hide variability in sub-groups. In the South African context Rose and Charlton (2002) pointed out that higher food costs in rural areas can be attributed to factors such as transportation costs and more limited food availability.

Sustainability:

Food intake also relates directly to two of the current Sustainable Development Goals (SDGs) (i.e. to "end hunger, achieve food security, improved nutrition and promote sustainable agriculture" and to "ensure healthy lives and promote well-being for all at all ages") (UNDP, 2018). The current version of the healthy food basket models did not have a specific sustainability focus. According to the FAO (2012), sustainable diets are defined as "those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimising natural and human resources". Future research should focus on the development and application of a healthy and sustainable food basket model.

7.5 CONCLUSIONS AND RECOMMENDATIONS

The pressure experienced by South African consumers in recent years was discussed in this thesis, including aspects such as inadequate growth in household disposable income, high levels of unemployment, rising debt and a young population structure. High and rising food prices were also discussed in the South African context. The increasing incidence of climate change and resulting climate variability (for example causing floods, droughts and disease outbreaks) is associated with rising food prices and food price volatility (Wossena et al., 2018; OECD/FAO, 2019). Future expectations such as predictions of continued urbanisation and the possibility of even higher unemployment rates as large numbers of young people move into the working-age population (BFAP, 2019a), suggest continued pressure on consumer food purchasing ability.

With one of the most unequal income distributions in the world, poverty, food insecurity and nutrition insecurity are unfortunate realities in South Africa. In 2014/2015 an estimated 40% of the population was living under the World Bank International Poverty Line (World Bank, 2015; Stats SA, 2017a), while approximately a quarter of the population was unable to purchase or consume enough food to provide them with the minimum per-capita-per-day energy requirement (Stats SA, 2017c). In terms of nutritional status South Africa faces a double burden of disease, with child under-nutrition (e.g. 27% of children below 5 years of age were stunted and 10% severely stunted in 2016 (Stats SA, 2017b) existing alongside over-nutrition (overweight and obesity) among children and adults (e.g. 68% of women and 31% of men in South Africa were overweight or obese in 2016 (Stats SA, 2017b). The co-existence of over- and under-nutrition in a household unit has been reported internationally (Doak et al., 2005; Doak et al., 2000) and in the South African context (Steyn et al., 2011).

When experiencing factors such as income pressure and / or rising food prices, households employ a wide range of food coping strategies. Recently Nielsen (Nielsen, 2019; Nielsen, 2018) reported that consumers typically reduced spending on clothes, out-of-home entertainment and gas / electricity. From a food perspective consumers typically reduced spending on take-away meals and beverages, as well as switching to less expensive grocery

brands such as private-label items, buying larger pack sizes to take advantage of 'bulk specials', undertaking fewer shopping trips and shopping around for special offers. Among lower-income households popular food coping strategies include the consumption of more starch-rich staple foods and less meat and / or fresh produce (fruit and vegetables) (BFAP, 2018a), reduced portions sizes for all household members (De Cock et al., 2013; BFAP, 2018a) and purchasing basic food items in bulk quantities (Mkhawani et al., 2016). Even though these coping strategies could potentially reduce the expenditure of households, dietary diversity and the micronutrient content of the diet can be severely compromised – implying a negative impact on food and nutrition security.

No evidence could be found of existing examples of nationally representative, regularly updated healthy or nutritionally balanced food baskets in the South African context. In this thesis, models of healthy (nutritionally balanced) eating were developed to measure the cost and affordability of basic healthy (nutritionally balanced) eating in the South African context. The results showed that basic healthy eating (as measured by the THFB[138] with a cost of R2 515 in January 2019 for the reference family of four) was outside the reach of the least affluent 50% of households in South Africa. With increased dietary diversity (e.g. relatively more animal-source foods and fruit) the MHFB cost R3 642 per month for the four-member reference family and was only affordable to the most affluent 40% of households. Previously, other researchers such as Temple et al. (2011) and Temple and Steyn (2009) also concluded that a healthy diet was unaffordable to the large majority of the South African population. The pressure on consumer ability to afford healthy eating was further emphasised in this study by the observation that the inflation rate on the healthy food baskets generally exceeded CPI food inflation.

When we consider the discrepancies between ideal[139] and actual food intake quantities in South Africa, lower than recommended intake levels for fresh produce (fruit and vegetables), legumes[140] as well as animal-source foods (specifically lean meat, fish, eggs and liquid dairy were reported). The analyses showed that even though the consumption of lean meat, fish and eggs increased with rising socio-economic status, consumption levels were below the recommendations of the SA FBDG for the least affluent 80% of the population and higher than the guidelines for the wealthiest 20% of the population[141]. Inadequate intake could potentially deprive consumers of nutritional benefits, for example resulting in a diet that is low in protein, iron, zinc, vitamin A and vitamin B_{12}, which might increase the occurrence of anaemia, vitamin A deficiency and poor physical and cognitive development (Schönfeldt et al., 2013b).

The study concluded that average intake levels of vegetable oil, sugar and starch-rich foods are higher than the 'ideal' intake levels. Excluding the least affluent 10% of households in

[138] The THFB contain items from all the food groups, with a relative stronger focus on starch-rich foods.
[139] As described in the SA FBDG and the DoH "Guidelines For Healthy Eating".
[140] Dried beans, lentils, split peas and soya mince.
[141] Future research should focus on the quantification of total protein intake on an aggregate level and a socio-economically disaggregated level, taking into consideration meat, fish and eggs as well as other foods such as grains, legumes and dairy – to develop a more comprehensive picture of the protein intake of SA consumers.

South Africa, the consumption of starch-rich foods[142] exceeds the recommendation of the SA FBDG, thus potentially contributing to excessive energy intake and limiting nutritional diversity. Among lower middle-income consumers particularly high intake levels of starch-rich foods were observed. The general preference for more refined starch-rich foods can deprive consumers of the nutritional benefits associated with the consumption of fibre-rich minimally processed grains and root vegetables, such as improved satiety which could potentially help to prevent excessive energy intake and overweight (WHO, 2003; Elia & Cummings, 2007)) and bowel regularity (Yang et al., 2012) (with the potential to help prevent bowel disease). The risk of inadequate fibre intake in South Africa is further emphasised by the inadequate intake of fruit and vegetables in South Africa as concluded in this study and also confirmed by Mchiza and co-workers (2015). Anderson and co-workers (2009) attribute inadequate fibre intake to lower than recommended consumption levels of whole-grain foods as well as vegetables, fruit, legumes and nuts.

Focussing on starch-rich staple foods such as bread and rice, rising socio-economic status was generally associated with an increased demand for refined starch-rich foods, as well as a pronounced increase in the expenditure on processed starch-rich foods such as breakfast cereals and baked goods.

In South Africa the nutrition transition had been shown to be a reality in numerous studies (Bourne et al., 2002; Steyn et al., 2012; Vorster et al., 2011; Steyn & Mchiza, 2014; Vorster et al., 2005; Nnyepi et al., 2015; Ronquest-Ross et al., 2015). Driven by income growth (due to economic growth), urbanisation and other factors[143], the nutrition transition refers to changes in dietary patterns. These changes include the increased consumption of refined foods (including refined carbohydrates), processed foods, animal-source foods, saturated fat and sugar, accompanied with a decreased intake of fibre-rich foods, fruit and vegetables (WHO, 2003; Ghattas, 2014; Mattei et al., 2012; Steyn & Mchiza, 2014). The nutrition transition is also associated with the increased consumption of food-away-from-home. Such meals often consist of highly processed foods, which are high in fat, salt and refined carbohydrates (Baker & Friel, 2016; Popkin et al., 2012). From an epidemiological perspective the nutrition transition is associated with a movement away from infectious diseases to an increased prevalence of overweight and nutrition-related NCDs (e.g. diabetes, cardiovascular diseases and some types of cancer (Amuna & Zotor, 2008; Steyn & Mchiza, 2014; Shisana et al, 2014).

It was shown that social class mobility (and subsequent changes in food expenditure and consumption) applies to the South African socio-economic landscape. The research presented in this thesis provided numerous elements supporting the reality of nutrition transition in South Africa, such as:

[142] Including maize meal, bread, rice, potatoes and processed starch-rich foods like pasta, breakfast cereals and baked goods.

[143] Also includes: demographic changes, social changes and changes in food systems (e.g. the development of technology making low-cost, energy-dense, nutrient-poor foods more available (Ghattas, 2014).

- The inadequate intake of certain nutrient-dense foods (e.g. whole-grain starch-rich foods, lean meat, fish, eggs, dairy, fruit and vegetables) – with inadequate intake generally more pronounced among lower income households[144];
- The excessive intake of refined starch-rich foods and processed starch-rich food options – with excessive intake generally increasing with affluence level.

When we consider the unaffordability of healthy eating for large proportions of the South African population as concluded in this thesis, policy interventions to promote public health through improved healthy eating patterns should address multiple components. Consumer education to ensure that consumers (across the socio-economic spectrum) know how to make healthy food choices could be viewed as a first component. Furthermore, policy actions should also address the affordability and availability of healthy food options with a comprehensive geographical and socio-economic focus (Drewnowski & Darmon, 2005; Temple & Steyn, 2009).

7.5.1 Recommendations for future research

At the consumer level, future research should focus on a wide range of possible topics, to inform policy actions and consumer education. Geographically and socio-economically diverse consumer research should be undertaken to elicit consumer knowledge, behaviour and perceptions regarding topics such as sustainability, fruit and vegetable intake[145]; whole-grain foods; bread choice in the context of low GI (glycaemic index) bread; sugar consumption[146] and the potential reduction in sugar intake; healthy meat choices, including the actions by consumers to reduce the fat content of meat; food-away-from-home; food choices in the context of energy density and nutrient density[147]; consumer choices between different food packaging sizes and consumer knowledge / awareness regarding the SA FBDGs. Such research can shed light on the factors driving consumer food choice behaviour and also contribute to a better understanding of the nutrition transition in South Africa. Furthermore the impact of additional factors (such as innovation, technology and land tenure) on consumers as well as on the rest of the role-players in food supply chains should be investigated in future research.

Research involving the retail level in the supply chain is also needed in future to inform policy decisions and guide the formulation of consumer education. When we consider the limitations observed in the Stats SA food retail price observations, an expansion of the product selection monitored by Stats SA would be beneficial. Furthermore future research should investigate the cost and availability of healthy food[148] at different types of retail outlets with a diverse socio-economical and geographical focus (including rural and urban locations). Retail-level research on the nutrient density and cost of dietary energy of more

[144] An exception in this regard was brown bread, which decreased in popularity with rising affluence levels.
[145] Building on the research by Schneider and co-workers (2007) and Ronquest-Ross and co-workers (2015).
[146] Building on the research by Steyn and Temple (2012).
[147] Building on the research by Temple and Steyn (2009).
[148] Building on the research by Temple and co-workers (2011).

and less healthy food items should also be widely investigated (Temple & Steyn, 2009). Improved insights into the impact of packaging size on food prices are also important.

7.5.2 Consumer education

In the last few years the South African DoH has engaged in consumer education relating to healthy food choices. The annual National Nutrition Week initiatives (www.nutritionweek.co.za) have focused on a range of topics such as obesity (2019), the importance of breakfast (2018), the importance of drinking water (2017), legumes (dry beans, peas and lentils) (2016), healthy eating in the workplace (2015), portion control (2014) and good food choices (2012). The South African Food Guide was also developed as a simplified representation of the SA FBDG for consumers (Vorster et al., 2013). Moving forward, attention should be given to policies guiding continued consumer education that concentrate on healthy eating. Informed by research on gaps in terms of consumer knowledge regarding healthy eating, these specific consumer education messages should be aimed at appropriate consumer segments through optimal marketing channels. In addition to giving continued attention to consumer education based on the SA FBDG principles of healthy eating, this study identified a number of specific potential topics for future consumer education, such as:

- Intake quantities among household members (to enhance the equitable distribution of food among household members);
- Making healthy choices in the context of food-away-from-home;
- The importance of and practical guidelines related to fruit and vegetable consumption;
- The importance of and practical guidelines related to the consumption of whole-grain foods;
- The importance of and practical guidelines related to the reduced consumption of sugar and sugar-rich foods and drinks;
- Practical advice on how to reduce the fat content of daily meals, with specific attention to the reduction of the fat content of meals (e.g. tasty alternative to deep fried food);
- Monthly updates on the single serving unit costs of popular food options based on Stats SA nationally monitored food prices;
- Practical advice on how to make food choices that are healthy and affordable with a limited budget. This can also include research-based suggestions regarding food choices pertaining to all the various food groups with low and intermediate costs of dietary energy and low energy density as suggested by Temple and Steyn (2009);
- Advice on how to reduce food waste at a household-level;
- The role of GI (Glycaemic Index) in food choices, with a specific focus on staple food choices;
- Practical advice to consumers on possible actions to maximise their food intake with constrained food budgets. For example, the Department of Human Nutrition at the University of Otago (2018) in New Zealand formulated several such suggestions, such as the preparation of “food from basic ingredients”, “buy a whole chicken rather than

boned chicken meat or portions", "buying house brands in particular for basic foods such as flour, sugar and milk" and "frozen or canned foods can often be as nutritious, and cheaper and easier to store, than fresh food". For South Africa specific practical food guidelines should be developed, based on scientifically-sound research on numerous topics such as:

- The price differences between larger and smaller pack sizes with consideration of the typical quantities required by households;
- The value-for-money of 'whole' food formats (e.g. buying a whole chicken) versus buying portions;
- The impact of skin, fat and bone on the value-for-money of meat choices;
- The cost and nutritional value of fresh versus processed (e.g. canned or frozen) fruit and vegetable options;
- Price differences between 'loose-sell' fruit / vegetables and pre-packaged fresh produce options;
- The relationship between seasonality and food prices.

The research process of this thesis revealed that a range of sources had to be utilised to obtain information regarding the various aspects needed to understand and interpret healthy eating in the South African context. The future development of a user-friendly web-based consumer education platform is recommended. This can provide consumers with the necessary information to help them to make healthy food choices, such as the principles of healthy eating, raw and cooked serving sizes, the nutritional value of foods, cooking yields, conversion factors e.g. accounting for the skin of fresh produce and the skin, fat and bone of meat, as well as science-based tips on how to make the best of their food budgets in the South African context.

7.5.3 Policy implications

The critical importance of policy interventions to improve the affordability of healthy food choices becomes clear when we consider the high level of income inequality in South Africa and the results of this study that showed that basic healthy eating is out of reach to at least half of the population. As mentioned in Chapter 1 of this thesis, food affordability can be defined as "the cost of the diet of a household relative to the household's income" (Lee et al., 2013). Policy actions to improve the affordability of healthy eating often focus on the household income and food price components.

Policy actions aimed at increasing household income levels (with a particular focus on vulnerable population segments) can help to relieve consumer debt, inequality and poverty (The Pietermaritzburg Agency for Community Social Action (PACSA), 2016; Saskatchewan Food Costing Task Group, 2017; Rakotoniaina, 2018). Such policies could for example focus on increased household income through higher minimum wages, child support grants and old-age pensions. The complexity of raising household income levels should not be underestimated, when we consider the broader economic and fiscal implications of such actions, as well as the wide range of factors that could potentially affect household income,

such as the number of income earners, the health of income earners (mental and physical), education levels, living location (e.g. rural versus urban) (Alves, 2012; Reardon et al., 2000; Stats SA, 2017a).

When we shift the focus to food price interventions it is critical to keep in mind that food prices are affected by numerous complex factors, such as "political, economic, socio-cultural and environmental factors at the local, national and international levels" (Lee et al., 2013). Taxation can be used to increase the cost (with the aim to reduce the popularity) of less-desirable food options like sugar-rich soft drinks (e.g. implemented in countries like South Africa (National Treasury, 2016), France and the United States of America (Brownell et al., 2009; Villanueva, 2011). Lee and co-workers (2013) emphasised the importance of evaluating the health outcomes of such interventions. A second example of taxation to affect food prices pertains to the association between fast-food (take-away food) intake and the global prevalence of obesity (Zobel et al., 2016). In 2011 Hungary implemented a 'junk food tax' on "food high in salt, sugar and caffeine" (Bíró, 2015) which was observed to decrease the consumption of processed food and improve eating patterns particularly for lower income households.

The first example of policy action aimed at improving the affordability of healthy eating involves the exemption of certain food products from value added tax (VAT) (Lee et al., 2013; Powell & Chaloupka, 2009; Assefa et al., 2016). In South Africa based on the Value-added Tax Act of 1991 (South African Revenue Service, 2019) a selection of widely consumed food items[149] is exempted from VAT (National Treasury, n.d.). Temple and Steyn (2009) argued that the VAT exempted food items in South Africa could be expanded to include other healthy food options with "a low and intermediate cost of dietary energy and a low energy density", such as oats. PACSA (2016) suggested that chicken portions should also be added to the list of VAT exempted food items as chicken portions are the dominant meat source for households in South Africa.

Policy actions aimed at improving the affordability of healthy eating can also rely on subsidies targeting vulnerable groups to impact food affordability (Lee et al., 2013; Sassi et al., 2009). In the United States of America food stamps have been in use since 1939 as part of the Supplemental Nutrition Assistance Program (SNAP) (USDA, 2018). In the United Kingdom the Healthy Start scheme has been active since 2006 (Crawley & Dodds, 2018). An example of a policy measure targeting vulnerable groups is the Farmers Market Nutrition Program of the Massachusetts Department of Agriculture in the United States of America (Massachusetts Department of Agricultural Resources, 2019). In this scheme coupons to buy

[149] Starch-rich foods: samp, maize meal, rice, brown bread, maize rice, dried maize, brown wheaten meal, bread flour and cake flour.
Legumes: dried beans, edible legumes and pulses of leguminous plants and lentils.
Fresh produce: vegetables and fruits.
Dairy: milk, dairy powder blend, cultured milk and milk powder.
Fats / oils: vegetable oil.
Animal-source foods: pilchards in tins and eggs.

fresh fruit and vegetables at farmer markets in the state are given to "vulnerable women[150], children and the elderly". Webber and co-workers (1995) observed an increase of approximately 30% in the quantity of fresh fruit and vegetables purchased by these participating households.

From a more general health perspective the South African DoH is involved in numerous policy initiatives, for example:

- Legislation[151] to decrease the mean salt intake of the population to less than five gram per day (DoH, 2013b) through a two stage approach (effective dates were 30 June 2016 and 30 June 2019);
- The mandatory fortification of the main staples in South Africa started in 2003, with the current list of fortified foods including maize meal, wheat flour for white- and brown bread and cake flour[152]. When we consider the potential substitution of maize meal and rice it is recommended that the mandatory fortification of rice should be applied in the South Africa context.

Food labelling and marketing practices that are not misleading and adhere to legislative requirements can help consumers to make more informed healthy food decisions. In South Africa the Agricultural Products Standards Act and related Regulations govern the labelling of agricultural products (such as animal-source foods (e.g. meat, poultry and dairy), fresh produce (fruit and vegetables) and grains) while the Foodstuffs, Cosmetics and Disinfectants Act and related Regulations govern the labelling of other foods (Food Advisory Consumer Service (FACS), 2019).

The increasing emphasis on the importance of sustainability in food choices (Willett et al., 2019) can prompt the future revision of the current SA FBDG (Vorster et al., 2013) to incorporate sustainable food choice considerations. Such recommendations should be based on sound scientific evidence in the South African food and socio-economic context. Furthermore, an increased focus on the consumption of food that is not only affordable but also sustainable, will have a significant implications for farming practices and supply chain systems in South Africa.

It is important to keep in mind that the improvement of the affordability of healthy eating in South Africa has no simple solution, but would require a complex, multi-dimensional strategy involving both the public sector (e.g. appropriate policies and legislation) and the private sector. Private sector contributions could include the application of technology to develop foods which are affordable and healthy (Ronquest-Ross et al., 2015), as well as the potential role of retailers to make healthy food such as fresh fruit and vegetables more affordable to consumers by initiatives such as bulk discounts when a variety of products are

[150] Including pregnant and breastfeeding women.

[151] DoH (2013). Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972), Regulations relating to the reduction of sodium in certain foodstuffs' (R.214), 20 March 2013.

[152] DoH, National Gazettes, No. 39776 of 03 March, 2016, as part of the Foodstuffs, Cosmetics and Disinfectants Act (54/1972): Regulations relating to the Fortification of certain Foodstuffs.

purchased[153]. Follow-up research should include a comprehensive review of actions undertaken around the world to improve the affordability of healthy eating, combined with research to investigate the viability of policy options at multiple levels (e.g. fiscal, nutritional, consumer and industry levels) in the South African context.

Robust, up-to-date, nationally representative food intake data is critical to enable the design and implementation of timely policy interventions to address the nutritional challenges (Van Heerden & Schönfeldt, 2011). However, in the absence of regularly updated food intake data in South Africa the approach presented in this study (i.e. to derive intake data from food expenditure data) provided an alternative to fill this data gap. However, this approach cannot replace traditional food intake data.

The healthy food basket model developed in this study is a useful tool to enable the regular (monthly) monitoring of the cost and affordability (across the socio-economic spectrum) of healthy eating in South Africa at a nationally representative level in a cost-effective manner. Since the fourth quarter of 2018 the monthly costs of the THFB and the MHFB have been released into the public domain on a quarterly basis in a bulletin dealing with food inflation and the healthy food baskets (BFAP, 2018b; BFAP, 2019b; BFAP, 2019c; BFAP, 2019d), with the potential to influence the food security policies in South Africa.

The food basket model can also be adapted in future to alternative target groups (e.g. per province, for a particular geographical area or for a particular socio-economic segment) subject to the availability of data on food preferences, food prices and household characteristics in the target area. Future plans to cost the healthy food baskets on a refined geographical level can enable spatial analysis of food affordability overlaid with other factors affecting food security such as household characteristics obtained from Stats SA household-levels surveys.

The monthly costing of the food basket models which were developed in this study and analyses thereof should be used as policy analysis tools to act as a practical, scientific basis for the food security debate in South Africa. It has the potential to contribute to the improvement of food security and the achievement of the Sustainable Development Goal to "end hunger, achieve food security, improved nutrition and promote sustainable agriculture". Furthermore if we consider the absence of recent nationally representative food intake data across the socio-economic spectrum for South Africa (Mchiza et al., 2015), the contribution of this study in terms of estimating the socio-economically disaggregated consumption of animal-source foods (meat, fish and eggs) and dominant starch-rich foods (maize meal, bread, rice and potatoes), provides a critical assessment of food intake across the socio-economic spectrum. This can contribute to the formulation and implementation of more focused policy interventions and practical interventions to make healthy eating achievable to more people in the South African context.

The research presented the complex and dualistic South Africa consumer landscape, with the various sub-segments facing unique nutritional challenges. Affluent consumers have the

[153] Such as the recent initiative of the Pick 'n Pay retailer in South Africa presenting consumers with a 20% discount if they purchased five packets of fresh produce.

luxury to demand food attributes in line with their needs for aspects such as indulgence, health / wellness and innovative food solutions to assist them with time pressure in their daily lives and their social aspirations such as sustainability. With less-desirable lifestyle choices and over-nutrition, some individuals in this segment face challenges controlling weight (particularly overweight and obesity) and the subsequent development of NCDs such as diabetes and coronary heart disease. At the lower end of the spectrum up to 60% of people in South Africa cannot even afford purchasing foods in order to follow a healthy eating pattern, resulting in monotonous diets with large volumes of affordable staples and a preference for inexpensive, energy dense and often micronutrient-poor foods. The occurrence of overweight and obesity increases the risk to develop NCDs. At the same time under-nutrition (evident for example in the prevalence of childhood stunting and micronutrient deficiencies in children, females and vulnerable groups) pose another major challenge for less affluent individuals in South Africa.

Failing to address and improve household income levels and the affordability of healthy eating in South Africa could potentially bring about an ever larger divide between affluent and less-affluent consumers - income inequality is a harsh reality in South Africa. Improving the affordability of healthy eating in South Africa requires a complex combination of multiple interventions involving public and private sector role-players with a broad range of interventions aimed at consumers, food production and processing systems. With significant input cost pressure at farm-level combined with dualism that is also pertinent in the farming sector in South Africa, comprising of a combination of commercial and small-scale farmers, the complexity of the policy intervention and actions required to produce affordable and healthy food become even more prominent. With passion, skill, innovative thinking, solid science backing and a strong desire to make a difference we can turn the tide and work towards an improved food system contributing to a healthier future for the people of South Africa.

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ADDENDUM A: ETHICAL APPROVAL LETTER

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics Committee

E-mail: ethics.nas@up.ac.za

Date: 29/5/2017

ETHICS SUBMISSION: LETTER OF APPROVAL

Prof Schönfeldt
Department of Animal & Wildlife Sciences
Faculty of Natural and Agricultural Sciences
University of Pretoria

Reference number: EC111018-072 Amendment dated 24/4/2017
Project title: Red meat impact and environmental impact

Dear Prof Schönfeldt

We are pleased to inform you that your submission conforms to the requirements of the Faculty of Natural and Agricultural Sciences Ethics committee.

Please note you are required to submit annual progress reports (no later than two months after the anniversary of this approval) until the project is completed. Completion will be when the data has been analysed and documented in a postgraduate student's thesis or dissertation, or in a paper or a report for publication. The progress report document is accessible of the NAS faculty's website: Research/Ethics Committee.

If you wish to submit an amendment to the application, you can also obtain the amendment form on the NAS faculty's website: Research/Ethics Committee.

The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Yours sincerely,

Chairperson: NAS Ethics Committee

ADDENDUM B: PUBLISHED JOURNAL ARTICLE

South African Journal of Animal Science 2015, 45 (No. 3)
Peer-reviewed Proceedings of the 12th Meat Symposium:
Relevance of the South African Carcass Classification system

A consumer perspective of the South African red meat classification system

H. Vermeulen[1,2#], H.C. Schönfeldt[2,3] & B. Pretorius[2,3]
[1] Bureau for Food and Agricultural Policy (BFAP), Pretoria, South Africa
[2] Department of Animal and Wildlife Sciences, University of Pretoria, Pretoria, South Africa
[3] Institute of Food, Nutrition and Well-being, University of Pretoria, Pretoria, South Africa

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Abstract

The South African consumer market is characterised by socio-economic and cultural diversity. Food expenditure patterns, behaviour and preferences differ significantly between the various socio-economic sub-groups. Packaging information, including red meat classification information, could be an important tangible resource used by consumers to gauge product quality. The first objective of the research reported in this paper is to investigate the red meat knowledge, usage and perceptions regarding beef and sheep meat classification and related quality parameters among South African consumers. Consumer perceptions of red meat classification were extracted from a comprehensive consumer survey among stratified representative samples of South African low-, middle- and high-income consumers (n = 165, n = 171 and n = 249). The paper also briefly reports on an in-store 'observational' research project that was conducted to develop an understanding of the communication of carcass classification to consumers through fresh red meat product labels at independent butchers and large retailers across South Africa (n = 60). Low-income consumers had very limited understanding and gave little attention to red meat classification. Even though middle-class and wealthy consumers also have a limited understanding of red meat classification, about half of these consumers check for a classification mark. Red meat classification was not mentioned by consumers as a major concern regarding red meat, but related aspects were important such as quality, fattiness, tenderness, juiciness, taste, freshness, smell and appearance. Purchase considerations for beef and mutton/lamb focussed largely on safety, appearance, price and eating quality. Labelling information observed at retail outlets gave very little attention to classification. There is a definite need for consumer education relating to the red meat classification system and for the development of an appropriate front-of-pack labelling system to communicate red meat classification.

Keywords: Beef, high-income, knowledge, labelling information, lamb, low-income, middle-income, mutton, perceptions
Corresponding author: hester@bfap.co.za

Introduction

The South African Carcass Classification System classifies lamb, mutton, beef and goat carcasses based on a set of predefined characteristics mainly focusing on animal age and the fat content of the carcass. The type of production system (i.e. grain-fed versus grass-fed animals) is to some extend embedded in the classification criteria. This system has been in use since June 1992 (Agricultural Product Standards Act, 1990 (Act No.119 of 1990)). Carcass class is indicated on the carcass by means of a coloured roller mark stamp. After processing into retail cuts only some cuts will display the roller mark (Healthy Meat South Africa, 2012).

Even though the system plays an important role in classifying red meat carcasses to facilitate carcass price formation, it should play a role at the consumer interface. Various classes within the carcass classification system imply different product characteristics which should enable consumers to make decisions about desirable product options.

The South African consumer market is characterised by socio-economic and cultural diversity. Various tools exist to classify consumers within this socio-economic spectrum. The income and expenditure deciles applied by Statistics South Africa (StatsSA) for their Income and Expenditure Surveys (StatsSA, 2012a) each represent 10% of the population from an income or expenditure point of view. Another widely used tool which

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will be discussed in this paper in more detail is the Living Standards Measure (LSM®) market segments developed and maintained by the South African Audience Research Foundation (SAARF). Socio-economic status increases with increasing LSM® level (SAARF, 2013).

Various lifestyle levels can be identified across the LSM® spectrum. For example, one approach is to distinguish between marginalised/poor consumers (LSM® 1–4), the middle-class (LSM® 5–8) and wealthy consumers (LSM® 9–10). In general the SAARF LSM® segments are not directly based on the income levels of consumers, but are based on consumer access to various amenities, such as durables, household location and dwelling type. Table 1 presents a summary of the characteristics of these lifestyle levels.

Table 1 Overview of the three main lifestyle levels within the 10 Living Standards Measure (LSM®) segments *(Sources: BFAP 2014, based on data from SAARF All Media and Product Survey (AMPS®) 2013; StatsSA 2012a)*

	Marginalised/poor group	**Middle-class**	**Wealthy consumers**
LSM® segments	LSM® 1 - 4	LSM® 5 - 8	LSM® 9 - 10
Share of SA adult population (15 years+)	22.3%	61.2%	16.5%
Average household monthly income (self-reported)	R1480 to R3205	R4344 to R16754	R23539 to R36883
Estimated contribution to total purchasing power in South Africa	± 5%	± 50%	± 40% to 50%
Estimated share of total expenditure allocated to food and non-alcoholic beverages	35% to 34%	32% to 15%	10% to 6%
Dominant education level	Up to primary completed Some high schooling	Some high schooling Matric	Matric Post-matric qualification
Dominant age groups	15 - 24 and 50+	15 - 49	35+
Dominant location (rural/urban)	Mostly rural, some urban	Increasingly urban	Urban
Dominant provincial location	KwaZulu-Natal, Eastern Cape, Limpopo	KwaZulu-Natal, Gauteng, Western Cape	Gauteng, Western Cape, KwaZulu-Natal
Unemployment rate (self-reported)	41% to 43%	38% to 17%	Insignificant
Dominant dwelling type	Traditional hut, house/cluster house/town house	Matchbox house, house/cluster house/town house, flat	House/cluster house/town house, flat
Share of group with access to in-home electricity	27% to 93%	98% to 100%	100%
Share of group with access to tap water in home or on plot	0% to 52%	82% to 100%	100%

Class mobility is a prominent feature of the South African consumer market, where consumers move towards higher LSM® groups driven by economic growth as well as socio-economic empowerment. As is evident from Figure 1, from 2004 to 2013 the share of South African adults in SAARF LSM® segments 1 - 4 declined (−56%), accompanied with an increase in the share of the adult population classified in wealthier segments such as LSM® 7 (+99%), LSM® 8 (+82%), LSM® 6 (+69%) and LSM® 9 (+68%). In recent years the class mobility rate has been variable. In generally increased in most of the socio-economic sub-groups after slowing down from 2007/2008 to 2009/2010 due to recession impacts (BFAP, 2014).

Food expenditure patterns differ significantly between the various LSM® groups as illustrated in Figure 2. (as estimated from the Statistics South Africa (StatsSA) Income and Expenditure Survey 2010/11) (StatsSA, 2012a). Marginalised consumers spend the largest relative share on grain-based staple foods (32% of their total expenditure), followed by meat products (22%), vegetables (11%), and dairy and eggs (8%). The middle-class group spends relatively less of their total expenditure on grain-based staples (26%), relatively more on meat products (26%), followed by vegetables (10%), as well as dairy and eggs (9%). The wealthiest segment of the population spends only 16% of their total food expenditure on grain-based staple foods, with meat representing their main expenditure category (27%), followed by dairy and eggs (11%) and vegetables (9%).

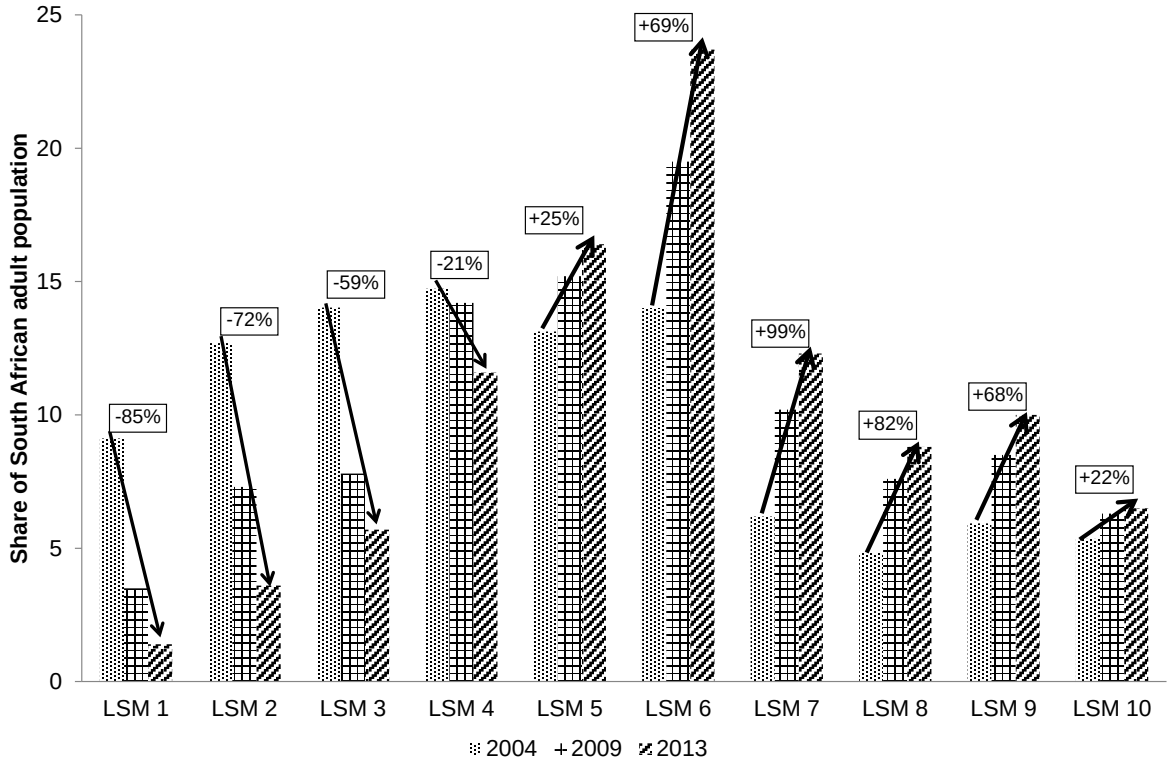

Figure 1 Class mobility among Living Standards Measure (LSM®) segments from 2004 to 2013. *(Source: BFAP 2014, based on data from SAARF AMPS® 2004 to 2013).*

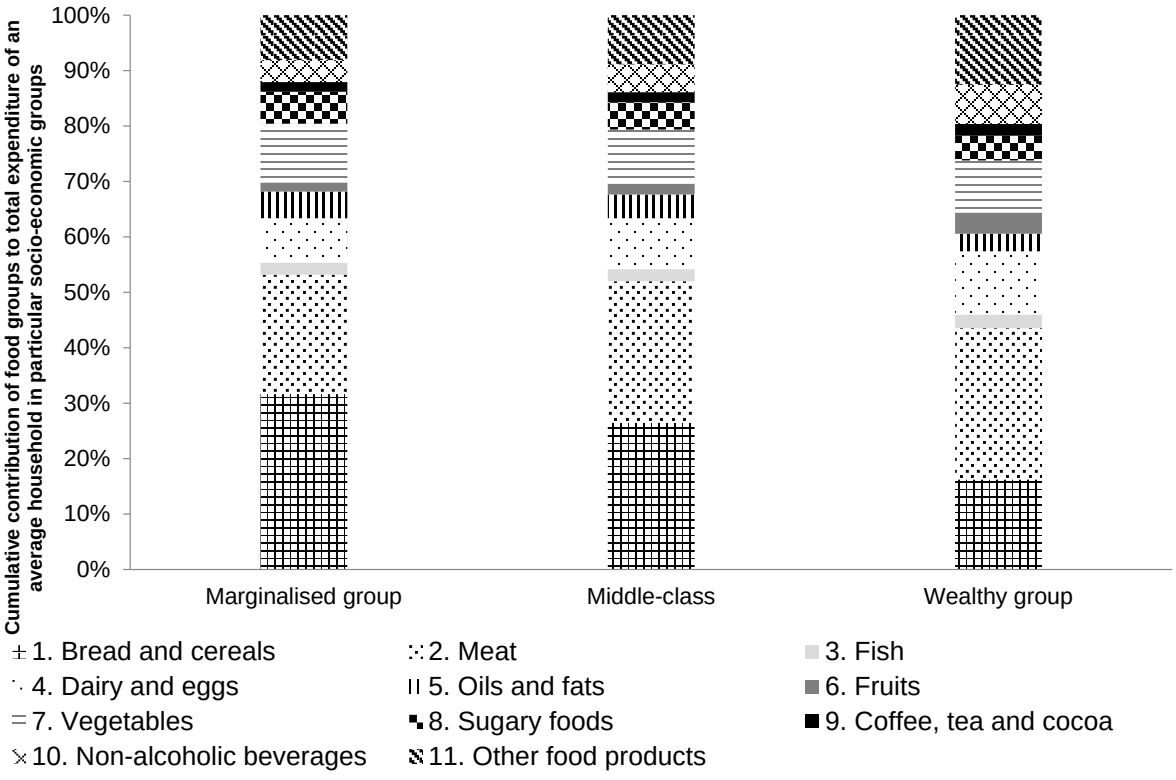

Figure 2 Estimated food expenditure composition of the main socio-economic sub-groups in South Africa. *(Source: Calculations based on data obtained from Statistics South Africa Income and Expenditure Survey 2010/11) (StatsSA, 2012a).*

The meat expenditure patterns of South African consumers, estimated from the Statistics South Africa Income and Expenditure Survey 2010/11, indicate that the middle-class dominated the expenditure on poultry. The wealthy segment dominated spending on sheep meat as well as pork. The middle-class and wealthy groups both had large expenditures on beef, processed pork and beef sausage (see Figure 3). Despite consuming all meat types, the low-income consumer segment has a clear preference for chicken followed by beef, as evident from Figure 3.

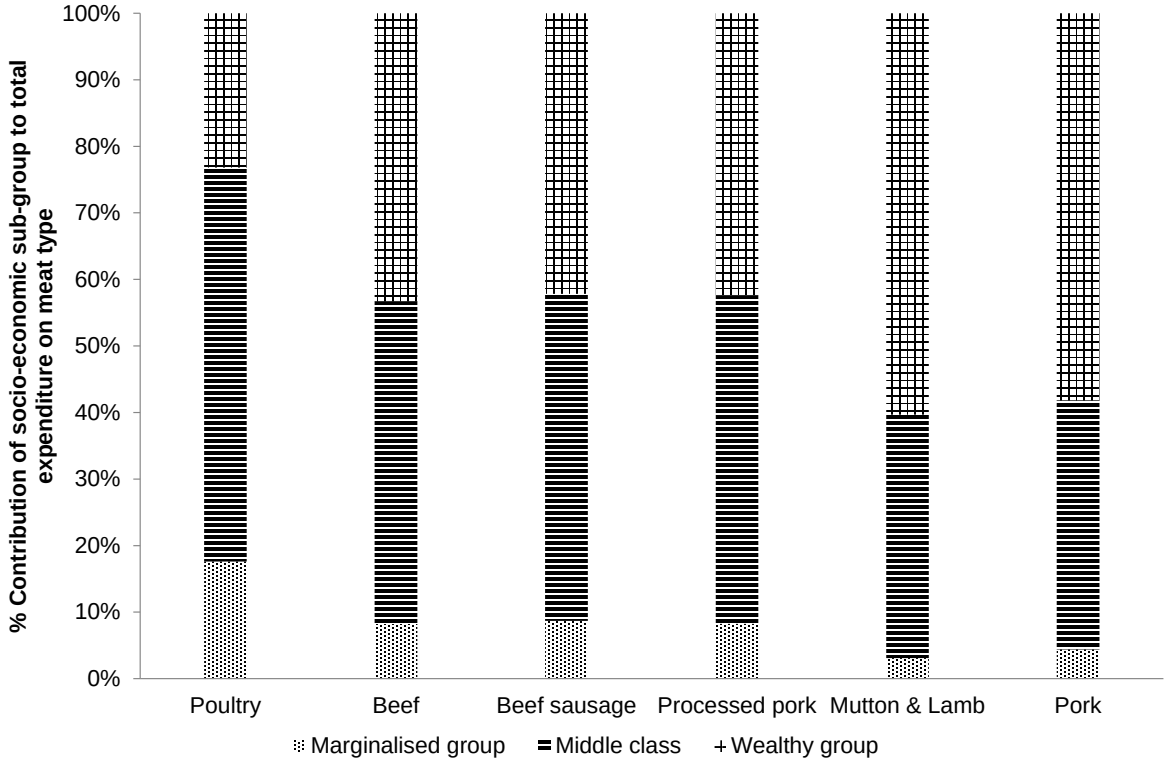

Figure 3 Meat expenditure patterns of socio-economic sub-groups in South Africa.
(Source: Calculations based on data obtained from Statistics South Africa Income and Expenditure Survey 2010/11).

Due to factors such as class mobility, urbanisation and changing preferences, the meat expenditure patterns of South African consumers are changing over time. To illustrate some of these changes, Figure 4 presents the changes in the annual expenditure of households on particular meat types after removing the effect of inflation (i.e. real changes in expenditure) (BFAP, 2014 based on data obtained from Statistics South Africa Income and Expenditure Surveys 2005/06 and 2010/11 [StatsSA, 2008; StatsSA, 2012a]). The most significant increases in real household expenditure on particular meat types, implying higher consumption levels from 2005 to 2010 were:

- Marginalised group: Processed pork (+121% increase in household expenditure above inflation), Poultry (+21%); Beef (+17%), Beef sausage (+3%);
- Middle-class group: Pork (+123%), Processed pork (+80%), Beef (+13%), Poultry (+5%);
- Wealthy group: Processed pork (+48%), Beef sausage (+9%), Pork (+5%), Beef (+5%).

The middle-class group experienced real expenditure growth in the largest number of meat categories (all except for sheep meat) from 2005 to 2010.

When purchasing products, including red meat, how consumers evaluate quality, will influence their purchasing behaviour. Quality is a complex concept with many definitions depending on perspective. Quality can be defined as the 'totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs' (Kotler, 2000). To classify quality characteristics in a meaningful manner, it is necessary to consider a suitable conceptual model of the quality perception process. For this purpose the model developed by Steenkamp (1989) (as applied by Oude Ophuis & Van Trijp, 1995) are presented where a distinction is made between quality cues and quality attributes (see Figure 5 for examples of meat quality cues and attributes and Diagram 1 depicting the conceptual structure of this model). Ultimately the

combination of environmental cues, personal factors, situational factors, quality cues and quality attributes could impact how consumers perceive the quality of the particular product.

Consumers are able to determine quality 'cues' with certainty before consumption by using their senses. 'Intrinsic quality cues' are part of the physical product and cannot be changed without changing the physical characteristics of the product itself. 'Extrinsic quality cues' are related to the product but not physically part of the product and can thus be changed without changes to the physical product.

Quality 'attributes' are product characteristics that deliver potential benefits to the consumer, but can only be observed after consumption and thus consumers generally have to rely on their perceptions of these attributes to form quality judgments prior to consumption. 'Experience quality attributes' can only be evaluated with certainty by the consumer after consumption and an actual experience of the product.

'Credence quality attributes' are 'intangible' and cannot be evaluated with certainty by the consumer even after consumption. Consequently consumers have to rely on judgment or the information of other role-players to develop certainty that the particular attribute is part of the particular product.

The quality cues and attributes linked to red meat classification are shown in Bold and Italic font in Table 2. Some factors are directly linked to red meat classification, such as the intrinsic quality cue 'visible fat on meat', the experience quality attributes 'fattiness of meat in terms of non-visible fat' and the intangible quality attributes of 'animal feeding practices' (in particular grass-fed versus grain-fed) and 'age of animal at time of slaughter'. The latter factor was listed as intangible as most consumers may not have the expertise to judge animal age based on the visual appearance of the meat and have to rely on product information supplied in this regard. Other factors could be linked indirectly to red meat classification in Table 2, such as meat colour, fat colour, taste, tenderness, juiciness, healthiness and nutritional value of the meat (e.g. in terms of fat content).

To utilise the South African Carcass Classification System for informed decision-making, consumers need a proper understanding of the various classes, as well as the quality attributes implied by these classes. Doubt arose in this regard, leading to a number of critical research questions. Do South African consumers across the socio-economic spectrum understand and utilise the Carcass Classification System when purchasing red meat? Do they understand the quality implications of different carcass classes? Are the quality signals (i.e. roller marks on meat and/or labelling information) in place to facilitate informed decision

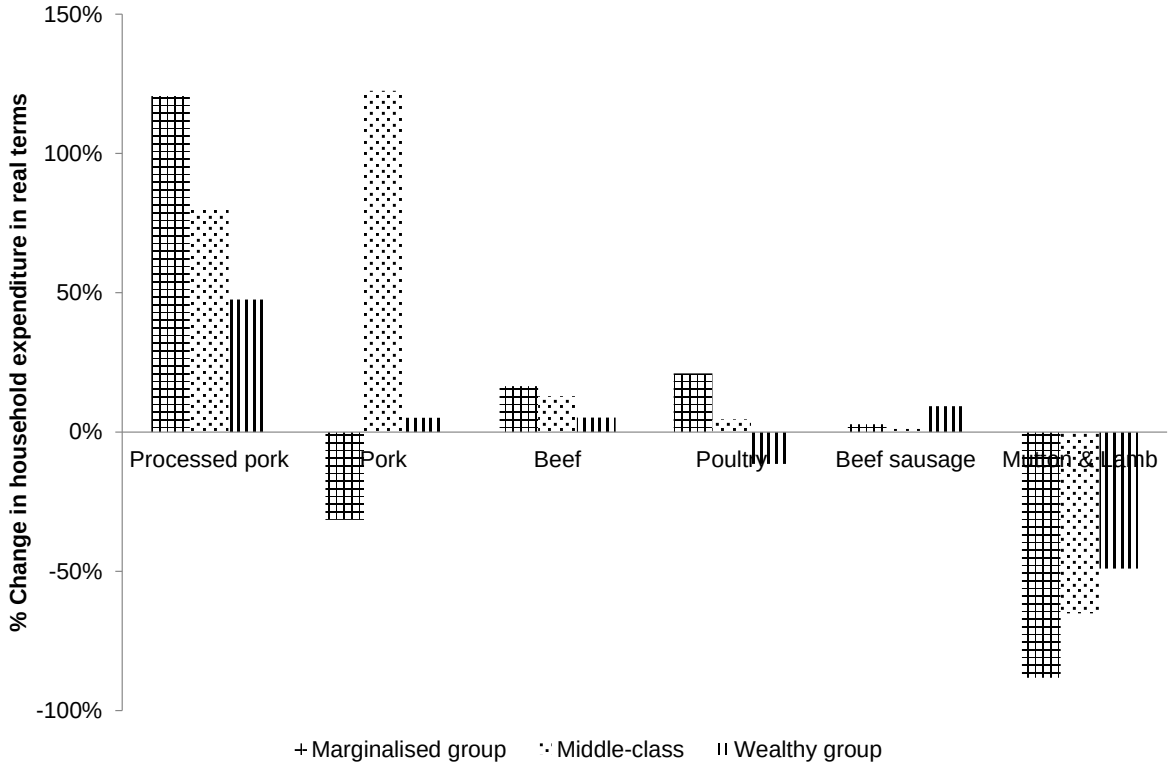

Figure 4 Real changes in the expenditure of households on main meat types by socio-economic sub-groups in South Africa 2005 and 2010.
(Source: BFAP 2014 based on data from Statistics South Africa Income and Expenditure Surveys 2005/06 and 2010/11).

Table 2 Examples of quality cues and attributes applicable to meat
(Source: Adopted from Oude Ophuis & Van Trijp, 1995)

QUALITY CUES:	QUALITY ATTRIBUTES:
Intrinsic quality cues: (Part of physical product) • Cues related to meat appearance • Shape of meat (meat cut) • ***Amount and proportion of visible meat, fat and bone*** • ***Type of meat (e.g. beef of lamb)*** • ***Meat colour*** • ***Fat colour*** • Size of meat cuts	**Experience quality attributes:** (Can only be evaluated with certainty after consumption) • ***Taste*** • Freshness • ***Fattiness of meat in terms of non-visible fat*** • ***Tenderness*** • ***Juiciness*** • Convenience • Safety • ***Texture of meat***
Extrinsic quality cues: (Related to product but not physically part of it) • Price • Brand name • Manufacturer name • Information on meat label related to aspects such as: o Warrantee o Certification marks o ***Carcass classification*** o Quality guarantee statement o Nutritional value of the meat product o The origin of the meat o Animal breed o Production practices e.g. animal friendly production, environmentally friendly production, organic production, free range production, animal feeding practices. • Purchase location • Packaging type / format	**Credence (intangible) quality attributes:** (Cannot be evaluated with certainty by the consumer even after consumption) • ***Age of animal at time of slaughter*** • ***Healthiness of meat*** • ***Nutritional value of meat*** • Safety • Naturalness • Wholesomeness • Traceability • Animal friendly production practices • Environmentally friendly production practices • Organic production practices • Free range production practices • ***Animal feeding practices*** • Hormones / antibiotics used during production of animals • Food miles associated with meat product

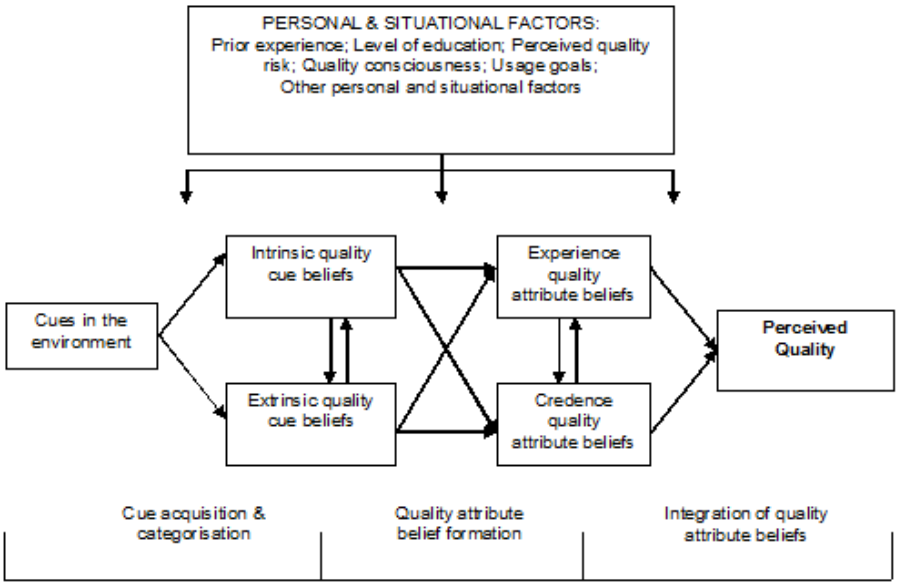

Diagram 1 Conceptual model of the quality perception process (Source: Steenkamp 1989).

making regarding carcass classification? The last research question is of particular relevance in the light of the identity loss created when roller-marked meat is processed into individual cuts where some of these cuts will not display the roller mark.

Due to the lack of relevant scientific data the first objective of the research reported in this paper was to investigate South African red meat consumer knowledge, usage and perceptions regarding beef and sheep meat classification and related quality parameters among low-, middle- and high-income consumers. The paper also reports on an in-store observational research study that was conducted to develop an understanding of the communication of carcass classification to consumers through fresh red meat product labels.

Materials and Methods

The data reported in this paper were part of a comprehensive consumer research project conducted during 2012/2013 on behalf of the South African Red Meat Industry. The overall project objective was to investigate South African consumer behaviour towards and perceptions to red meat. Consumers were divided into three socio-economic groups: the marginalised class (low-income consumers) (LSM® 1–4), the middle-class (middle-income consumers) (LSM® 5–8) and the wealthy group (high-income consumers) (LSM® 9–10) residing in the Gauteng Province of South Africa. The specific focus of the study was current meat purchasing and consumption behaviour, behavioural motivations and perceptions of red meat, and current and most trusted information sources relating to red meat. The survey questionnaire drew on previous questionnaires that were used to compare data (Meat Board's Quantitative Survey, 1996; Protein survey, 1996; Quantitative survey, 1997; South African Pork Producers Organisation (SAPPO), 2000). The questionnaire was also tested in a pilot study in Limpopo to validate it (De Cock *et al.*, 2013). A wide range of question types were used including dichotomous questions, multiple choice questions, Likert scale/level of agreement, rating scale questions and open-ended questions.

The survey targeted adult consumers from both gender groups responsible for food purchasing and preparation in their households residing in the Gauteng Province of South Africa. Gauteng is the smallest province in South Africa, but generates 34% of South Africa's Gross Domestic Product (GDP). A fifth of the South African population (11.3 million people) resides in Gauteng. It is the wealthiest and most densely populated province (City of Johannesburg, 2013). Quota sampling was applied with the sampling plan which had been designed by the research team to reflect the characteristics of the South African population in terms of LSM® segment, age category and ethnic groups (n = 165, n = 171 and n = 249 for the low-income group, middle-class group and wealthy consumer group, respectively). No formal female/male split was included in the sampling, but it was expected that the sample would be dominated by female consumers given their traditional dominance in household food purchasing. Table 3 presents a summary of the planned and actual characteristics of the sample in terms of LSM® segment, age category, ethnicity and gender group.

This study was approved by the ethics committee of the University of Pretoria (Ethical Clearance certificate: EC 11118/072). Participants were ensured of confidentiality and encouraged to provide accurate answers.

Data gathering was done during 2012 and 2013. A typical consumer interview lasted between 90 minutes and two hours. Panel recruitment was done through a professional consumer panel recruitment agency ('Consumers in Focus'), to ensure the validity of the sampling process. Sampling of consumers was done randomly in Johannesburg and surrounding areas. Door-to-door recruitment was done where consumers were first screened for shopping role and demographics profile. A screening questionnaire was used to verify the LSM® segment of the household and other screening criteria. Once qualified, potential consumers were invited to participate by means of one-on-one interviews, at convenient times at their homes. Participants were incentivised. A random sample was back-checked by 'Consumers In Focus' personnel after questionnaires were returned to gauge recruiting accuracy and monitor interview protocol adherence. The meat scandal relating to the presence of foreign meat species in local meat products broke in the media while field work was being performed for the middle-class group. This was taken into consideration when evaluating responses.

Data capturing and cleaning was done in Microsoft Office Excel 2007, after which a wide range of descriptive, comparative analyses (ANOVA (Analysis of Variance) and Chi-square analyses) and multivariate techniques were applied to analyse the data with SPSS (Statistical Package for the Social Sciences) version 21.0.

In addition to the consumer survey, as mentioned above, this paper also reports on a second survey of a different nature involving in-store observational research of fresh red meat products. The second survey was conducted to develop an understanding of the communication of carcass classification information to

Table 3 Summary of the planned and actual characteristics of the sample in terms of Living Standards Measure (LSM®) segment, age category and ethnicity

Sub-segment:	Variable:	Levels of variable:	Share of sub-segment sample:	Share of population:
Marginalised consumers	LSM® segment	LSM® 2	9.7%	17.5%[1]
		LSM® 3	26.1%	26.7%[1]
		LSM® 4	64.2%	55.7%[1]
	Age category	Younger than 35	57.3%	53.2%[1]
		35 and older	42.1%	46.8%[1]
	Ethnicity	Black	98.8%	77.9%[2]
		Coloured	0.6%	3.5%[2]
		Indian	0.6%	2.9%[2]
		White		15.7%[2]
Middle-class consumers	LSM® segment	LSM® 5	17.0%	28.6%[1]
		LSM® 6	38.6%	37.9%[1]
		LSM® 7	22.8%	19.2%[1]
		LSM® 8	21.6%	14.4%[1]
	Age category	Younger than 35	42.1%	51.2%[1]
		35 and older	57.9%	48.8%[1]
	Ethnicity	Black	75.4%	77.9%[2]
		Coloured	9.4%	3.5%[2]
		Indian	1.8%	2.9%[2]
		White	12.3%	15.7%[2]
Wealthy consumers	LSM® segment	LSM® 9	52.6%	60.9%[1]
		LSM® 10	47.4%	39.1%[1]
	Age category	15–24	34.5%	43.4%[1]
		25–34	65.5%	56.6%[1]
	Ethnicity	Black	27.3%	77.9%[2]
		Coloured	4.4%	3.5%[2]
		Indian	4.4%	2.9%[2]
		White	63.5%	15.7%[2]

[1] Source: SAARF (2013) based on data from SAARF AMPS 2012.
[2] Source: Statistics South Africa (2012b) Census 2011 Municipal Report Gauteng. ***Please note:*** These values are for Gauteng as a whole and not only for the lower income groups within the province, thus explaining the larger dominance of black consumers in the marginalised consumer sub-segment sample and the dominance of white consumers in the wealthy consumer sample.

consumers by means of fresh red meat product labels. These results were also extracted from a larger research project conducted as an in-store observational product survey with a specific focus on fresh red meat (beef and lamb) labelling claims at major national retailers, chain and independent butcheries, 'factory meat outlets', chain delicatessen ('deli') shops and independent deli shops in selected geographic locations across South Africa, to serve as a sub-sample indicative of what is presented to consumers in South Africa. In September and October 2013 the field work team (final year students at the Department of Consumer Sciences at the University of Pretoria) surveyed a sample of 37 butchers, located in a range of geographical locations in South Africa (e.g. greater Pretoria and Johannesburg areas, Barberton, Bronkhorstspruit, Boksburg, Heidelberg, Hermanus, Kimberley and Secunda). These observations were supplemented with product labelling observations made at large national retail chain outlets. All observations were captured on the survey questionnaire and a Microsoft Office Excel 2007 data capturing sheet. Data analysis involved mainly descriptive statistics.

Results and Discussion

In the consumer survey the respondents were asked whether they had knowledge regarding the grading/classification systems of red meat, how often they checked the grading/classification of meat and also to define red meat classification if possible. These questions pertained only to beef and mutton/lamb and not to chicken and pork, as the main focus of the consumer study was on red meat. These results are summarised in Table 4.

The share of respondents within the different sub-samples perceiving that they have knowledge regarding red meat classification differed significantly (Chi-square = 6.536, df = 2, P = 0.038) with a significantly larger share in the wealthier socio-economic sub-group. Perceived knowledge of beef classification among the middle-class group was generally higher for beef than for mutton/lamb, but it should be kept in mind that beef is also more widely consumed than mutton/lamb. However, it should be noted that even among the wealthy segment only about 15% of the particular sample perceived that they have red meat classification knowledge. This underlines the inadequacy of consumer knowledge in this regard even among these consumers who have high general education levels.

Table 4 Consumer knowledge and usage of red meat classification as a percentage of various sub-groups

		Marginalised group (LSM® 1–4) (n = 165)	Middle-class group (LSM® 5–8) (n = 171)	Wealthy group (LSM® 9–10) (n = 249)
Share of sample perceiving that have knowledge regarding red meat classification		4.2% (red meat)	9.9% (beef) 5.8% (mutton/lamb)	14.9% (beef) 12.5% (mutton/lamb)
How often respondents check the classification mark when purchasing red meat	Always	5.4% (red meat)	32.7% (beef) 28.1% (mutton/lamb)	14.1% (beef) 12.6% (mutton/lamb)
	Sometimes	13.6% (red meat)	23.5% (beef) 19.9% (mutton/lamb)	44.0% (beef) 43.9% (mutton/lamb)
	Always or Sometimes	19.0% (red meat)	56.2% (beef) 48.0% (mutton/lamb)	58.1% (beef) 56.5% (mutton/lamb)

LSM®: Living Standards Measure.

Only 19.0% of the low LSM® sample checks the classification mark when buying red meat, increasing significantly towards the middle-class and the wealthy groups to about 50% and more (Chi-square = 43.828, df = 4, P = 0.0) despite the fact that few consumers have knowledge regarding red meat classification. An interesting observation relates to the relatively higher share of middle-class consumers who 'always' checks the classification of red meat (about 30% versus only about 13% for the wealthy segment). It can be argued that the middle-class group possibly purchases food and meat at retail outlets with potentially lower food safety and quality standards, and thus has to rely more heavily on additional quality cues (such as the classification mark) in their meat choices to reduce the risk of buying potentially unsafe food. On the other hand the wealthy segment probably have significant trust in their selected purchase outlets and consequently pay less attention to other quality cues such as the classification of meat because the potential food safety risk associated with the purchase of meat is 'absorbed' by the trusted retail outlets.

The results presented in Table 5 clearly illustrate that very few consumers could explain red meat classification in terms of animal age and fat class, while most responses related it to be a general indication of product quality.

Only about 4% of the marginalised segment associate red meat classification with red meat quality, increasing to 8% of the middle-class group and 11% of the wealthy group. The ranking of 'grading' among the other concepts mentioned by respondents was 5th for the marginalised- and middle-class groups, and 6th for the wealthy segment. For consumers to willingly purchase and consume a particular food type, they must have positive perceptions about the food. In the context of food and particularly meat, it is normally understood that consumer perception of meat relates to its quality in a broad sense. Even though many respondents did not mention red meat classification directly when defining red meat quality, many aspects potentially related to it qualify such as freshness, meat colour, appearance, smell, tenderness, taste and leanness, were mentioned.

When asked to define red meat safety, a larger share of consumers associated red meat classification with red meat safety than with red meat quality. The shares of the various samples associating red meat

Table 5 Consumer understanding of red meat classification (open question responses)

Marginalised group (LSM® 1 - 4)	Middle-class group (LSM® 5 - 8)	Wealthy group (LSM® 9 - 10)
Extremely limited understanding	***Beef classification (16 responses):*** • Indication of quality standard/best quality (60% of responses) • Higher grades more expensive (12%) • Indicated by meat grade stamp (6%)	***Beef classification (25 responses):*** • Indication of quality standard/best quality (45% of responses). • To do with fat on meat (18%) • Different colours for different gradings (11%) • To do with animal age (11%) • Product certification (8%) • There are A and B grades (6%) • First grade is best (5%) • A-AB means animal age and 0–6 means fat classification (3%) • Marbling colour (3%) • Purple stamp is the best meat (3%)
	Mutton/lamb classification (10 responses): • Indication of quality standard/best quality (58% of responses) • Grade A is best quality (24%) • Higher grades more expensive (6%) • Indicated by meat grade stamp (6%) • First grade best (6%)	***Mutton/lamb classification (21 responses):*** • Indication of quality standard/best quality (50% of responses) • There are A and B grades (15%) • Different colours for different gradings (6%) • First grade is best (6%) • To do with fat on meat (6%) • Green or purple stamp mentioned (6%) • To do with animal age (6% • Based on fat and quality (3%) • Product certification (3%) • Higher grades more expensive (3%) • Stamp on meat (3%)

safety with red meat classification were 5% for the marginalised group, 14% for the middle-class group and 19% for the wealthy segment. These results suggest that some consumers associate the classification mark with meat that is safe to eat, which is most probably linked to the 'proper' handling of the meat that is assumed to be associated with classified red meat.

Respondents were asked (in an open-question format) to list their most prominent concerns regarding red meat in general without distinguishing between different grades and cuts. A summary of results is presented in Table 6. The marginalised group focussed mostly on health (45%) followed by affordability (40%) concerns. Interestingly, both the middle-class group and the wealthy consumers focussed mainly on affordability, followed by fattiness and health concerns for both beef and mutton/lamb. Health conscious consumers associate diet with the probability of non-communicable diseases resulting in a shift away from high-fat diets.

Tenderness was a more prominent concern among wealthy beef consumers compared to middle-class beef consumers, and it was not a concern mentioned for mutton/lamb among middle-class and wealthy consumers. It is interesting to observe consumer concerns about fatty meat (middle-class and wealthy groups) and a lack of beef tenderness (wealthy segment) could potentially be improved if they had better knowledge of the red meat classification system which would empower such consumers to make more informed product decisions. From a red meat classification perspective, even though the respondents did not mention red meat classification as a concern, many aspects potentially related to it were identified such as general quality concerns, fatty (also fattiness linked to health concerns), tenderness, meat colour, taste, freshness and smell.

Respondents were asked to define red meat quality in an open-question format. These responses were analysed to determine whether consumers linked the concept of red meat quality with red meat classification (Table 7). Across sub-segments meat colour was an important tangible cue for red meat quality, as well as 'freshness' which seems to be gauged through general product appearance and aspects such as sell-by date. Banovic *et al*. (2012) confirmed the importance of meat colour as a cue to evaluate beef

Table 6 Dominant consumer concerns regarding red meat (open-question responses)* as a percentage of sub-groups

Marginalised group (LSM® 1 - 4)	Middle-class group (LSM® 5 - 8)		Wealthy group (LSM® 9 - 10)	
	Beef concerns	Mutton/lamb concerns	Beef concerns	Mutton/lamb concerns
• Health concerns (45.4%) • (e.g. fatty, cholesterol, blood pressure, heart problems, diabetes, allergies, gout) • Affordability (40.2%) • Long cooking time (2.1%) • Availability (1.0%) • General quality concerns (1.0%) • 'Mixed with strange meat' (1.0%) • Perishable (1.0%)	• Affordability (17.5%) • Fatty (5.8%) • Health concerns (7.0%) • Long cooking time (4.7%) • Dark colour (2.3%) • Not tender (1.8%) • Perishability (1.8%)	• Affordability (24.0%) • Fatty (11.7%) • Health concerns (4.0%) • Dark colour (1.2%) • Long cooking time (0.6%) • Not tender (0.6%)	• Affordability (35.7%) • Fatty (28.5%) • Not tender (13.7%) • Quality concerns (9.6%) • Freshness (7.6%) • Long cooking time (5.2%) • Health concerns (2.4%)	• Affordability (55.2%) • Fatty (37.1%) • Bad taste (6.0%) • Quality concerns (5.6%) • Colour (5.2%) • Health concerns (4.0%)

**NOTE: the aspects mentioned by the respondents with links to red meat classification are highlighted in grey.*
LSM®: Living Standards Measure.

quality. Interestingly, wealthy consumers also associated quality red meat with lean meat. Appearance determines how consumers perceive quality and significantly influences purchasing behaviour. The amount of visible fat is a strong visual cue for consumers. Fat is perceived as negative, as are all aspects associated with fat. Brewer *et al.* (2001) found that highly marbled chops appeared lighter coloured, less lean, had a less acceptable appearance and were less likely to be purchased. Carpenter *et al.* (2001) showed that consumer preference for beef colour was sufficient to influence their likelihood to purchase, but was not enough to bias eating satisfaction at home. Nevertheless, the presentation of fresh red meats with appropriate colour at retail level is of the utmost importance as consumers will discriminate negatively against meat that does not appear to match their expectations.

Flavour, juiciness and succulence together with tenderness are important factors in meat palatability. Marginalised- and middle-class consumers did not mention tenderness as associated with red meat quality, while only 10.8% of the wealthy segment did make this association. This was not expected as it was anticipated that the association between red meat quality and tenderness would be much stronger.

Table 7 Dominant consumer associations with red meat quality (defining red meat quality in an open-question format)* as a percentage of sub-groups

Marginalised group (LSM® 1–4) (n = 165)	Middle-class group (LSM® 5–8) (n = 171)	Wealthy group (LSM® 9–10) (n = 249)
• Freshness (40.0%) • Meat colour red (21.2%) • Clean meat (12.1%) • Appearance (4.8%) • Grading (4.2%) • Price (3.0%) • Nutritional value (1.8%) • Shelf life (1.8%) • Smell (1.8%) • Tenderness, taste (1.8%)	• Meat colour (25.1%) • Freshness (21.1%) • Appearance (19.3%) • Clean meat (11.1%) • Grading (8.2%) • Smell (8.2%)	• Colour red/pink/uniform (40.2%) • Freshness (27.3%) • Leanness (16.1%) • Smell is good (14.1%) • Clean (10.8%) • Grading (10.8%) • Tenderness (10.8%) • Appearance (9.2%) • Good cut (7.2%) • Taste (6.0%)

**NOTE: the aspects mentioned by the respondents with links to red meat classification are highlighted in grey.*
LSM®: Living Standards Measure.

Consumer purchase considerations for raw beef and raw mutton/lamb were also investigated. Tables 8 and 9 present the ranking of consumer purchase consideration attributes for beef and mutton/lamb comparing the three socio-economic sub-segments.

The dominant purchase considerations for both beef and mutton/lamb focussed largely on safety, appearance, price and eating quality. Price was significantly more important among the poor- and middle-class groups for both beef and mutton/lamb, while expiry date was significantly more important among the middle-class and wealthy groups. Similarly, Du Plessis & Du Rand (2012) found that when purchasing lamb, South African consumers predominantly considered price, followed by food safety and quality. In a rural South African setting Vimiso *et al*. (2012) also confirmed consumer reliance on price and visual cues to develop quality perceptions of meat. It could be argued that the type of red meat purchased by poor consumers may not even have an expiry date on the packaging or that they lack understanding of the concept of sell-by dates. Food safety and clean meat (without blood) were important to all sub-segments.

The attribute 'Grading stamp' (indicative of red meat classification) was not among the top 20 considerations for consumers even though many aspects potentially related to red meat classification appeared in the top 20 such as appearance, quality, tenderness and fat-related attributes.

To compare consumer preferences with the actual information on classification presented to South African consumers on red meat product labels, this section presents an overview of the results from in-store observational research at retail outlets (independent butchers and national chain retailers) selling fresh red meat. The fresh red meat labelling claims observed at independent butchers are shown in Table 10. Product pricing information (price per kilogram and price per packet), store branding and meat cut information appeared on labels at all the sampled independent butchers, while 92% of these butchers indicated the packaging date on labels. The next cluster of labelling information aspects appeared on the fresh red meat labels of 22% to 43% of the sampled butchers and included the following: Distinguishing between mutton and lamb, a unique product brand, sell-by date, flavour added to meat (e.g. marinade, spices), home storage

Table 8 The top 20 considerations (in order of importance) for the various socio-economic sub-groups when purchasing raw beef (marginalised group) and beef steak (middle-class and wealthy groups)*

Marginalised group (LSM® 1–4) (n = 165)	**Middle-class group (LSM® 5–8) (n = 171)**	**Wealthy group (LSM® 9–10) (n = 249)**
Price	Expiry date	Food safety
Appearance	Price	Expiry date
Cleanliness	Meat colour	Quality guarantee
Meat colour	Appearance	Taste
Quality guarantee	Clean meat	Appearance
Convenience	Food safety	Meat colour
Tenderness	Taste	Clean meat
Expiry date	Quality guarantee	Flavour
Bone-to-meat-ratio	Easy to prepare	Visual appeal
Eaten by all	Flavour	Price
Easy to prepare	Tenderness	Tenderness
Fat-to-meat-ratio	Eaten by all in family	Eaten by all in family
Packaging size	Fat-to-meat-ratio	Store where you buy
Fat colour	Freshness	Keepability
Preparation time	Store where you buy meat	Nutritional value
Freshness	Visual appeal	Succulence
Taste	Brand/Product reputation	Fat-to-meat-ratio
Juiciness	Packaging size	Household preferences
Packaging type	Preparation time	Fresh (not frozen) meat
Flavour	Convenience	Brand/product reputation

**NOTE: the aspects mentioned by the respondents with potential links to red meat classification are highlighted in grey.*
LSM®: Living Standards Measure.

instructions, 'Tender' and 'Quality'/'Quality guaranteed'. Other labelling information mentioned in Table 8 as applicable to less than 20% of the sampled butchers, included aspects such as country of origin, expiry date, cooking recommendations, additives added to meat (e.g. MSG, salt, SO_2), 'Lean'/'Extra lean', cooking instructions, recipe, 'Tasty', 'Aged'/'Matured', cooking time, region of origin, 'Fresh', claims indicating specials or value-for-money, red meat classification (animal age and fat class), fat-to-meat ratio, 'Juicy', 'Grain-fed' and allergens listed on label. Thus, the bulk of fresh red meat sold at the observed butchers was more 'generic' with mainly the price and meat cut (and packaging date in many cases) indicated on the product packaging.

Even though the labelling of fresh red meat at some of the national retailers is more sophisticated than at most butchers, a large share of the fresh red meat sold at national retailers is 'generic' with only the store brand, price, meat cut and sell-by date indicated on the product packaging. Labelling information with additional but limited application among the national retail outlets included the following: Claims indicating specials or value-for-money, unique product brand, classification information related to animal age ('A-grade') other date information (e.g. use-by date), 'Lean'/'Extra lean', 'Low fat', 'Tender', 'Tasty', 'Juicy', storage instructions at home, cooking suggestions, serving suggestions, 'Aged'/'Matured', 'Deboned' and flavour added (e.g. marinade, spices).

It is evident that observations related to fresh red meat classification were insignificant (applicable to fewer than 5% of butchers). Selected brands offered by large retailers indicated more advanced labelling information (such as free range, region of origin, feeding practices, animal welfare), but extremely limited labelling information regarding red meat classification was observed with only limited observations of terms such as 'A-grade' indicated on some more up-market red meat cuts. Further investigation is needed to determine whether the limited application of labelling claims is related to a lack of product innovation in the

Table 9 The top 20 considerations (in order of importance) for different socio-economic sub-groups when purchasing raw mutton/lamb (marginalised group) and mutton/lamb chops (middle-class- and wealthy groups)*

Marginalised group (LSM® 1–4) (n = 165)	**Middle-class group (LSM® 5–8) (n = 171)**	**Wealthy group (LSM® 9–10) (n = 249)**
Price	Price	Food safety
Meat colour	Appearance	Expiry date
Appearance	Expiry date	Taste
Easy to prepare	Taste	Meat colour
Clean meat (e.g. no blood)	Food safety	Appearance
Tenderness	Flavour	Flavour
Amount of meat per package	Meat colour	Price
Quality guarantee	Clean meat	Clean meat
Bone-to-meat ratio	Quality guarantee	Visual appeal
Expiry date	Juiciness	Tenderness
Convenience	Store where you buy meat	Quality guarantee
Fat colour	Easy to prepare	Eaten by all in family
Fat-to-meat-ratio	Tenderness	Amount of fat
Packaging size	Eaten by all in family	Keepability
Fresh (not frozen)	Amount of fat	Juiciness
Eaten by all in family	Freshness	Nutritional value
Juiciness	Lean/low fat meat	Store where you buy meat
Taste	Brand Product Reputation	Natural
Preparation time	Packaging size	Freshness
Packaging	Convenience	Personal preferences

**NOTE: the aspects mentioned by the respondents with potential links to red meat classification are highlighted in grey.*
LSM®: Living Standards Measure.

industry or whether retailers do not wish to make statements on their product labels which may be viewed as contentious of the recently updated Food Labelling Regulations (R429, of 29 May 2014).

Table 10 Summary of fresh red meat labelling claims observed at independent butchers

Claim:	Claim category:	Share of butchers (n = 37):
Price per kg; Price per package	Product pricing	100%
Store brand	Branding	100%
Meat cut	Cut	100%
Packaging date	Date information	92%
Distinguishing between mutton and lamb	Classification (only applicable to mutton/lamb)	43%
Unique product brand	Branding	32%
Sell-by date	Date information	32%
Home storage instructions	Post-purchase handling	24%
'Tender'	Palatability claims	22%
'Quality'/Quality guaranteed	Quality	22%
Flavour added (e.g. marinade, spices)	Palatability claims	30%
Country of origin	Origin	16%
Expiry date	Date information	14%
Cooking recommendations	Post-purchase handling instructions	14%
Additives such as MSG, salt, SO_2 listed on packaging	Additives	14%
Lean (mince)	Fat related claims	11%
Cooking instructions/recipe	Post-purchase handling	11%
'Tasty'	Palatability claims	8%
Aged/matured	Post-slaughter handling	8%
Cooking time	Post-purchase handling	≤5%
Region of origin	Origin	≤5%
'Fresh'	Palatability claims	≤5%
Claims indicating specials or value-for-money	Affordability	≤5%
Classification (animal age and fat class)	Classification	≤5%
Fat-to-meat ratio	Fat related claims	≤5%
'Juicy'	Palatability claims	≤5%
Grain-fed beef	Production practices	≤5%
Allergens listed on label	Allergens	≤5%

Conclusions and Recommendations

The poor consumer segment had very limited understanding and gave little attention to red meat classification. Although middle-class and wealthy consumers also had a limited understanding of red meat classification, about half of the sampled consumers checked the red meat classification sometimes or often when buying beef or mutton/lamb.

Among red meat problems or concerns perceived by consumers, red meat classification was not prominent. However, many aspects potentially related to classification were of concern such as general quality concerns, fattiness (also fattiness linked to health concerns), tenderness, meat colour, taste, freshness and smell.

Many respondents did not mention red meat classification when defining red meat quality and safety, but many aspects potentially related to classification were mentioned such as freshness, meat colour, appearance, smell, tenderness, taste and leanness. There was little association between red meat grading

and red meat quality and safety. Only 5% of the low LSM® sample associated grading with red meat quality and safety. Among the middle-class and wealthy consumers up to 11% of consumers associated red meat classification with quality and up to 19% of consumers associated it with safety. These associations were stronger among the higher LSM® consumers. Thus, the results indicated a slightly stronger association between red meat grading and safety compared to quality.

Among an extensive range of red meat decision factors, red meat classification was not among the top 20 most important factors. Once again, many aspects potentially related to red meat classification were important such as appearance, taste, flavour, quality guarantee, meat colour, fat content, juiciness and tenderness. It is interesting to note that the place of purchase is a stronger quality cue to consumers than the classification marks on the meat. This is an important observation and could be further investigated in future.

There is a definite need for comprehensive consumer education about the red meat classification system and its implications in terms of product characteristics and quality. The pork industry in the United States of America (USA) has portrayed pork as a light and nutritious alternative to chicken with the 'Pork: the other white meat' advertising campaign launched in 1997 which focussed on leaner cuts with a lower fat content. Research indicates that consumers are now less likely to perceive pork negatively in terms of fat (Resurreccion, 2003). Enhanced knowledge could assist consumers to make more informed decisions and to utilise the red meat carcass classification system as a useful tool. However, given the potential loss of product identity which occurs at the point in the supply chain where carcasses are processed into individual meat cuts, it is critical that fresh red meat product labels should have trustworthy and clear indications of the class of the meat being sold. This research illustrated that the current application of classification information displayed on fresh red meat labels is extremely limited. There is a definite need for the development and consumer testing of an appropriate front-of-pack labelling system to communicate red meat classification to consumer by means of product labels.

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