An analysis of the food baskets and their implications for household food security, uMsunduzi Local Municipality

By

Nomfundo Shelembe

Submitted in fulfillment of the requirements for

Master of Agriculture (Food Security)

School of Agricultural, Earth and Environmental Sciences

College of Agriculture, Engineering, and Science

University of KwaZulu-Natal

Pietermaritzburg

2018

ABSTRACT

In South Africa, most, poor households rely on food purchases than production, the regularity of quality food intake relates directly to cost and access. The compromised access to food status exposes most households to a shortage of essential vitamins and minerals in the human body that define hidden hunger. Hidden hunger is a silent killer with a potential to afflict irreversible health effects as well as socioeconomic consequences that can hinder an individual's development and welfare. Iron, iodine, vitamin A, and zinc deficiencies are the most widespread hidden hunger outcomes that are common contributors to poor growth, intellectual impairments, perinatal complications and increased risk of morbidity and mortality. In 2003, the food fortification program was introduced in South Africa to assist in alleviating the micronutrient deficiency problem. This study assessed the composition of household food baskets and the implications on food security, with special focus on how food fortification affects a household's diet in the uMsunduzi Local Municipality, KwaZulu-Natal Province of South Africa. A random sample of 200 households was selected for data collection from an urban and peri-urban residential area. A structured questionnaire administered through face-to-face interviews collected data.

Descriptive statistics presented the relationship between household-level characteristics, on one hand, and food fortification awareness and food security, on the other. Demographic results showed that there were 26 percent of unemployed and 37 percent of pension holding household heads where 60 percent have a secondary level of education. It was also observed that households who were unaware and those aware of food fortification had a significant association in food purchasing patterns, household monthly income, household food expenditure, media recognition, garden ownership as well as price, brand, and considerations of child preference when purchasing food. Binomial regression models estimated predictors of food fortification awareness and of household fortified food purchasing. Results showed that age of head of household, employment status, price consideration, food fortification logo identification and household size had a significant effect on household fortified food purchasing. On the other hand, age, employment status, household medical issues, the frequency of shopping, food basket decision-maker and household monthly income significantly affected awareness of food fortification. Price was found to be a leading influencing factor of purchasing decision-making as opposed to nutrition value. However, the modern consumer purchasing decision-making processing is slowly changing as they are beginning to care and are curious about the nutritional value of their foods and contribution it

makes to their health and active life. The findings identify some factors that can be used for positively influencing food fortification awareness and household fortified food purchasing. Results also showed that after 14 years of the introduction of food fortification in South Africa, 73% households remain unaware of food fortification and on average consumed less than the recommended daily caloric requirements. Results in the study suggested that although households may be unaware of food fortification, food products chosen to improve the crisis (fortification program) are reaching the consumers and are being purchased, as they are accessible and affordable. The analysis of household food baskets showed that prices of food items influence a large number of consumers and this dictates what is purchased for the household. Households with a low income are more likely to focus on quantity than quality foods meaning that the importance of nutrition lacks behind. Households who are unaware of food fortification tend to make poor food choices and need to be more exposed to nutrition education. The limited awareness of food fortification suggested that it may be an underlying indirect cause of hidden hunger. It was recommended that the ultimate objective of the staple food fortification program is to assist the South African population to receive the necessary quantities of the micronutrients needs via the purchasing and consumption of the chosen food items, this can be achieved through further programs that assure the awareness of the population. It was also recommended that intervention programs be implemented to empower nutrition education and that they target all types of consumers and specific areas that are similar to Sweetwaters and Edendale.

Schools, health facilities, and media must be given a greater platform for the output distribution and maintenance of nutritional education with special focus on the benefits of food fortification as it was clear, in the study that such information has not yet transcended ages, educational levels and employment statuses. The cost-effective and efficient way of ensuring that households have access to micronutrients rich diets is the promotion of household gardens, agricultural-based interventions such as biofortification and planting of indigenous plants/crops as they are usually rich in vitamin A, Zinc, Iron and other valuable minerals.

Keywords: Food fortification, food baskets, micronutrient deficiency, nutrition education

DECLARATION

I, Nomfundo Shelembe declare that:

1. The research reported in this dissertation, except where otherwise indicated, is my original research.

2. This dissertation has not been submitted for any degree or examination at any other university.

3. This dissertation does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons.

4. This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

   a. Their words have been re-written, but the general information attributed to them has been referenced.

   b. Where their exact words have been used, then their writing has been placed in italics and inside quotation marks and referenced.

5. This dissertation does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the dissertation and in the References sections.

Signed: …… Date.....
Nomfundo Shelembe

As the research supervisor, I agree to submission of this dissertation for examination.

Signed:……Date……

Dr. M Mudhara

As the research co-Supervisor, I agree to submission of this dissertation for examination.

Signed:……Date……

Prof. U Kolanisi

DEDICATION

For Thandiwe Melcy Shelembe

My mother

ACKNOWLEDGEMENTS

A powerful verse from Psalm 37 reads “The Lord makes firm the steps of the one who delights in him; though he may stumble, he will not fall for the Lord upholds him with his hand”, these words ring true to me as I thank the Lord above all else for always carrying me in His warm hands throughout this amazing process.

My deepest appreciation goes to my supervisor Dr. Maxwell Mudhara and co-supervisor Professor Unathi Kolanisi, who, without their guidance throughout this process and unwavering support would not have resulted in the completion of this paper. Your doors were always open to me, at all times when you were available, and your patience towards me will always be remembered. It was an honour to work with such great minds.

My mother, Thandiwe Melcy Shelembe who has defined all the love and care a parent could ever possibly show to a child is the shining beam of light in me. She has carried me through this process and every chapter is wrapped with her belief in me, a thousand times I thank you, mother.

I acknowledge the National Research Foundation for their generous financial assistance towards this research. The funding allowed ease in the completion of the study and contributed towards several educational expenses, this research would have been difficult without their help. I am forever grateful to all those mentioned above.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CARE	Cooperative for Assistance and Relief Everywhere
CSI	Coping Strategy Index
DOA	Department of Agriculture
DOH	Department of Health
FAO	Food and Agriculture Organization
GAIN	Global Alliance for Improved Nutrition
HFIAS	Household Food Insecurity Access Scale
HIV	Human Immunodeficiency Virus
IES	Income and Expenditure Survey
IFSS	Integrated Food Security Strategy
IPSOS	*Institut de Publique Sondage d'Opinion Secteur*
MRC	Medical Research Council
NAMC	National Agricultural Marketing Council
PACSA	Pietermaritzburg Agency for Community Social Action
SANHANES	South African National Health and Nutrition Examination Survey
STATS SA	Statistics South Africa
TANGO	Technical Assistance for NGOs
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Background

According to the World Health Organization (WHO) (2017), household food and nutrition security is a basic human right. Although this is true, approximately 14 million South Africans are vulnerable to food insecurity. South Africa produces sufficient food to feed the nation, but household food insecurity is still a great concern for several households. Several factors contribute to household food insecurity namely poverty, increased household members, gender, poor health and illiteracy (Abdu-Raheem and Worth, 2011). The Food and Agriculture Organization (FAO) (2009) upholds that the nutritional status of each member of the household depends on several conditions being met, i.e., the food available to the household must be shared according to individual needs; the food must be of sufficient variety, quality, safety and each family member must have good health status to benefit from the food consumed. In South Africa, women, children and the elderly are the most prone to food insecurity.

According to Steyn *et al.* (2007), women and children from resource-poor households suffer from at least one micronutrient deficiency. Hidden hunger, also known as micronutrient deficiencies, is a form of undernutrition that occurs when intake and absorptions of vitamins and minerals such as zinc, iodine, and iron are too little to withstand good health and development. Deficiencies in micronutrients such as vitamin A, iodine and iron are widespread and have negative consequences for children and adult growth as well as development and this is the highest in provinces with large rural populations (Steyn *et al.*, 2007). These vitamin and mineral deficiencies impose a considerable disease burden on the affected persons and on the societies in which they live. Adverse functional outcomes include stunting, increased susceptibility to infectious disease, physical impairments, cognitive losses, blindness and premature mortality. Factors that contribute to micronutrient deficiencies include poor diet, increased micronutrient needs during specific life stages such as pregnancy, lactation and health problems such as diseases, infections, and parasites.

Undernutrition leads to bearing the cost of illnesses due to physical and mental impairments, which are caused by micronutrient deficiencies. Individuals may live in food secure households but still consume poor diets due to their food intake, which contributes to malnutrition and disease. Improvements in the availability of food and a household's access

to food will not necessarily translate into improved nutrition for all household members (D'Haese *et al.,* 2013). In some households, the most vulnerable are individuals who often lack the power to make decisions on how to utilize household and who may lack information on food and nutrition education (Labadarios *et al.,* 2011). Prices of wheat and maize, which form the majority of most households' staple diet have risen which leave household members facing difficulties in purchasing food items from their income. Dietary variety was found to be low in rural areas, where nearly 40 percent of South Africans only have one to three different food groups on a daily routine (Altman *et al.,* 2009). In most rural areas, household's fruit and vegetables are the least consumed foods despite their importance (Altman *et al.,* 2009). Affording a nutritional household food basket is the foundation of decreasing micronutrient deficiencies.

High levels of poverty, unemployment and seasonal variability of income mean that many households in South Africa find themselves permanently or temporarily unable to meet their daily food requirements. The rising cost of food prices affects food baskets negatively(Jacobs, 2009) since lower inflation implies only a lower rate of increase in price, consumers with a lower income still find it difficult to budget for all food needs of the household (Brinkman *et al.,* 2010). Income, social class, gender, and age can be factors that determine or limit the food basket. Labadarios *et al.* (2011) state that income has a strong influence on both what consumers purchase and where they shop, the lower the economic status of consumers leads to food price being a higher drive when purchasing food.

Food choices and preferences can also be influenced by the problem of food becoming rotten for example fruit and vegetables, as well as the ability to store food. Fruit and vegetable consumption may be low in South African households due to high-energy density foods sold at cheaper prices. This decreases the motivation of purchasing fruits and vegetables that contain good nutrients than high-energy dense foods that lack needed nutrients. Food is not the initial cost, which households pay for because the amount spent on food is one of the few costs which households are able to control. As economic pressure is constantly rising on households, certain foods are becoming unaffordable and households substitute these foods for cheaper products. According to the Pietermaritzburg Agency for Communication Social Action (PACSA) (2014), these cheaper products have now become unaffordable for low-income consumers leaving household members food insecure. The Department of Health, therefore, recognized the problem of household food insecurity and hidden hunger, which

gave rise to the food fortification program as a resolution. Food fortification refers to the practice of deliberately increasing the content of an essential micronutrient irrespective of whether nutrients were originally in the food before processing or not, to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to health (FAO, 2006:2). Foods that are mainly fortified in South Africa are staple products that are mostly made from maize and wheat. Although the food fortification program was implemented in 2003 nationally in South Africa, hidden hunger and household food insecurity is still prevalent. Therefore, efforts to analyze the implications of different food baskets, the awareness of food fortification on levels of household food security can shed some light on the matter and recommendations can be made.

1.2 Importance of the study

The study identified the key drivers behind consumer behaviour reflected through the different purchasing patterns of their food baskets. The study shed light on the awareness of consumers on fortified food products and if their purchasing patterns had any significance in their household food security. The study showed that although food fortification has been in place since 2003, most consumers who purchase the chosen food vehicles were not aware of the benefits it encompasses. The study also highlights that several households purchase unfortified wheat flour which is used to make steamed bread which lacks proper nutrients, therefore, proper fortification methods for wheat flour were suggested. The study will benefit the public by placing emphasis on the importance of media communication of food fortification for households to better their nutrition education, their diet as well as the food items purchased in a household food basket.

1.3 Problem statement

All individuals require a variety of food to meet their recommended daily food intake. According to the United Nations Children's Fund (UNICEF) (2010), individuals are only food secure when food is available, accessible and utilized. Food must not only be in the market, but individuals must be able to acquire it, and the food should bear nutritional benefits. For a sustainable, energetic and nutritious life, individuals need sufficient food as well as the right balance of micronutrients. Financial constraints amongst other factors drive consumers to purchase food baskets with less than the recommended nutritional value (Jacobs, 2009). This causes household food baskets to lack essential nutrients through the purchasing of cheaper substitute products, which have a shortage of the required

micronutrients. Consuming less than the required nutrients leads to the triple burden of malnutrition (Marshall *et al.*, 2001).

Programs to reduce household food insecurity including the food fortification program started in 2003 and the Integrated Food Security Strategy (IFSS) in 2002 have been implemented. However, food inadequacy in South African households has only slightly decreased from 23.9 percent in 2010 to 22.5 percent in 2014. Statistics South Africa (STATS SA) (2014), reported that in the KwaZulu-Natal province, 20.5 percent of households face inadequate food access and 5.9 percent of those households are face severely inadequate food access. Fortified foods have been introduced to the various food retail stores, however, there is limited knowledge of whether consumers are aware of these food items if they are purchasing them as part of their food basket and whether these items are improving their daily diet.

1.4 General Objective

To demonstrate how compositions of different food baskets affect the food security of households in the uMsunduzi Local Municipality.

1.4.1 Specific Objectives

- To determine the composition of food baskets consumed at the household level in the uMsunduzi local municipality.
- To assess the awareness of fortified foods across different wealth groups in the uMsunduzi local municipality.
- To determine factors underlying preferences and choices of different food basket types in the uMsunduzi local municipality.

1.4.2 Research Questions

- Are households in the uMsunduzi local municipality area consuming the necessary daily calorie requirements?
- What changes have taken place in household diets since the introduction of food fortification?
- Do demographic profiles play a role in whether a household is aware of food fortification?

1.5 Definition of terms

Food Security: Food security is defined as achieved when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle at the individual, household, national, regional and global levels (FAO, 2006:2).

Food fortification: Food fortification is whereby micronutrients which include vitamin A, iron and folic acids are added on to foods to improve foods original nutritional component. It has been passed as a legal and safe way of positively influencing the public's health for several years (Department of Health, 2007). Foods that are mainly fortified in South Africa are staple products that are mostly made from maize and wheat.

Micronutrient Deficiencies: Micronutrient deficiencies are defined as a lack of essential vitamins and minerals required in small amounts by the body for proper growth and development (Steyn *et al*., 2007).

Food Baskets: For the purposes of this study, household food baskets are differentiated in two ways, namely basic food baskets and nutritiously balanced food baskets. A basic food basket is a set of goods and services essential for an individual or a household to meet their basic needs from their income whilst a nutritiously balanced food basket consists of goods essential for an individual or household to meet their nutritional requirements to have a healthy life, physically and mentally (Williams, 2010).

1.6 Study Limitations

The findings in the study may not be universally applicable. Food fortification awareness, food access scores, and food baskets may vary between countries and communities due to different demographics. This study focused mainly on household food baskets and demographics to assess food fortification awareness as well as how food access scores affect household diet diversity.

1.7 Organization of dissertation

The current chapter outlines the background to the study, statement of the research problem, importance of the study, general and specific objectives of the study, definition of key terms

and study limitations. Chapter 2 presents a review of relevant and related literature. It reviews the concept of food security/ insecurity, household food basket in terms of drivers of different types of food baskets purchased as well as consumer purchasing patterns in high and low-income households, status of micronutrient deficiencies in South Africa, food fortification in South Africa, its progress and awareness amongst consumers as well as media relations. Chapter 3 outlines the study methodology. Chapter 4 and 5 represents the results and discussion. Chapter 6 presents the conclusions and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter looks at the food security concept and household food baskets, and how they differ between high and low income consumers. It also discusses the different socio-demographic factors that drive choices of household food baskets. Micronutrient deficiencies and the food fortification relationship is explored as well as food fortification progress in South Africa.

2.2 Food security concept

2.2.1 Food security background

The Food and Agricultural Organization (1996), defined food security as achieved when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle at the individual, household, national, regional and global levels. This definition was later revised in 2002 to state that food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2002). The social aspect was added to the definition in 2002 due to the rising hunger and poverty cases throughout the world at the time.

According to Vermeuleun *et al.* (2015), interest in food security came after the sharp increase in food prices in 2008 along with the worldwide food disturbances that occurred. In South Africa, food security received higher interest after 1994 due to the number of historically disadvantaged people who were exposed to hunger (Department of Agriculture, 2002). The government revisited public spending to focus on improving food security conditions in the country. By 2002, policies and programmes were being exercised such as the Reconstruction and Development Programme, school feeding schemes, child support grants, and free health services for children between zero to six years and pregnant women, as well as pension funds for the elderly. South Africa also introduced food fortification in 2003 on foods such as bread, wheat flour, maize meal, salt and cereals (Department Of Health- DOH, 2003). Regardless, of the introduction of these programmes, South Africa is known to be food secure at the national level but not at the household level (Jacobs, 2009).

Oxfam Research (2014) reported that one in four people in South Africa is exposed to food insecurity and half of the population is at risk of being exposed to hunger. These findings

correlate with that of the South African National Health and Nutrition Examination survey (SANHANES-1) (Shisana *et al.*, 2014) where 45.6percent of the South African population was reported to be food insecure. Within this 45.6percent of the population, 32.4percent were from peri-urban areas and 37.0percent were from rural areas (Shisana *et al.*, 2014). According to Matuschke (2009), the reason for higher food insecurity numbers in rural areas is different socio-economic backgrounds as rural areas are characterized by poverty and high unemployment rates as well as low education levels.

The National Department of Agriculture (DOA) (2002) stated five key areas as the main challenges of food security namely; inadequate safety nets, lack of purchasing power, poor nutritional status, inadequate and unstable household food production, weak support networks and disaster management systems. These challenges may be decreased by employment, nutritional education and well-structured policies.

Household food insecurity refers to the social and economic problem of lack of food due to resource and other constraints, not voluntary fasting or dieting, or because of illness, or for other reasons (Campbell, 1991). Figure 2.1 shows the possible causes and results of household food insecurity. Whilst financial constraints are most common amongst households, food insecurity may be experienced not by the lack of access of food but also by the inappropriate utilization and inconsistency to maintain enough food for the individual or households (FAO, 1997).

Figure 2.1 also shows how the improper dietary intake can lead to a poor nutritional status and affect the well-being of the individual/ household. Poor well-being causes negative effects such as worry, anxiety, deprivation, and distress. Improper access and utilization of food can lead to the inadequate dietary intake. Inadequate dietary intake and diversity affect the development of all age groups and reduces resistance to infection. An inadequate dietary intake in adults can reduce productivity and poor intake during pregnancy for the fetus which can impact on the health and survival of the infants by increasing risk for intrauterine growth retardation (IUGR) and low birth weight infants (PACSA, 2014). Most food consumed by individuals, which cause inadequate dietary intake and lack of diversity is attained in the household.

2.2.2 Four pillars essential to achieve food security

To understand a household's food security status, it is necessary to explore how resources of a household determine its access to food. There is sometimes confusion between national food security and the actual experience of households of obtaining food (Altman *et al.*, 2009). According to D'haese *et al.* (2013), factors such as rising food prices, unemployment, and poverty along with other domestic needs increase household food insecurity. Jacobs (2009) reported that one in five households in South Africa is able to meet their average dietary energy costs due to financial constraints leading to the deep levels of food insecurity that exists in rural areas, with 85percent of rural households not able to meet their average dietary cost estimates. Access to adequate food at a household level increasingly depends on household income, which cannot be understood in separation from other factors such as social protection, rural and urban development, changing household structures, health, access to land, water and inputs, retail markets, or education and nutritional knowledge (Altman *et al.*, 2009).

Four pillars are essential in the achievement of household food security namely;

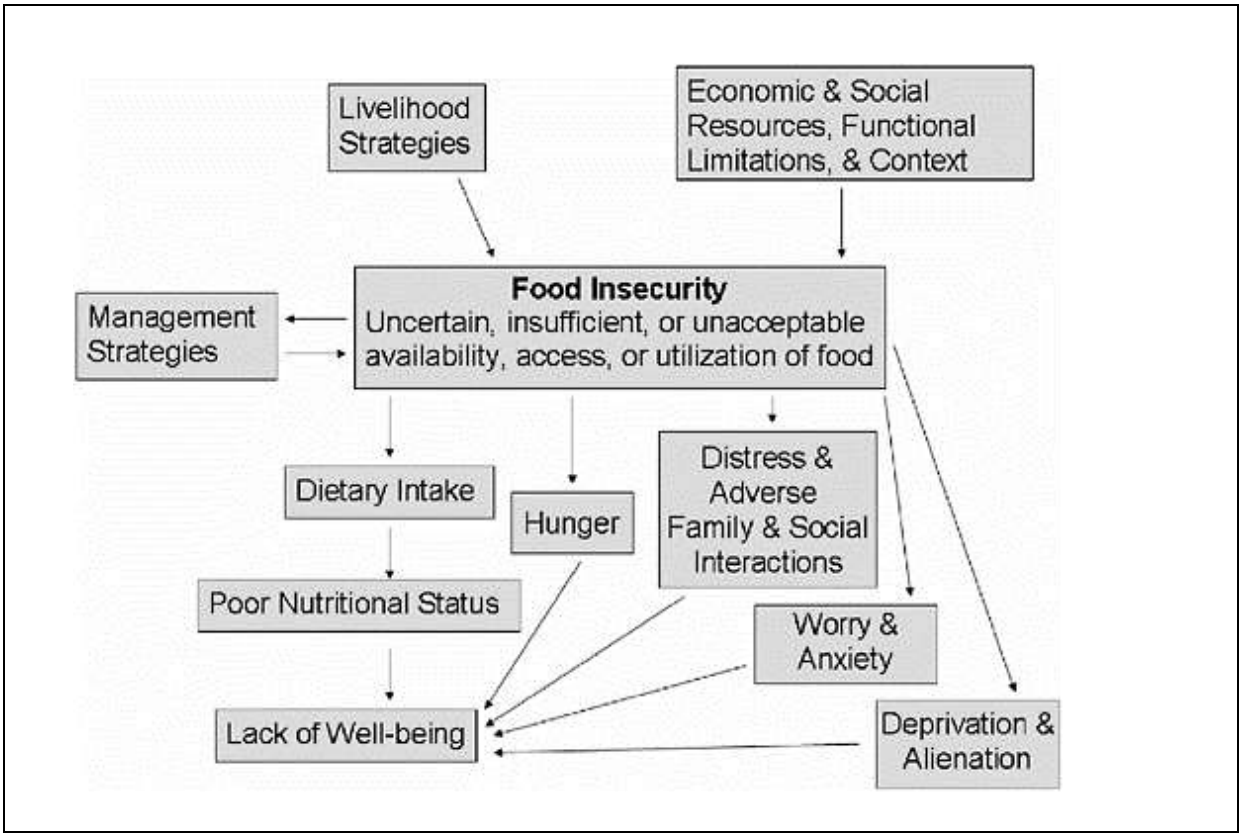

Figure 2. 1: **Food insecurity, and its determinants and consequences (Source: Habicht *et al*., 2004)**

Food Availability

Food availability is defined as "the sufficient quantity of appropriate, necessary types of food from domestic production, commercial imports or donors that are consistently available to the individuals or are within reasonable proximity" (United States Agency for International Development, 1995:8). Food production is determined by several components which include land ownership and use; soil management, crop selection, livestock breeding, management and harvesting which can be affected by changes in rainfall and temperatures (Godfray *et al*., 2010). Agriculture is essentially an environmental activity. Food availability can be increased in the household through subsistence production.

Subsistence production has the potential to improve the food security of poor households in both rural and urban areas by increasing food supply, and by reducing dependence on purchasing food in a context of high food price inflation, this, in turn, lowers the constant monthly income spent on the food basket to maintain other household domestic needs and improves the health of all individuals in the household (Baiphethi and Jacobs, 2009). Although subsistence farming has a positive effect on households, poor households that cannot afford the resources to purchase farming material or assets such as land, improved technology, credit, extension advice, and training are still exposed to food insecurity (FAO, 2002). However, Pereira (2014) reported that there is an increasing reliance on food purchasing in rural and urban areas in South African households, which increases the poor's susceptibility to food insecurity by disheartening home production and simultaneously households are susceptible to economic shocks that cause food price increases.

Food Access

The United States Agency for International Development (USAID) (1995:8), states that food access is defined as when "individuals have adequate incomes or other resources to access or barter to obtain levels of appropriate food required to maintain consumption of an adequate diet or nutrition level". A household may either produce or purchase food if there are resources to do so. Rural farming households purchase foods, which are not produced in the household whilst urban households tend to purchase most of their food basket. Rural households may purchase what they do not produce to expand the total household income for other household needs or as a strategy to stabilize their food basket for a longer period. Households may have a lower access to a nutritious food basket by lack of employment

or/and large household size (FAO, 1997). Rising food prices also impact the decisions consumers make in acquiring their household food items (Jacobs, 2009).

Food Utilization

Food utilization refers to when "food is properly used, has proper food processing and storage techniques employed along with adequate knowledge of nutrition and child care techniques and are applied with adequate health and sanitation services" (USAID, 1995:8). Nutritional values of the household and whether food meets cultural preferences determine the food choices made in the food basket, which is important to food utilization since the health of individuals' controls productivity and efficiency in daily life situations (Loring and Gerlach, 2009). Education about safe food preparation, sanitation and nutrition can affect household food utilization positively (FAO, 1997). Nutrition education about adequate micronutrient intake of children and adults can improve household food choices. This, in turn, improves the household food basket nutritional value, use and consumption patterns.

Food Stability

Stability of a household's food supplies refers to "the ability of a household to procure, through income, production and/or transfers, adequate food supplies on a continuing basis, even when the household is faced with situations of unpredictable stress, shocks or crises" (USAID, 1995:8). Vulnerability of shocks and stresses increase due to factors such as crop failure resulting from drought, market fluctuations such as sudden price increases, the decline or loss of employment and loss of productive capacity because of a sudden illness (FAO, 1997). Stability entails the consistency through instability of seasons in production and income; and the ability of a household to cope with the effects of food shortages (FAO, 1997). Instability of seasons such as climate change affects food supplies, food prices, and employment opportunities negatively, placing severe stress on the ability of households to maintain nutritionally adequate food baskets. This difficulty is often reflected in the body weight and health of vulnerable household members, especially women (FAO, 2002). Stability can also be examined through the ability to recover sufficient food rapidly and to do so households must create coping mechanisms and safety nets to survive shocks.

2.3 Measuring household food security

Food insecurity may be reduced and monitored by determining the individuals that are food insecure, and why and how they became vulnerable. According to FAO (2002), food insecurity must be determined by obtaining information on various specific conditions, experiences, and behaviours that serve as indicators of the varying degrees of the severity of the condition. Household surveys conducted in person or by telephone can be utilized to find such information. The following indicators are used to measure household food security; household survey food consumption and expenditure data, household food insecurity access scale, household diet diversity score and non-food factors. In this study, the focus is given to the household diet diversity score.

Household Diet Diversity Score

According to FAO (2013), dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of food and is a proxy for nutrient adequacy of the diet of individuals. Past research shows that a close relationship exists between socio-economic factors and household food security when assessing diet diversity through the years (FAO, 2013; Hoddinott and Yohannes, 2002; Hatloy *et al.*, 1998). Ruel (2006) emphasizes that dietary diversity is internationally identified as the main element of a balanced, healthy and nutritious diet but argues that there are not enough tools on how to measure diet diversity properly.

According to Swinsdale and Bilinsky (2006), the household dietary diversity score is an important tool in measuring diet diversity. Developed by Food and Nutritional Technical Assistance, it is the number of food groups consumed over a given period, it is calculated by the sum of different kinds of food groups consumed at the household level after a 24-hour recall. These tools are increasingly used in food and nutrition security surveys to assess the dietary quality of household members and individuals. Although the household diet diversity score is used widely as a measuring tool, it has disadvantages. Fortified foods are not included because the information captured is used for primary uses, there is also uncertainty about which food groups to cover or exclude, this raises concerns, as different studies cannot be completely compared to one another (Lynman *et al.*, 2010). The Household Dietary Diversity Score (HDDS) may assist in assessing how diverse household food baskets are as opposed to the standard food basket.

Household Food Insecurity Access Scale

The household food insecurity access scale (HFIAS) is a survey-based tool developed by Food and Nutrition Technical Assistance (FANTA) to evaluate whether a household has experienced problems with food access during the last 30 days. Several studies have used the Household Food Insecurity Access Scale (HFIAS) to measure food insecurity in different parts of South Africa, proving it useful (De Cock *et al*., 2013; Dewing *et al.*, 2013; Battersby 2012; Oketch *et al.,* 2011). The HFIAS score is a continuous measure of the degree of food (access) insecurity, where households have a yes or no response to each of the nine questions weighing occurrences as never, rarely, sometimes, often and always. The score ranges from 0 to 27 and the higher the score, the greater the food (access) insecurity the household experienced. The researcher can thereafter be able to categorize households into four levels of household food insecurity: food secure, and mildly, moderately and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently (Coates *et al*., 2007). The HFIAS tool will assist in measuring if the amount of the food basket purchased in the household is sufficient for all household members for the period it is purchased for.

Coping Strategy Index

The Coping Strategy Index (CSI) is an indicator of household food security to measure degrees of vulnerability developed by the Cooperative Assistance for Relief Everywhere (CARE), the World Food Program and Technical Assistance for NGOs (TANGO), which is highly efficient (Maxwell and Caldwell, 2008). A set of simple questions can be developed to apprehend individual's fundamental consumption-related coping replies to insufficient access to food in each culture or location. According to Maxwell and Caldwell (2008), the CSI provides a rapid and current status of the magnitude of food insecurity that can be immediately utilized for progressive decision-making, it is also utilized in emergencies to monitor the effect of interventions, including food aid on household food security. The coping strategy index can also be used as an early warning indicator for household food insecurity.

2.4 Household Food Baskets

According to Williams (2010), food basket research has been utilized internationally for different purposes, including examining the different costs between healthy and unhealthy food, mapping the availability of healthy foods in different locations, calculating the minimum cost of an adequate diet for social policy planning and developing educational material on low cost eating as well as examining trends on food costs over time. For the purposes of this study, household food baskets are differentiated in two ways namely; basic food baskets and nutritiously balanced food baskets. A basic basket is a set of goods and services essential for an individual or a household to meet their basic needs from their income whilst a nutritiously balanced food basket consists of goods essential for an individual or household to meet their nutritional requirements to have a healthy life, physically and mentally.

According to Rose *et al.* (2002) reported that the different kinds of food items usually purchased in South African households. These food items ranged from highly popular to less popular. The most popular food items amongst the list were reported to be cake and bread flour, mealie meal flour, rice, white/brown bread, beef, poultry, eggs, potatoes, onions, bananas and white sugar whilst the least popular were food items such as yoghurt, bacon, sorghum meal flour, maas, sweet potatoes and fresh/frozen vegetables. Amongst the highly popular and less popular are foods that have driven significant levels of inflation in January 2016 as compared to January 2015 namely rice (up 11.9percent on 10kgs), cake flour (up 10.3percent on 10kgs), samp (up 10.8percent on 5kg); white sugar (up 5percent on 10kgs); sugar beans (up 11.9percent on 5kgs); cooking oil (up 23.3percent on 4 litres); maas (up 6.3percent on 2 litres); eggs (up 5.9percent on a tray of 30); beef (up 8.7percent on 1kg); potatoes (up 109.5percent on a 10kg pocket); onions (up 65.9percent on a 10kg pocket); cabbage (up 78.8percent on 2 heads); spinach (up 82.5percent on 4 bunches) (PACSA , 2014). This causes a problem for consumers as higher food prices limit the household food basket purchased especially in low-income households.

2.5 Consumer food baskets in high and low-income households

Inglis *et al*. (2009) discuss how sustaining a healthy food basket in South Africa is an increasing concern. Low-income households were found to use 35percent of their income on

food but are more vulnerable to shocks of higher food prices and malnutrition, these households (rural and peri-urban) were also found to pay more for a basic food basket than urban households (Altman *et al.*, 2009). Pereira (2014) suggests that the reason for higher costing food baskets in these areas are the following but not limited to; transport costs (including fuel and maintenance costs), low or no volume discounts for rural outlets, stock losses due to spoilage, breakage, products exceeding their expiry dates and loading costs.

Statistics South Africa (2013) reported that low-income households spend approximately 22 percent on meat, fish, and poultry, where it may be one or the other or sometimes no meat due to financial constraints. Higher income households spend over 30 percent on meat where white poultry is the most commonly purchased food (STATS SA, 2013). White poultry is a healthier choice, and this suggests some nutritional knowledge from the higher income households. On the contrary, it was found that lower-income households in some instances purchase potatoes rather than meat. Potatoes are used as a substitution for meat in low-income households which leads to a lack of diet diversity (Oxfam Research, 2014). Several studies also show that low-income households have been found to purchase maize products more as it is consumed more than four times a week, whilst consumption of eggs, dairy, fruit, and meat are consumed much less and not frequently purchased in their food basket (D'haese *et al.*, 2013; De-Cock *et al.*, 2013; STATS SA 2013; Hendricks and Msaki 2009).

The problem with mostly purchasing maize products is the monotonous diet that is based on starches, which has been closely associated with food insecurity (Jacobs, 2012). The Pietermaritzburg Agency for Community Social Action (2014) reported that there are food products household members cannot survive without namely; maize meal, white rice, cake flour, brown sugar and cooking oil. These food items are mainly used for most meals during the week and when there is no money to purchase bread, steamed bread is made with cake flour, which is much less nutritious. Maize meal is used not only in the form of porridge for breakfast but as pap to accommodate dinner. Rice is an important addition to consumers because of the duration it lasts as well as for variety and not necessarily nutrition.

Jacobs (2012) similarly reported that 40 percent of South Africans have between one and three food groups in their food basket namely; cereal, beef or chicken, and a vegetable. The most neglected groups included vitamin A rich fruit and vegetables, legumes and nuts, which contributes to the micronutrient deficiencies faced by many South Africans today. Labadarios *et al.* (2011) also investigated the role of a monotonous diet in food baskets and mentions that

a diverse diet is linked with positive health outcomes including improved micronutrient intake, increased productivity, and decreased illnesses especially in young children.

Oxfam Research (2014) research shows that households that engage in home production tend to be less food insecure. According to Baiphethi and Jacobs (2009), similarly, a household that engages in home production as a supplement for affording a healthier food basket tend to be more food secure. Fresh fruit and vegetables supply individuals with several vitamins and minerals (FAO *et al*., 2012). Hart (2011) contends that home production may not change a household's food security status, although there are savings from the households' food expenditure that comes from home production, it does not necessarily mean household members will purchase nutritious food items in their food basket.

The Food and Agricultural Organization (2009) suggests that a household's food basket changes with every stressor or shock and hence households have different food security levels annually.

2.6 Drivers of food basket choices

Shepherd (1999) stated that food choice, like any complex human behavior, is influenced by several interdependent factors. Food choice is not absolutely controlled by social elements alone. The culture in which individuals are cultivated from has a powerful impact on the kind of choices consumers make as well as social interactions, which have an influence on opinions and views of food and eating behavior as shown in the figure below. This section discusses what influences households on which purchases they make on their food baskets. According to Zielinska (2006), food choice is a sensitive phenomenon that depends on several factors that influence the human psyche.

Figure 2.2 depicts the different factors that play a role in consumer food choice. It focuses on the type of non-physical factors that play a role in consumer food choices and thereafter food intake. According to Pambo *et al.* (2014), consumer perception and attitude towards food products dictate the decision on what is purchased for the household (for example. how households value a healthy lifestyle). Culture, religion, amongst others, influence household food choices. On the other hand, Daurice e*t al.* (2010) reported that psychological factors namely stress, anger, fear, anxiety are associated with negative dietary patterns, this, in turn, leads to unhealthy diets, obesity and lack of important micronutrients. Contrary to Pambo *et al.* (2014), Zielinska (2006), highlights that the complexity of food choice does not only lie in

the psychological and physiological factors or perception but in the socio-demographic background of a household.

2.6.1 Food price inflation

According to Brinkman *et al.* (2010), food access is determined by the price of food and the total household income, which leads to members of any household decreasing their dietary diversity when responding to higher food prices. Several authors point out that households are more exposed to high food price shocks when they use a large amount of their total household expenditure to food and are not equipped with the necessary coping strategies (Jacobs, 2009; Temple and Steyn, 2009; Oldewage-Theron *et al.*, 2006).

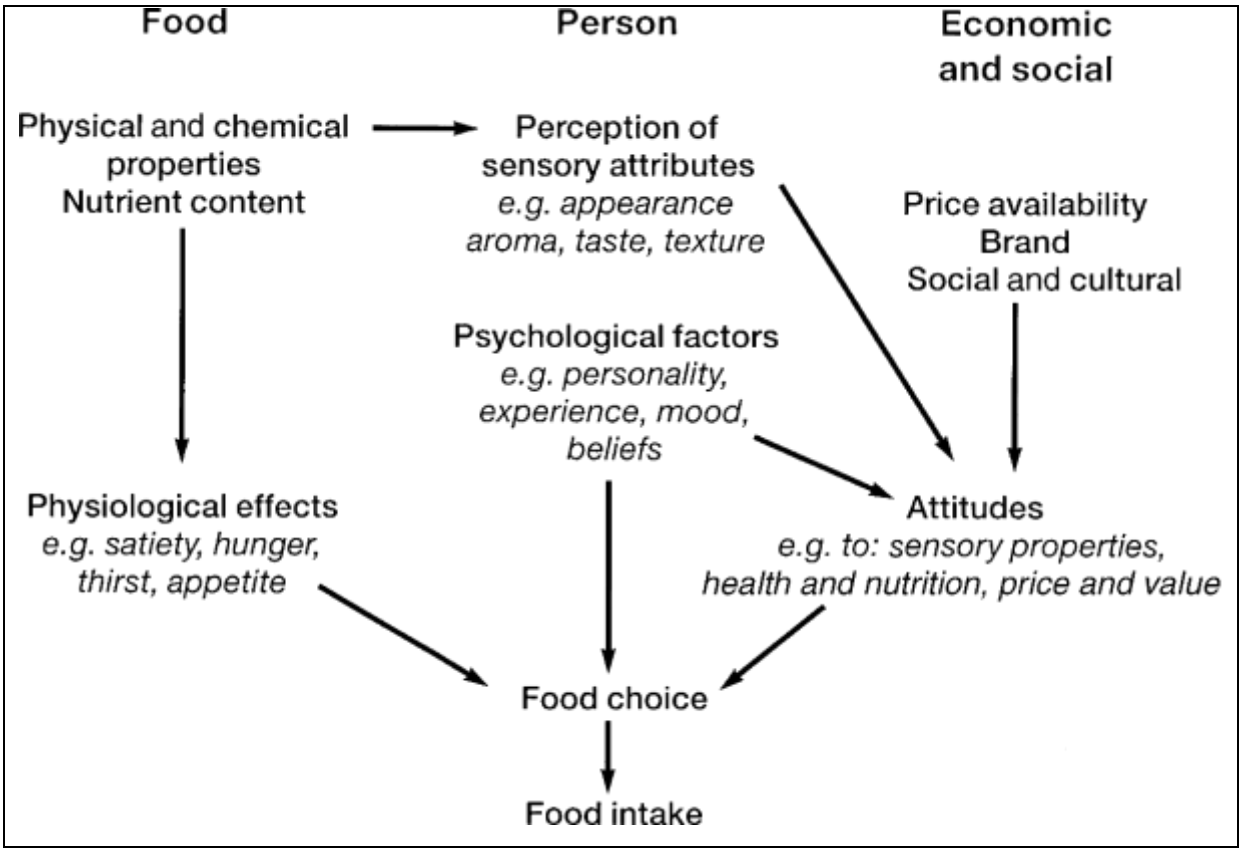

Figure 2. 2: **Factors influencing food choice and intake**

(Source: Shepherd, 1999**)**

The cost of a basic food basket in South Africa has increased by R243.63 from R1616.97 to R1860.60 from September 2015 to September 2016 (PACSA, 2014). Smith (2013), reported

that significant price increases are found in some of the most important items in the food basket that is maize meal, chicken portions (fresh and frozen), bread (white and brown), cabbages, banana, full cream milk, and eggs. This poses a difficulty for consumers because the five most consumed food items in South Africa include maize porridge, brown bread, tea, full cream, and milk. For rural households, the inflation of the price of maize products dictates their household food basket, frequency consumption and portion of food, this leads to households reducing their spending power and increasing their long-term micronutrient deficiencies. Statistics reveal that the inflation of maize products affects about 64.5 percent of women and 35.9 percent of men in South Africa, which are likely to be from rural areas (STATS SA, 2014; Oxfam Research, 2014). When the most consumed item in the household food basket increases in price, it leads to an increased food expenditure budget forcing households to acquire coping mechanisms (Smith, 2013).

Brinkman *et al.* (2010) points out that households tend to have similar coping strategies. Coping mechanisms used by households after significant price inflations include: adjusting consumption patterns, switching to different food brands, reducing diet diversity and skipping meals (Thabethe *et al.,* 2016). At times when such strategies fail, households may also decrease the money spent on food (sugar, cooking oil, salt and/ or staples); decreasing their micronutrient intake significantly (Victoria *et al.,* 2008; Hoddinott and Yohannes, 2002).

Table 2.1 compares the different price inflations for food items purchased in the food basket, some major contributions to price inflation are the most essential for a household to survive.

These major contributors lead to consumer survival strategies such as moving to minor contributors that are still affordable to the consumer as a substitute. According to NAMC (2015), the rate of inflation was lower for most products except for staple, fats/oils and animal protein food items, leading to household food insecurity due to the lack of diet diversity that will come from decreased purchasing power as staple foods are amongst the essential products for low-income households.

2.6.2 Household income

Jacobs (2009) argues that household food security depends highly on household income and asset status. A low-income household has a higher chance of facing food shortages than a high-income household, as a poor household cannot handle the stressor of increased food prices.

Several studies have shown that a decrease or increase in income changes the quantity and quality of foods purchased and consumed (Jacobs, 2012; Temple and Steyn, 2009; Oldewage-Theron *et al.,* 2006). Income shortages for low-income households are experienced commonly in January-February and June-July (D'haese *et al.,* 2013; De-Cock *et al.,* 2013). This is because of the high amount of money spent over the festive season and in January children requiring certain materials for schooling, during the time of June and July it is possibly due to the winter seasonal change affecting the households acquiring of resources (MacMahon and Weld, 2015).

Table 2. 1: Price inflations in different food groups

Food group	Overall inflation rate			
	July 2014-July 2015	April 2014-April 2015	Major contributions to this category	Minor contributions to this category
Animal Protein	+6.7%	+5.8%	Tinned Fish (excl. tuna) (+13.8%) Chicken portions fresh (+8.8%) Chicken portions frozen (+7.6%)	Beef chuck (+3.2%)
Bread and Cereals	+0.6%	-0.8%	White bread (+6.4%) Brown bread (+6.0%)	Rice (+1.3%)
Vegetables	-2.9%	+2.4%	Cabbage (+4.2%)	Potatoes (+0.41%)
Fruit	+13.0%	+13.2%	Oranges (+ 34.3) Bananas (+8.5%) Apples (+7.0%)	None
Dairy	+5.5%	+11.6%	Full cream milk- long life 1 litre (+5.5%)	None
Eggs	+2.5%	+5.5%	Eggs 1.5 dozen (+2.5%)	None
Fats and Oils	+6.4%	+2.4%	Brick margarine (+8.9%)	Sunflower oil (+3.9%)
Bean products	-0.8%	+1.7%	Baked beans (+5.5)	None
Coffee and Tea	+5.0%	+7.3%	Ceylon/ Black tea (+16.9%)	Instant coffee (+3.4%)

(Source: National Agricultural Marketing Council (NAMC), 2015)

Figure 2.3 shows how South African consumers spend their income, food was reported to be the fourth most important item in the household expenditure, this implies that the lesser the income, the lesser the amount retained for food. According to Jacobs (2009), there was a high dependency ratio on income in South African households which conveyed that if a food

secure household loses an income earning opportunity, it can easily shift to becoming a food-insecure household. Households can lose an earning income opportunity through diseases leading to extra household costs, absenteeism at work and less income (PACSA, 2014).

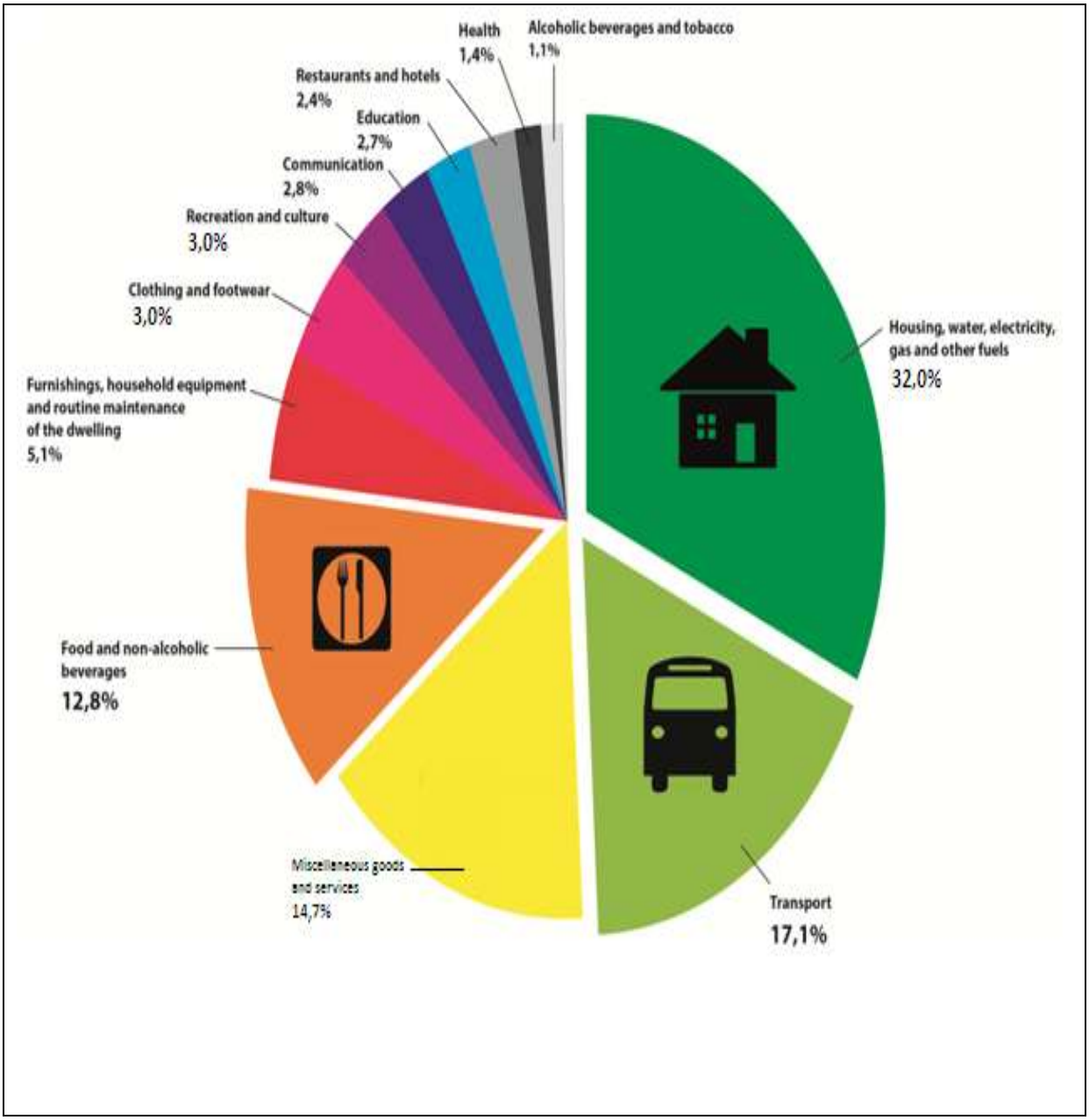

Figure 2. 3: **How do consumers spend their income?**

(Source: Statistics South Africa, 2013)

Subsistence farming is one of the aspects of food security that can aid households to save income. Subsistence farming can reduce the amount spent on food for the household to

acquire a nutritional food basket (Aliber, 2009; Baiphethi and Jacobs, 2009). D'haese *et al.* (2013) also reported that an estimated R4000.00 per year was saved from home production in Limpopo and provided household members with an increased vitamin A and C intake. Similarly, Hendriks and Msaki (2009) reported that diet diversity along with good health increased after households focused on organic household farming.

2.6.3 Education

Education is one of the most powerful engines for reducing hunger and poverty and suggests that female education has a higher impact as women with basic or minimum education are able to capture nutritional messages from mass media (for example. radio) and thereafter are able to educate their children (FAO, 2005). According to De Muro and Burchi (2007), more than 800 million people globally are victims of food insecurity and lack of education. This is because low education is one of the main factors that contribute to household food insecurity in rural areas and low-income households. Education has several positive benefits that improve all elements of food security namely;

Increased productivity and income

Access information on health and sanitation

Diversify assets and activities

De Muro and Burchi (2007) reported that there is a strong relationship between food security and education, the relationship becomes weaker as education deteriorates. Households, where most members have a low education, are more at risk with food security (Fiedler *et al.*, 2012). Figure 2.4 shows the potential benefits of education towards food security. It breaks down how different levels of education factor to food security and most importantly mother and child nutrition empowerment, through nutrition education.

Farrell (2014) reports that the more a household or household members are illiterate, the higher the chance of household food insecurity. According to Garrett and Ruel (1999), in Mozambique education levels are much higher in urban areas, in rural areas no male is literate or has any higher education in 71 percent of rural households while at least one adult male in more than 73 percent of urban households is literate or has some form of education.

In females, 71 percent of females are illiterate or no form of education while only 54 percent are illiterate in urban areas (Garrett and Ruel, 1999).

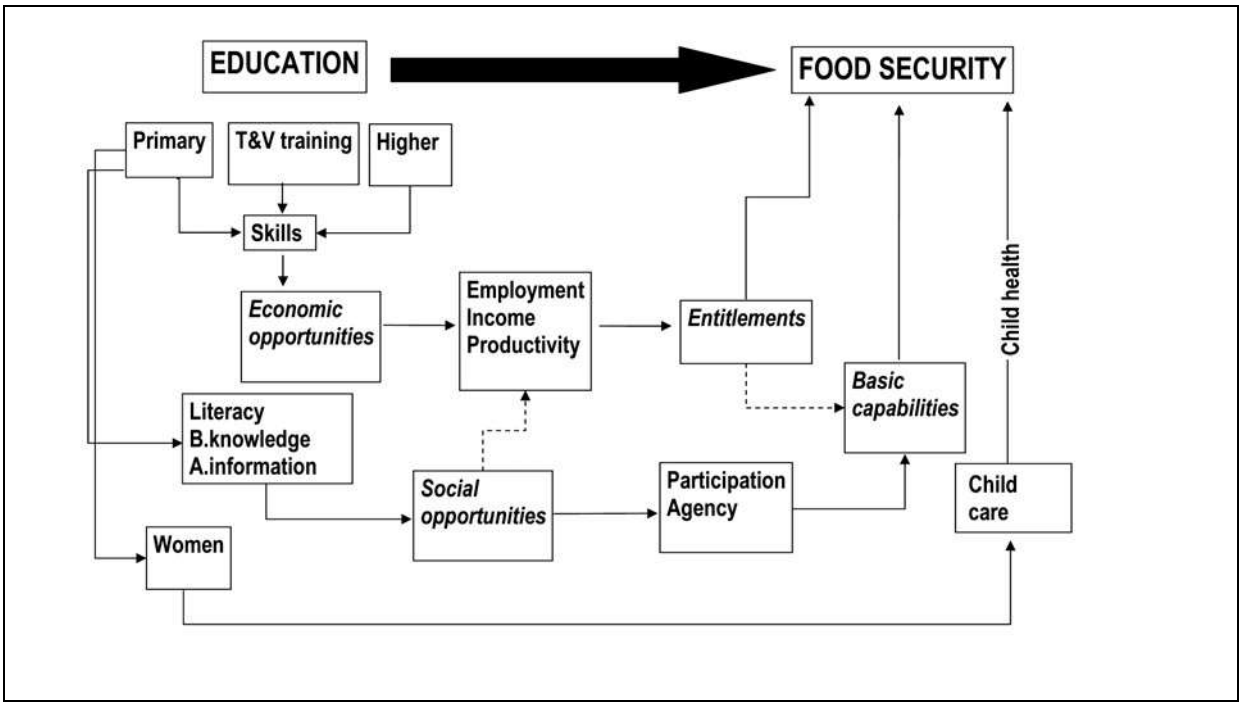

Figure 2. 4: **Direct and indirect contributions of education to food security**

(Source: De Muro and Burchi, 2007)

2.6.4 Poverty

Mangusho (2013) defines poverty as a fundamental cause and outcome of undernutrition. Poverty is identifiable by low education opportunities, low income including physical and environmental factors, which could be the inaccessible costs to cover medical costs and other basic resources (Vorster, 2010). Poverty is highly influenced by the sociodemographic background of a household. According to Jacobs (2012), poverty in the country is uneven in its spread and strength. In 2002, Gauteng and the Western Cape Province were the wealthier provinces with the least number of poor households less than 12 percent whereas in the Free State, Eastern Cape and the Northern provinces there was a higher number of poverty cases. The average household in Gauteng spent R7742.00 per month compared to R2665.00 in the Eastern Cape for household food baskets.

Statistics South Africa (2009) reported that 80.8 percent of individuals who reside in rural areas qualify as poor whereas only 40.7 percent in urban areas. This percentage increased in

2009 by 2.2 percent in rural areas whilst increasing by 0.3 percent in urban areas. Comparably the poverty gap was reported to be wide in 2006, with 41.9 percent in rural areas, 16.1 percent in urban areas and increased in 2009 to 45.0 percent in rural areas and 17.6 percent in urban areas (STATS SA, 2011). A high poverty gap between urban and rural areas suggests that poverty is more severe although it does not necessarily indicate how poor are those in rural areas. Aliber (2009) suggested that poverty is influenced by the gender of the household head, this is due to female-headed households of 43.9 percent living under the poverty line whereas male-headed households of 33.6 percent were living under the poverty line. Tladi (2006) argues that gender may not have any influence on poverty but there could be a higher number of female-headed households in South Africa.

Access to food differs across urban and rural areas, the socio-demographic background of a household influences the quality of food access as well as the quantity purchased. Urban areas often have available food at supermarkets which are in close proximity with a variety of good quality food whilst rural areas are far from main food distributors and are generally more exposed to "spaza" shops that do not have high-quality food, limited variety as well no fresh fruit and vegetable, rural area households also incur higher costs for transportation to urban situated supermarkets (PACSA, 2014; Oxfam Research, 2014).

2.6.5 Female-headed households

Female-headed households have been found to have financial constraints to secure food for the household due to time constraints that is due to domestic responsibilities (Oxfam Research, 2014). Usually when women acquire employment, most of the income is spent on food for the children, this is observed though women showing physical signs of lacking nutrition and children often showing more energy and functioning productively at school (Grebmer *et al.,* 2014; Mangusho, 2013; Oxfam Research, 2014; WHO, 2009). Females often take farm field employment as it does not require skills that are taught in higher education and is flexible enough to allow time to run the household (Oldewage *et al.,* 2011; Schatz *et al.,* 2011). Similarly, Shisana *et al.* (2014) reported that in South Africa 46 percent of males receive a higher salary than female employees because of the fewer hours female's work.

2.6.6 HIV/AIDS

Ivers *et al.* (2009) provide evidence that the HIV/AIDS epidemic is one of the reasons why households in South Africa are experiencing food shortages. Household level studies clearly show a decrease in agricultural production because of HIV/AIDS, making household members less exposed to the advantages of community gardening. Sebolaaphuti (2005) substantiates that past research identifies HIV/AIDS as an epidemic that leads to loss of labour, assets, income, high death rate and further places households in food insecurity in most urban and rural households. Households that are affected by HIV/AIDS may sell assets and crops produced as a coping strategy and means of purchasing other domestic needs, limiting food expenditure. Stein and Qaim (2007) argue that female-headed households are not as vulnerable as past research suggests, as female-headed households have more nutritional children than in male-headed households.

2.6.7 Residing Area

According to Oxfam Research (2014), the socio-demographic conditions are a factor and contribute to a household's food security or insecurity status. The average low-income household is said to consist of seven members which may include three to four children of ages 0-18 months and three to four adults of 19 years or older hence a greater demand for food in the household (PACSA, 2014).

Intense levels of food insecurity occur in rural areas where 85 percent of rural households are not able to afford below average dietary energy costs (Oldewage-Theron *et al.*, 2006). A significant food quality difference was reported in food baskets related to the places where consumers purchased food, and this leads to decreased individual nutrition in household members (MacMahon and Weld, 2015). Poor access to the right kind of food is a problem because of more exposure to small stores or popularly "spaza shops', where there is a small amount of food variety and fewer vegetables and fruits. Rural low-income household members must travel further than urban household members to get to supermarkets, and this increases transportation costs from their total monthly expenditure (Mangusho, 2013).

2.6.8 Unemployment

The loss of employment in households is one of the most negatively effective shocks that change a household's food security level (Altman *et al.,* 2009). According to Oxfam

Research (2014), the current unemployment rate in South Africa is 25.4 percent. A household that earns less than R3100 per month qualifies as a food insecure household that has a higher chance of being unable to provide sufficient food for the duration of a month. Burchi *et al.* (2011) suggest that individuals who have higher chances of being food insecure are poor urban individuals and unemployed; rural poor individuals who do not own land and generally unemployed. If these individuals were to hypothetically be members of a household, they increase the household's vulnerability to shocks and therefore food security.

Feeley *et al.* (2009) reported that low-income employees tend to spend their income on highly processed foods which are energy dense but do not have the required nutrients with belief that it is a better fit for their diet although lacking in proper nutrients.

2.7 Micronutrient Deficiencies

Micronutrient deficiencies are defined as a lack of essential vitamins and minerals required in small amounts by the body for proper growth and development (Steyn *et al*., 2007). According to Sablah *et al*. (2013), micronutrient deficiencies are responsible for significant public health problems in the developing world causing primitive death, disability and reduced work capacity. It is further pointed that vitamin A deficiency considerably increases in mortality and morbidity while iron deficiency anemia is accountable for an estimated 20 percent of all maternal mortality in Africa (Sablah *et al*., 2013). Although measures to decrease micronutrient deficiencies such as nutrition education, supplementation, and dietary diversification, micronutrient deficiencies are still prevalent in developing countries.

Fortification of staple foods in South Africa has proven to be a vital part of reducing and preventing micronutrient deficiencies (Steyn *et al*., 2011). Moreover, food fortification provides the South African population especially low-income groups the ability to access essential nutrients without changing food consumption patterns. Micronutrients are separated as vitamins (Vitamin A, Vitamin B1, Vitamin B2, Vitamin B6, Niacin and Folic acid) and minerals (Iron and Zinc). According to WHO (2009), there are three micronutrients namely vitamin A, iodine and iron that pose a recurring threat to young children as well as adults which lead to the increased need for an intervention (WHO, 2009).

2.7.1 Vitamin A deficiency

According to Pillay (2016), vitamin A deficiency affects approximately 190 million children under the age of five in South Africa. Vitamin A deficiency is a prevalent micronutrient deficiency in developing countries due to diets that are high in starch such as maize and low in animal-sourced food (Govender *et al*., 2017). According to Faber *et al.* (2001), vitamin A is a fat-soluble vitamin that is present in a variety of food. It is important for eyesight vision, the immune and reproduction system. Vitamin A assists in a number of organs to function properly such as the heart, kidney, and lungs. There are two types of vitamin A namely; preformed and provitamin A. Preformed vitamin A is found in meat, poultry, fish and dairy products. Provitamin A is found in fruits as well as plant-based products (Russel *et al*., 2001). Vitamin A fortified food products in South Africa are breakfast cereal, maize-based products as well as wheat-based products, wheat flour, maize meal (super, special, sifted and unsifted) and salt. The mentioned foods were fortified due to their social popularity amongst low-income households (DOH, 2007).

Recommended daily allowance (RDA) is defined as the average daily level of intake sufficient to meet the nutrient requirements of nearly all (97 %-98 %) healthy individuals (Russel *et al.,* 2001). The RDA for vitamin A increases with human growth regardless of gender from age zero months to 13 years. After this time RDA between males and females differ, with males requiring a higher RDA (Russel *et al,* 2001). When an individual's RDA for a micronutrient is not met for a prolonged duration, it leads to a micronutrient deficiency. Vitamin A deficiency is common in developing countries, mainly because of poverty effects (WHO, 2009). Vitamin A deficiency begins during early childbirth stages when a child does not receive the sufficient amount of breastmilk. Vitamin A deficiency symptoms are more likely to include anemia, unavoidable blindness called xerophthalmia. Xerophthalmia is common in young children and pregnant women who have a severe case of vitamin A deficiency and may lead to mortality risk infections if not before the xerophthalmia.

2.7.2 Iron deficiency

Iron is a mineral that is naturally present in many foods, added to certain food products and can be used as a dietary supplement. Iron functions as part of hemoglobin, transferring oxygen from the lungs to the tissue and as part of myoglobin as a provider of oxygen as well as supporting the metabolism (Russel *et al.,* 2001). Iron promotes growth, development and

normal cellular functioning (Jackson and Lee, 1991). Iron can be consumed in natural food sources, for example; red meat, liver, fish, egg yolk, lentils, dried beans and dried fruit as well as in iron-fortified food products.

Iron deficiency is an increasing problem in South Africa as well as internationally, affecting two billion people globally (Zimmerman and Hurrel, 2007). Iron deficiency is caused by a lack of iron-based food consumption, it has a number of health consequences such as poor pregnancy, anemia, poor productivity levels amongst children and adults. Shisana *et al.*, (2014) reported the symptoms of iron deficiency include fatigue, headaches, trouble breathing, brittle nails and hair. The human body requires iron in higher doses during times of infancy, childhood, puberty, pregnancy and when lactating in women. The RDA for iron differs in males and females with females needing a higher RDA than males especially during lactation and pregnancy, this is due to less iron being absorbed in the body at that time (Russel *et al.*, 2001).

2.7.3 Iodine deficiency

According to FAO (2001), iodine is an element responsible for the production of the thyroid hormone. Iodine is not made in the body, therefore, consuming foods high in iodine produces the thyroid hormone that can assist lower chances of goiter and mental retardation in children. This leads to lower productivity in children (FAO, 2001). Iodine deficiency is the lack of the iodine element in the human body. The RDA increases with age from 110mg during birth to six months, decreasing at one to eight years to 90mg then increasing for adults to 150mg excluding pregnant teens and women (220mg) and breastfeeding women (290mg) who require a much higher dose (Russel *et al.*, 2001).

Jooste and Zimmerman (2008) stated that before salt iodization in 1954, South Africa was one of the many with high iodine deficiency. A salt iodization programme introduced in 1955, failed due to the use of low concentrations (10ppm-20ppm). Increased doses of mandatory iodization of table salt (40ppm-60ppm) proved more successful and decreased goiter and iodine deficiency (Hurell, 1997). The food fortification programme in South Africa has allowed fortified iodized salt, cereals and bread as a means of fighting iodine deficiency although households can also consume natural food sources that are high in iodine to balance their iodine daily requirements i.e., fish (tuna), dairy products (milk, yoghurt, and cheese), fruits and vegetables (DOH, 2007).

Russel *et al.* (2001) state that although iodine is low in crops, it can be richly found in seafood. WHO (2009) estimated that 70 percent of households used iodized salt to control iodine levels, which is the most effective way for all wealth groups. According to Jooste and Zimmerman (2008), South Africa was one of the leading African countries that were effectively eliminating iodine deficiency after the implementation of the salt iodization programme. Jooste and Zimmerman (2008) also point out that although there was progress after the implementation of the programme, iodine deficiency has increased after 2007 especially in children and low-income households, therefore a third of South Africa still need to be reached for iodine deficiency to be fully eliminated.

2.8 Fortified foods in South Africa

Food fortification is whereby micronutrients which include vitamin A, iron and folic acids are added on to foods to improve foods original nutritional component. It has been passed as a legal and safe way of positively influencing the public's health for a number of years (DOH, 2007). Foods that are fortified in South Africa are mainly staple products mostly made from maize and wheat. According to Steyn *et al.* (2007), the decision to implement food fortification in South Africa was brought on by evidence from studies suggesting that the diet of poor individuals does not have enough amounts of the required vitamins and minerals by the body due to lack of dietary diversity.

Food fortification was implemented officially on the 7th October 2003, which stated that all maize meal and wheat flour be compulsory fortified published under the South African Act No.54 of 1972 Foodstuffs, Cosmetics, and Disinfectants (DOH, 2007). The regulations applied to any persons or company, which manufactured imported or sold maize meal and wheat flour as well as foodstuffs, which contain 90 percent of either maize meal or wheat flour such as bread. A fortification logo was developed as well for the awareness of consumers (Faber *et al.,* 2005). Micronutrients are crucial because they are critical components of one's physical along with mental health and development. According to Faber (2007), food fortification is highly cost-effective in tackling micronutrient deficiencies in South Africa. Food fortification was mainly targeted at low-income household and the poor, this is because high-income households may be able to afford a more diverse diet than low-income households. Steyn *et al.* (2008) argues that unsound dietary activities such as consuming popular energy-dense foods threaten the diet and expose both low and high-

income households to micronutrient deficiencies hence food fortification opened the door for consumers to be able to choose the type of food that will contribute positively to their nutrition regardless of their wealth status.

Pretorius and Schonfeldt (2010) argue that even though food fortification has been implemented in South Africa since 2003, the quality of fortification premixes used by manufacturers leads to a much more decrease in vitamins when cooked in households and since low-income households decrease the food quantity to survive shocks, they are still exposed to micronutrient deficiencies. An investigation that focused on the effect of sunlight exposure on fortified products in rural areas reported that a number of "spaza" shops or outlets stock fortified products inappropriately decreasing the micronutrient components especially in the case of vitamin A as it is highly sensitive to sunlight exposure (DOH, 2007). This suggests that even though consumers may purchase fortified products, by the time of consumption the essential vitamins and minerals composed in the product may be of low value, further exposing consumers to micronutrient deficiencies.

Food fortification positively influenced school feeding programs. According to Faber (2007), school feeding programs in South Africa that provided fortified biscuits with iron, B-carotene, and iodine lead to an increased vitamin A and iron status for scholars although it was found to decrease during long school holidays. Steyn *et al.* (2007) suggest that the benefits of fortification may not be able to benefit the targeted populations because of how diverse the cultures of South Africans are. Not all low-income households consume bread or maize meal regularly and some households reside in secluded farm areas where food is a form of payment which may exclude maize or wheat flour products, as well as the large Indian population who mainly consume rice, also premixes lack calcium and may be low in iron levels (Steyn *et al.*, 2007).

2.9 Food fortification progress

Internationally, particularly in low and middle-income countries, there are problematic areas in food fortification including not reaching the target population and monitoring additional intakes as well as nutritional status linked with the consumption of fortified foods (Dwyer *et al.*, 2014). Dwyer *et al*. (2014) also highlight that food fortification needs to be assessed in whether individuals are obtaining adequate nutrients or consuming nutrients in excess. Harvey (2010) reports that in Uganda problems arise in food fortification via access to

fortified goods, especially in rural areas. There are three factors that limit the degree to which fortification levels can be adjusted in response to the consumption levels of the food vehicles in Uganda; firstly foods cannot be fortified beyond a level at which those individuals consume large amounts may reach the maximum safe level of intake from food; secondly there must be technological compatibility between the fortificant source of micronutrient and the food matrix; and lastly the high levels of fortification can increase costs of the food and this would, in turn, create a disincentive for the food industry to observe food fortification standards.

In South Africa, Luthringer *et al*. (2015) reported that of households with access to fortified foods less than half are consuming adequately fortified foods according to data from 22 national fortification programs. The decentralized government structure and a national bias by local authorities to focus on inspection activities in areas that represent the most immediate threats represent some major weaknesses in monitoring the fortification program. District authorities do not consider sub-standard flour or maize that does not comply with fortification regulations to be an urgent threat to public health because it remains safe to consume (UNICEF, 2014).

Unintended gaps in food fortification regulations decreases food fortification efficiency in reducing the number of micronutrient deficient individuals. Food fortification regulations in South Africa do not specifically require the use of fortified flour in all bread, but only stipulate that the logo and any associated claims on packaging and advertising may not be used unless the bread contains more than 90 percent fortified wheat flour. As many of the small bakeries in South Africa use a mixture of cake and bread flour and market with no packaging (and associated opportunity to make claims on a label), the fortification program may be losing a portion of the bread market as a delivery vehicle, amending regulations to require the use of fortified flour in all bread, whether packaged or not, may be helpful in closing this potential loophole (Darnton-Hill *et al.*, 2005).

Another reason for the need of continuous monitoring is to safeguard the effectiveness of the fortification process in terms of the stability of the products from factory to household. Steyn *et al*. (2007), reported that fortification in the South African context does not solve all micronutrient deficiencies due to some nutrients not being present in the fortification mix whilst other nutrients present such as iron may not meet the high demands for individuals such as women in the childbearing age as they require larger amounts than most. Figure 2.5

shows the mean nutrient adequacy ratio of before and after food fortification of staple foods was implemented in order to determine the nutrient quality of children's diets in the different nutrients from urban areas.

Nutrient adequacy ratio was calculated as the ratio of the intake of a nutrient divided by the recommended nutrient intakes for a given nutrient utilizing World Health Organization and Food Agricultural Organization recommended intakes. Steyn *et al*. (2008) found that the ratio of the nutrient quality of all vitamins and minerals tested improved in children after food fortification had been implemented.

2.10 Consumer awareness and perceptions of fortified foods

According to Pambo *et al.* (2014), there is a lack of empirical information on consumers' awareness for fortified foods and this remains the barrier to the uptake of these enriched foods. Purchasing from supermarkets, the age of the consumer, reading of newspapers, marital status, years of formal education, location area and whether a household has infant members plays an important role in the awareness of consumers on food fortification. Consumers perceive price and nutrition to be the most important consumption factors, although in overall price and sensory characteristics (measured as taste/ flavour and colour) were found to be ranked higher than nutrition.

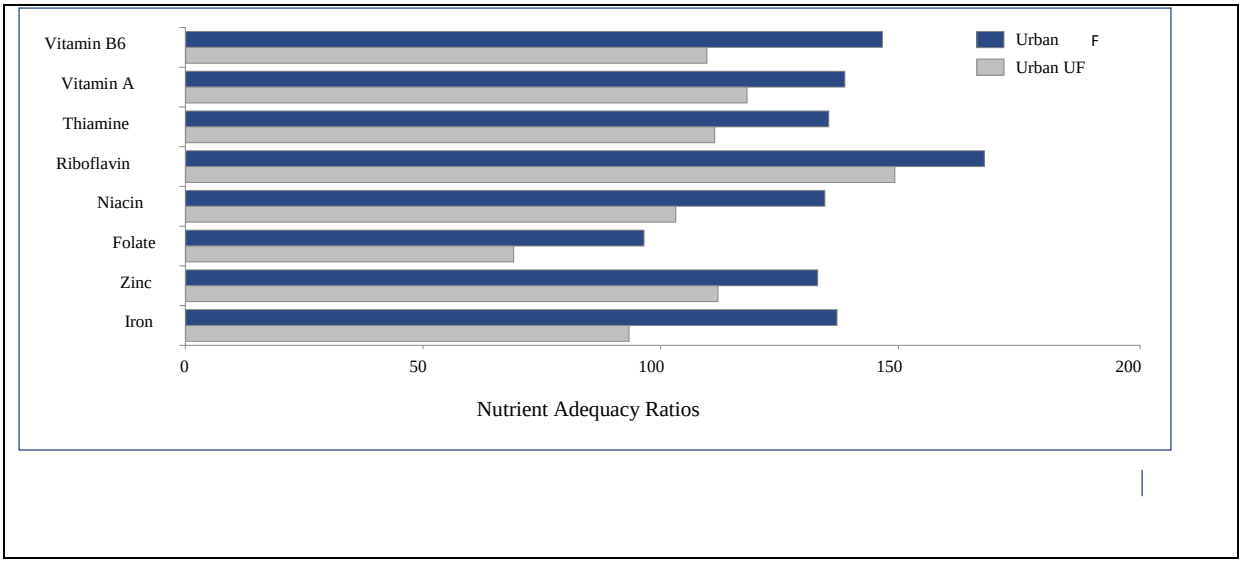

Figure 2. 5: **Mean nutrient adequacy ratios of children in urban areas of South Africa before (UF) and after food fortification (F) of staple foods according to the South African government regulations** (Source: Steyn *et al*., 2008)

The *Institut de Publique Sondaage d'Opinion Secter* (IPSOS) (2010) reported that there are more negative than positive perceptions on food fortification. Consumers have skepticism regarding the health value of fortified foods, there is mistrust in the motivations of food fortification being utilized as a skill to market unhealthy foods as healthy. Fortified foods are normally perceived to cost more than non-fortified foods. There is a low understanding of the term fortification and is interpreted as concentrated or "with added alcohol" hence consumers were found to prefer the term "with added vitamins and minerals".

2.11 Media communication and information

According to Verbeke (2008), communication and information supply efforts can have an impact in terms of changing consumer's knowledge, molding their attitudes and re-managing their decision-making process in food choices and dietary conduct. The role and potential effect of communication-related to food products have gained considerable awareness. Consumers were reported to demand information that will assist them to obtain more nutrition and sustain an improved diet, to avoid allergens and to know the origin, environmental, ethical and technological conditions under which the food was produced. This is because health and nutritional value are product factors that cause the determining purchase intentions and choice although they are weighed heavily against preferences such as taste, price, and convenience.

2.12 Summary

This chapter reviewed the literature on household food baskets, consumer food purchasing patterns and the key drivers of food basket choices. The concept of food security was critically discussed. Food fortification history, its progress in South Africa as well as the perception and awareness from consumers was also discussed. The discussion of drivers of food basket choices has led to the conclusion that household income is the most important driver as it dictates the quantity and quality of food purchased for a household. Food fortification although introduced in 2003, still has not reached the goals set for the program. Micronutrient deficiencies are still prevalent and there is not much research on the acceptance and perception of food fortification from South African consumers. The chapter also highlighted the advantages and disadvantages of food fortification realized so far.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the research methodology, that is, data collection and analysis for the study. A description of the urban areas studied includes issues prevailing in the areas. Questionnaire administration used for data collection and analysis techniques will then be discussed.

3.2 Study Areas

The study was conducted in urban areas of Edendale and Sweetwaters in the uMsunduzi Local Municipality represented by Figure 3.1. Edendale is located about 10 kilometers south-west of the Pietermaritzburg City. According to the 2011 Census, it has a population of 140 891 people with 37 208 households. Amongst those households, there are 74 622 females and 66 269 males. The Edendale area has a shopping mall, which is convenient for consumers as traveling costs to purchase goods are low. The mall was opened in 2011 in order to decrease traveling costs for Edendale residents as well as nearby areas. Employment opportunities are low in the area and unemployment is prevalent. The area also consists of informal settlements as well as a high rate of crime. The Edendale area was chosen for this study due to the food insecurity that it experiences

Figure 3. 1: **Map of KwaZulu-Natal with special focus on the uMsunduzi municipality**

Sweetwaters is an urban area under a tribal authority, 17 kilometers north of Pietermaritzburg in KwaZulu-Natal. It has a population of between 50 000 and 60 000 people and is characterized by poor housing and a limited supply of essential services and facilities. There are 51 percent (Census, 2011) households in Sweetwater, which are single-parented or are child-headed households and 39 percent of households who suffer from poverty in the area in addition individuals lack the skills or the financial means to produce food (Census, 2011; STAT SA, 2011).

3.3 Research Design

According to Babbie and Mouton (2001), research design is the plan, which provides the overall framework for the collection of data as well as an outline of the detailed steps taken to ensure the success of the study. This study was mainly explanatory and was conducted using

quantitative research in the form of a survey. Quantitative research is the gathering of hard data in the form of numerical values to enable evidence to be represented in quantitative form (Neuman, 2003). Quantitative research emphasizes objective measurements and statistical data analysis through questionnaire and surveys. The quantitative approach was deemed feasible and efficient for the study as it allowed collection of data to explore the different relationships that investigate whether food fortification has had any implication on household food security through several variables, namely; the daily household diets consumed by individuals or consumers, socio-demographic factors, level of awareness of food fortification, food purchasing patterns and underlying reasoning for preferred food.

Administering of questionnaires was managed in the home environment in order to minimize unwillingness to participate. The questionnaire collected relevant data from households. The design of the questionnaire was developed according to the specific objectives of the study with mainly close ended questions to avoid inefficient responses such as "uncertain/I do not know". The questionnaire was developed in an easy to follow manner such that questions did not cause confusion between the enumerator and respondent. The questionnaire was divided into the following sections, namely; basic demographic information, food fortification awareness and nutritional knowledge, list of household food baskets and food consumption patterns in the form of the household dietary diversity score.

Six enumerators were trained on all aspects of the questionnaire and were chosen on the basis of prior experience. Enumerators were trained extensively on each question to ensure proper understanding of what was expected for efficient data.

3.4 Sampling Procedure

Sampling design is one of the most fundamental elements of data collection for any scientific research and plays a significant role in ensuring that data is sufficient to draw necessary conclusions (Jennings, 2001). The sampling units for this study were urban and peri-urban households in the area of Sweetwaters and Edendale. A sample of 200 households was drawn from approximately 1031 households. According to Mugenda and Mugenda (2003), research requires ten percent of accessible population is adequate as a sample size. The total population was found to be extremely large to be studied in its totality due to constraints such as financial, time and personnel, hence the study limited itself to the sampled households. Simple random sampling was used to select the households for the study. Simple random

sampling is the basic sampling technique where a group of subjects are selected (a sample) for a study from a larger group (a population). Each individual is chosen entirely by chance and each member of the population has an equal chance of being included in the sample (Salganik and Heckathorn, 2004). The technique provides valid estimates of population parameters permitting valid deductions about the whole population. Simple random sampling was found to be suited for the study as t represented the various socio-demographic types of households that are found in the UMsunduzi Municipality area. A 100 households were sampled in each study area, making a total sample size of 200 households.

3.5 Data Collection

Quantitative data collection through a structured questionnaire took place between May and June 2016. The questionnaire had different sections that interviewed households on demographics, whether consumers purchase fortified foods, awareness of consuming fortified foods, how they acquire their food basket, where it is acquired, food basket items, household expenditure as well as preferences and tastes that influence the food basket.

The questionnaire was pre-tested on five non-sampled households in the two urban areas. The five non-sampled households were randomly selected, and the questionnaire was administered to understand whether it flowed well. After pre-testing, the questionnaire was modified accordingly. Enumerators were trained before data collection to familiarize them with the questionnaire. The enumerators in this study interviewed and filled the questionnaires on behalf of the respondents. Face-to-face interviews with households ensured direct communication and this was necessary to ensure clarity with the questions in the questionnaire.

3.6 Data analysis

3.6.1 Descriptive Statistics

The Statistical Package for Social Sciences (SPSS version 21) was used to analyze the survey data. Data presentation tools in the form of tables, bar graphs, and pie charts were used to report broad demographic data, relationships between variables and summaries.

The Chi-square test was employed to determine significant relationships between variables such as employment status, educational level and purchasing of fortified foods in urban areas;

relationship between employment status, household income, gender, educational level and knowledge of food fortification; association between socio-demographics of urban households and food choice factors and factors associated with fortified food product awareness among respondents.

3.6.2 Determining the calories consumed at the household level

To determine the calories consumed at the household level, the average food basket was adapted from the National Agricultural Marketing Council report, which includes 54 food items commonly purchased by South African consumers (NAMC, 2015). These food items were separated into different food groups namely; wheat products, maize products, sunflower products, processed vegetables, fresh vegetables and fruits, processed meat, unprocessed meat, dairy products, fish products and miscellaneous food items following the Income and Expenditure Survey (IES) of 2014/2015 (STAS SA, 2015). Households were interviewed on food items they usually purchased on a monthly basis, the quantity, and frequency. This was done to determine how much food the household consumed and whether it was adequate for the month as per recommended daily intake in kilojoules/ kilocalories. Households were also interviewed to observe whether they purchased fortified foods and are aware of their benefits.

Energy conversions adapted from the South African Medical Research Council (Rose *et al.*, 2002), were used to calculate the metabolizable energy value of each food item households purchased. The medical research council provides composition tables for condensed foods of different food items purchased in South Africa. To calculate metabolizable energy, the amount of protein, carbohydrates (available carbohydrates plus dietary fiber), total fat and alcohol (when applicable) was multiplied by the general Atwater factors (Wolmarans, 2010). The Atwater system was utilized to calculate the available energy of foods (FAO, 1981). The food item energies were tallied for all factors necessary to represent the complete nutritional value for human consumption. The Wolmarans (2010) notes that no allowance was made for the energy contributed by amino acids when the vegetables and fruit groups were updated. It was also noted that amino acid may have contributed up to 15 kilojoules per gram.

Microsoft Excel was used to perform calculations as to whether households were consuming the recommended calories per day. Households' lists of food items purchased in their food basket were recorded and segmented into different columns food item purchased, in grams,

frequency of purchase per month. Thereafter, a separate column for total kilojoules consumed per household per month. The total kilojoules consumed per household per month was then divided to total kilojoules consumed per household per day and thereafter divided by the number of household members to approximately identify how much each individual in the household is consuming per day in kilojoules. The amount of kilojoules was converted to kilocalories.

According to the WHO (2015) for a healthy, balanced diet, an average male requires an estimate of 2500 kilocalories and 2100 kilocalories for an average female on a daily basis. The amount of energy required per individual depends on their age, lifestyle, and weight. For the purposes of this study, the recommended daily energy intake for men and women was used to compare whether households were consuming enough energy.

3.6.3 Determinants of fortified foods awareness

The study assessed the determinants of food fortification awareness amongst households. Binary logistic regression estimates the probability that a character is present, given the values of explanatory variables where in this study a single categorical variable is used (Weisberg, 2005). This is denoted as follows:

Model: $$\pi_i = \Pr(Y_i = 1 | X_i = x_i) = \frac{\exp(Bo + B_i X_i)}{1 + \exp(B_o + B_i X_i)}$$

(Model adopted from Weisberg, 2005)

Where Y is a binary response variable

$Y_i = 1$ if the respondent is aware of food fortification

$Y_i = 2$ if the respondent is not aware of food fortification

$X = X_1, X_2 \ldots\ldots X_k$ be a set of explanatory variables

B_o = the constant term in the model

B_1 = a vector of the variable coefficients for $i = 1 \ldots k$

Independent variables in the model are explained below:

The gender variable is a categorical variable and represents the gender of the household head. The variable was coded as 0= female and male= 1. Ruel (2006) reported that female individuals have better nutritional knowledge than male individuals due to females taking care of the children in the household most of the time. It is therefore hypothesized that the relationship with this variable can either be positive or negative with food fortification awareness.

The age variable is a continuous variable and represented the age of the household head. Mohajeri *et al.* (2015) suggested that age is important to nutrition education as younger people are more likely to grasp this knowledge and utilize properly than older individuals. Therefore, it is hypothesized that the age variable is more likely to have a negative relationship with food fortification awareness.

The marital status is a categorical variable and represents whether the household head is married or unmarried. The variable was coded 0 = Not married and 1 = Married. According to Victoria *et al.* (2008), married individuals are more likely to be healthier and at a lower risk of death than those who are unmarried due to the marital role influencing health consciousness. Contrary, Ruel (2006) reported that individuals with poorer nutritional knowledge tend to fall into certain categories, with the marital status of the household head negatively affecting nutrition knowledge if married. Therefore, it is expected that the marital status can have either a positive or a negative relationship with food fortification.

The employment status is a categorical variable and represents whether the household head is employed or unemployed. The variable was coded 0= Unemployed and 1= Employed. An employed household head is more likely to be aware of fortified foods as being employed is linked with acquiring information, the need to improve productivity by increasing energy and changing the diet (Mohajeri *et al*., 2015). It is expected that the household head employment status will have a positive relationship with food fortification awareness. It is assumed that a household head who is employed is more likely to be aware of food fortification.

The education variable is a categorical variable and represents whether a household head has any form of schooling or not. The variable was coded 0= No schooling and 1= Has a form of schooling. Education is an important instrument for enhancing the well-being of individuals

as it decreases the need for health care and promotes healthier lifestyles as well as positive choices (Farrell, 2014). Therefore, the education variable is expected to have a positive relationship with food fortification awareness. It is assumed that an educated household head is more likely to be aware of food fortification.

The household members variable is a continuous variable and represents the number of household members in a household. According to Caswell and Yaktine (2013), as household size increases, the food items for each household member is decreased due to meals being prepared cooperatively and spread over more individuals. The household members variable is therefore expected to have a negative relationship with food fortification awareness. It is assumed that an increase in household members will decrease the likelihood of fortified food awareness.

The planting variable is a categorical variable and represents whether a household participates in home production or not. The variable was coded 0 = No and 1 = Yes. Home gardens are a platform for promoting nutrition, increasing preferences for fruits and vegetables and diet diversification. The planting variable is expected to have a positive relationship with food fortification awareness. It is assumed that participation in home production increases the likelihood of a household being aware of fortified foods.

The media variable is a categorical variable that included four different variables, which included whether respondents listened to the radio, read the newspaper, attends any health institutions and those who watch television regularly or not. Different forms of media can be influential to eating habits as households are exposed to several advertisements per day, most of these advertisements focus on foods such as sugar-sweetened cereal, candy, sugar-based beverages and fast food. Therefore, it is expected that different media avenues have a negative relationship with food fortification awareness.

The total household income variable is a continuous variable and represents the monthly total income received by the household head. As total household income increases, households have increasing purchasing power as the household is able to afford a healthier household food basket. It is expected that household head monthly income will have a positive relationship with food fortification awareness. It is assumed that an increase in total household income leads to the likelihood of food fortification awareness. Table 3.1 summarizes the expected outcome between the dependent and independent variables.

Table 3. 1: Expected relationship outcome amongst chosen dependent and independent variables

Independent Variable	Categorical/Continuous	Expected Outcome
Dependent Variable is Fortification Awareness		
Gender	Categorical	-/+
Age	Continuous	-
Marital Status	Categorical	-/+
Employment Status	Categorical	+
Education	Categorical	+
Household Members	Continuous	-
Planting	Categorical	+
Media	Categorical	-
Total household income	Continuous	+

3.6.4 Household Dietary Diversity Score (HDDS)

The household diet diversity score was used for this study to assess the frequency consumption of different food groups in the last seven days from the time of performing the survey. Respondent's answers were analyzed and scored to assess how diverse each household's diet is. Scores from the HDDS range from zero to twelve where each food group carries a score of one, with zero being the lowest score and 12 being the highest. FAO (2013), states that dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of food and is also a proxy for a nutrient adequacy of the diet of individuals. Several studies have found that a close relationship exists between socio-economic factors and household food security when assessing diet diversity through the years (FAO, 2013; Hoddinot and Yohannes, 2002; Hatloy *et al.*, 1998).

According to Swindale and Bilinsky (2006), the household dietary diversity score is an important tool in measuring diet diversity. Developed by Food and Nutrition Technical Assistance, it is defined as the number of food groups consumed over a given period and is calculated by the sum of the different kinds of food groups consumed at the household level after the recall. These tools are increasingly being utilized in food and nutrition security surveys to assess access and the dietary quality of household members or individuals

according to the study's objectives. Although the household diet diversity score is used widely as a measuring tool, it has certain disadvantages. Fortified foods are not usually included because the information captured is mostly used for primary uses, there is also uncertainty about which food groups to cover and exclude and this raises concerns as different studies cannot be completely compared to one another due to the different food groups included (Lynman *et al.*, 2010).

According to Ruel (2003), when dietary diversity is measured at the household level, it is considered an indicator of food security as dietary diversity shows the level of access a household has on food. Household diet diversity scores were collected from 200 households, then categorized to food secure and food insecure. This was done through categorizing households with a score less than and equal to six as food insecure and households with scores above six as food secure.

The Chi-Square test was used to determine whether a relationship exists between food fortification awareness, household diet diversity scores, and sociodemographic factors. Independent factors consisted of gender, marital status, education level, employment status, household medical issues, number of household members, garden owning, media, preferred supermarkets, the purpose of planting, price consideration, market specials, brands, nutrition, the age of the household head and child preferences. These independent variables were then compared as to whether they affect food security in terms of households who are aware and unaware of food fortification.

3.6.5 Determinants of fortified food purchasing

Binary logistic regression estimates the probability that a character is present, given the values of explanatory variables where in this study a single categorical variable is used (Weisberg, 2005). Binary logistic regression was used to determine household food security determinants using the HDDS score as the dependent variable.

This is denoted by:

Model: $$\pi_i = \Pr(Y_i = 1 | X_i = x_i) = \frac{\exp(Bo + B_i X_i)}{1 + \exp(B_o + B_i X_i)}$$

(Model adopted from Weisberg, 2005)

Where Y is a binary response variable

Y_i = 1 if the respondent is food secure

Y_i = 2 if the respondent is food insecure

X = X_1, X_2……X_k be a set of explanatory variables

B_o = the constant term in the model

B_1 = a vector of the variable coefficient for i= 1…k

The gender variable is a categorical variable and represents the gender of the household head. The variable is coded 0= male and 1=female. Westenhoefer (2005 reported that women have a higher intake of fruits and vegetables, dietary fiber than men and lower intake of fat. It is also highlighted that women usually attach greater importance to healthy eating. The gender of the household head is expected to have either a positive or negative relationship with fortified food purchasing.

The age variable is a continuous variable and represents the age of the household head. According to Drewnowski *et al*. (2001) as individuals become older they tend to consume lower intakes of food which is associated with lower intake of calcium, iron, zinc amongst other vitamins. This poses a health risk of diet-related illnesses. It is expected that an increase in age will decrease the likelihood of fortified food purchasing; therefore a negative relationship is expected.

The employment variable is a categorical variable and represents the employment status of the household head. The variable was coded 0=Not employed and 1= Employed. Employment in the household increases the chances for a household to be able to afford a nutritional food basket, unemployment decreases the amount spent on food leading to households sacrificing nutritional foods due to affordability. It is expected that the employment variable will have a positive relationship with fortified food purchasing.

The price variable is a categorical variable and represents whether a household considers prices of food items. The variable was coded 0= No and 1=Yes. Price consideration is common amongst low-income households (Ward, 2012). It is assumed that price consideration can decrease the chances of purchasing fortified foods. It is expected that price consideration will have a negative relationship with fortified food purchasing.

The food labels variable is a categorical variable that represents whether a household reads food labels when purchasing their household food basket. The variable was coded 0= No and 1= Yes. It is assumed that an increase in reading different labels of food items, increases the chances of purchasing fortified food. The food labels variable is expected to have a positive relationship with fortified food purchasing.

The health variable is a categorical variable that represents whether a household considers any health issues when purchasing their food basket. The variable was coded 0= No and 1=Yes. It is assumed that health issues consideration increases the likelihood of fortified food purchasing. It is expected that the health variable will have a positive relationship with fortified food purchasing.

The food fortification logo variable is a categorical variable and represents whether a household member can identify the food fortification logo. The variable was coded 0=No and 1=Yes. It is assumed that household members who are able to identify the food fortification logo increase the likelihood of purchasing fortified food. It is expected that the food fortification logo variable will have a positive relationship with food fortification purchasing.

The household members variable is a continuous variable and represents the number of household members in a household.

The amount spent on food is a continuous variable and is represented by the food expenditure utilized by a household. The relationship between the amount spent on food and household food security variable is expected to have a negative outcome. It is assumed that as the amount spent on food increases, the food fortification purchasing decreases as some households fail to afford all the required food items for a nutritious household food basket.

Table 3.2 shows the chosen independent variables and their expected influence on household food security status.

Table 3. 2: Expected relationship outcome amongst chosen dependent and independent variables

Independent Variable	Categorical/Continuous	Expected Outcome
Dependent variable: fortified food purchasing		
Gender (M/F)	Categorical	-/+
Age	Continuous	-
Employment	Categorical	+
Price Consideration (Yes/No)	Categorical	-
Health Consideration (Yes/No)	Categorical	+
Reading of Food Labels (Yes/No)	Categorical	+
Identification of Food Fortification Logo (Yes/No)	Categorical	+
Number of household members	Continuous	-
Food Basket Expenditure	Continuous	+

3.7 Ethical Considerations

Ethical approval was obtained from the University of KwaZulu Natal by the Humanities and Social Science Research Ethics Committee. Several ethical considerations were taken, namely: respondents were not subjected to any harm nor lack of dignity when participating in the study. Local leaders were contacted prior to data collection to attain full consent for the study as well as a full description of what the research entailed and what was required from participants with no financial reimbursements. Participants from respondents was voluntary and respondents were made aware of the right to withdraw at any stage of the interview. The questionnaire had no use of discriminatory or any other inappropriate language, in addition privacy and anonymity of respondents was paramount.

3.8 Summary

This chapter has given an overview of the methodology used to determine the multiple factors of household food security, food fortification awareness as well as what is consumed in the household. Data was collected from 200 households of the urban and peri-urban areas of Sweetwaters and Edendale in Msunduzi Municipality. The random sampling procedure was used to select the sample of households. To collect data, a structured questionnaire was administered to respondents through face to face interviews. The results are presented in the next following chapters.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the survey data analysis. The section firstly presents the demographic data of the sampled households. Secondly, relationships between employment status, educational level of the household head and purchasing patterns of fortified food is explored as well as the association between educational level, employment status and knowledge of fortified foods. Purchasing patterns between aware and unaware households were also observed. Lastly, the section presents the determinants of fortified food awareness and fortified food purchasing using binomial regression.

4.2 Demographic characteristics of the sampled household heads

In this section, demographic characteristics of the household heads are discussed. The variables include; gender, age, marital status, employment status and educational level.

4.2.1 Gender and marital status of household head

Results showed that about 61 percent of households were female-headed. Household heads' marital status was divided into four categories; namely: single, married, widowed and divorced. Results showed that 43 percent households were single, about 38 percent were married, 17 percent widowed and 2 percent were divorced.

These results are comparable to those reported by STATS SA (2011), who found that there are more female-headed households than male-headed in KwaZulu-Natal and Eastern Cape provinces. Households may become female-headed due to never being married, widowed, divorced as well as abandonment by a partner (Budlender and Woolard, 2006). While there is a high number of female-headed households, it has been suggested that it leads to a household being more exposed to poverty due to financial constraints from working fewer hours as they must adhere to domestic responsibilities and therefore are more susceptible to food insecurity (Oxfam Research, 2014).

4.2.2 Employment status of household head

Household heads employment status was divided into six categories; unemployed, full time employed, part-time employed, doing informal work, self-employed and pension holder. Households had a small percentage of heads in formal full-time employment (about 23 %).

Most household heads either were unemployed (26 percent) or on pension (37 %) (Figure 4.1). These results corroborate those of STATS SA (2016) who reported that unemployment in KwaZulu-Natal reached 36 percent in 2016, which increased the levels of poverty in the province. Households who have unemployed heads are more likely to be prone to food insecurity. Unemployment affects household income, which in turn affects food accessibility of all household members. Households who are unable to meet their daily food requirements are also susceptible to illnesses and micronutrient deficiencies. A high number of households had household heads on pension, where the social grant was their only source of income. This reduced the amount of income spent on food regardless of household size. Stein and Qaim (2007) suggest that households cannot survive on social grants as their only source of income.

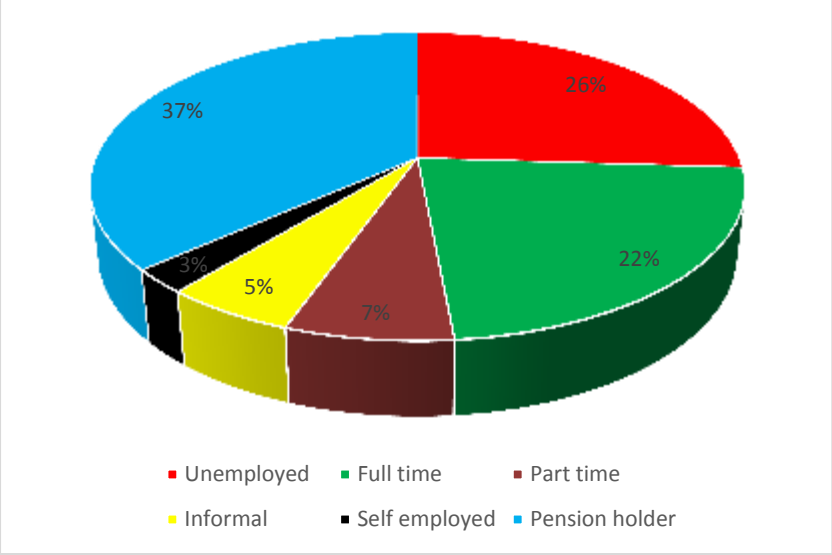

Figure 4. 1: **Employment status in sampled households**

Source: Survey data (2016)

4.2.3 Household head educational level

Most household heads had a secondary level of education (60 %) whilst the lowest percentages had tertiary (7%) educational level (Figure 2).

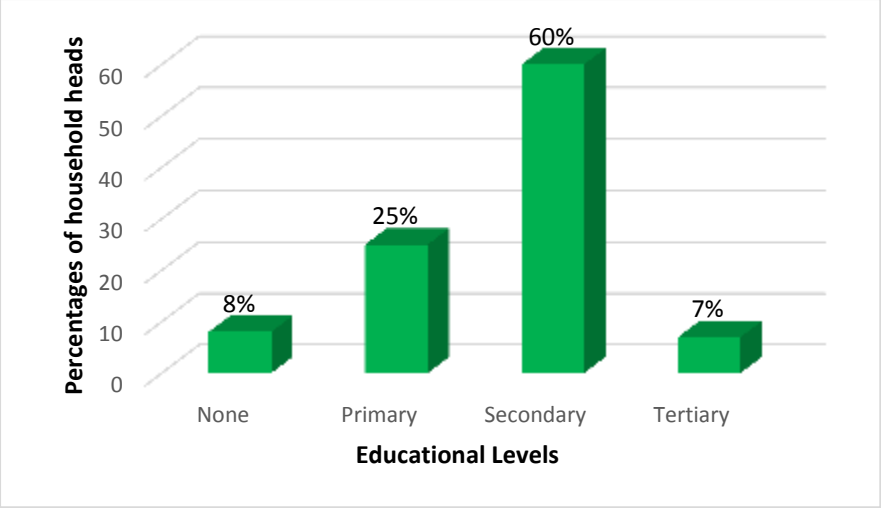

Figure 4. 2: **Distribution of educational levels amongst sampled households**

Source: Survey data (2016)

The educational level of the household head is important in understanding awareness of food fortification. Higher levels of education are associated with better nutritional awareness (Mangusho, 2013). Bashir *et al*. (2012) found a positive relationship between educational levels and household food security. This suggests that a lack of education may ultimately lead to food fortification unawareness as well as poor access, stability and utilization of food in the household.

4.2.4 Garden ownership and their uses

Households were interviewed on whether they grow fruits and/or vegetables. It was found that that 92 percent household of the sample planted different fruit and vegetables whilst 8 percent households did not part take in home gardening.

Figure 4.3 shows the reasoning behind home gardening amongst households where the most common reason was household consumption (85%). Results show that 85 percent of the sample planted the crops for household consumption only and 7.0 percent for both household consumption and selling. Figure 4.4 shows the different kinds of crops planted by households who own gardens. Food production for own consumption is a viable way of alleviating food insecurity. Baiphethi and Jacobs (2009) suggested that households that plant fruits and vegetables tend to be less exposed to hunger, food insecurity and micronutrient deficiencies.

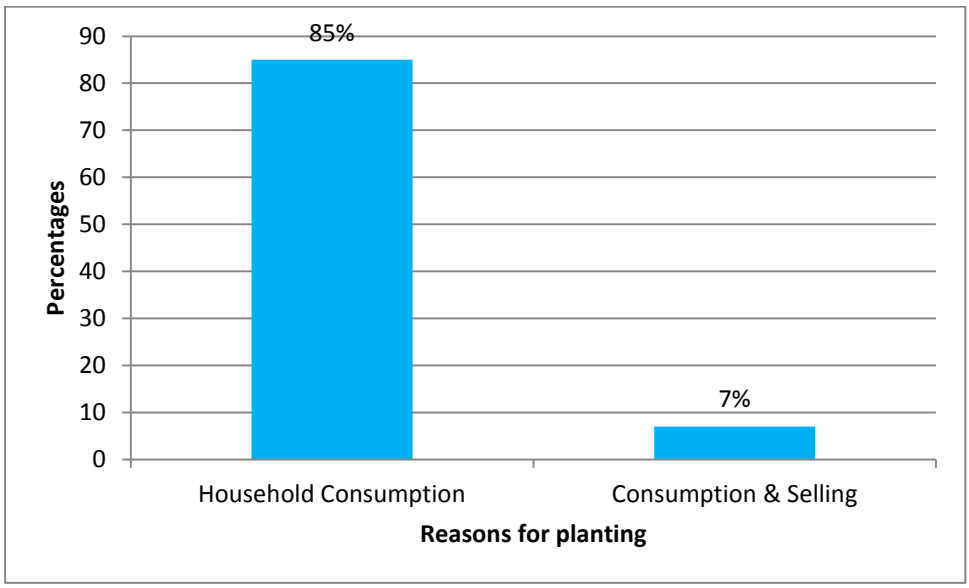

Figure 4. 3: **Reasoning for home gardens amongst households**

Source: Survey data (2016)

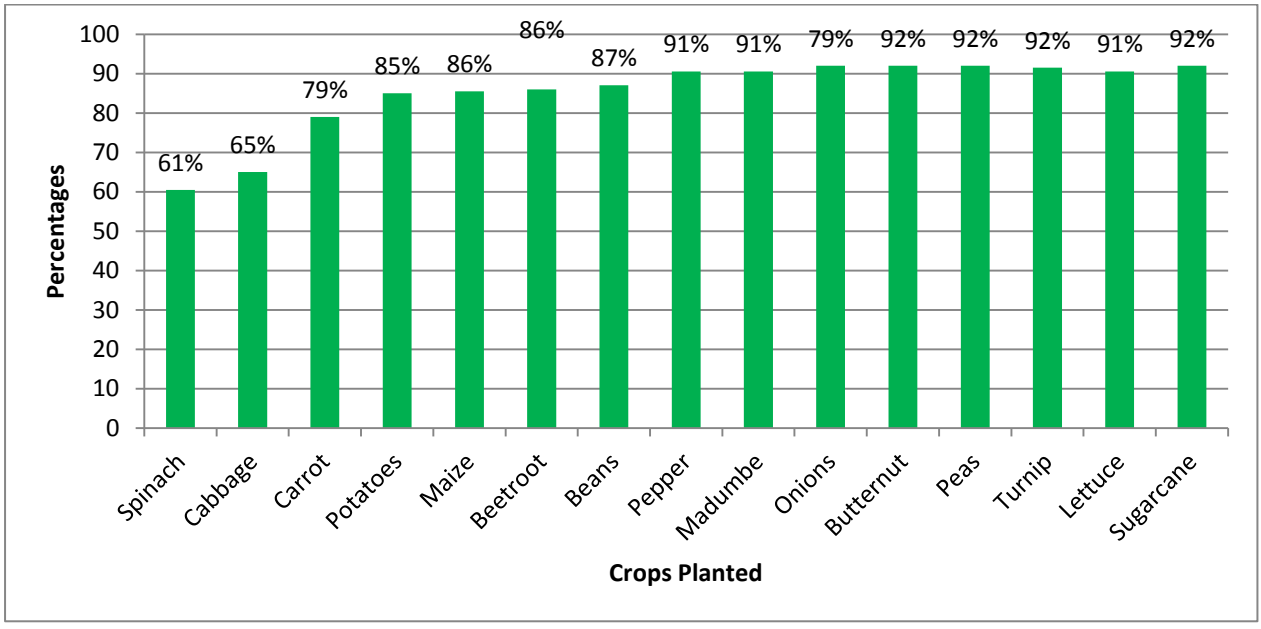

Figure 4. 4: Percentage of households planting different crops

Source: Source data (2016)

These results are similar to UNICEF (2014) showing that households use home gardens as a means of supplementing their diet, with only a few using them for increasing household income. In this study, home gardens provided diversity in the household's diet as well as a reduced the income spent on food. Lack of land or financial constraints to purchase the necessary material for planting was the reason some households did not plant crops.

4.2.5 Common sources of nutrition information amongst households

Figure 4.5 represents the common sources of nutrition information for households. Most respondents received nutrition information via the television (31%), followed by health institutions (24%), newspapers (23%) and radio (22%). Some households had more than one source of information.

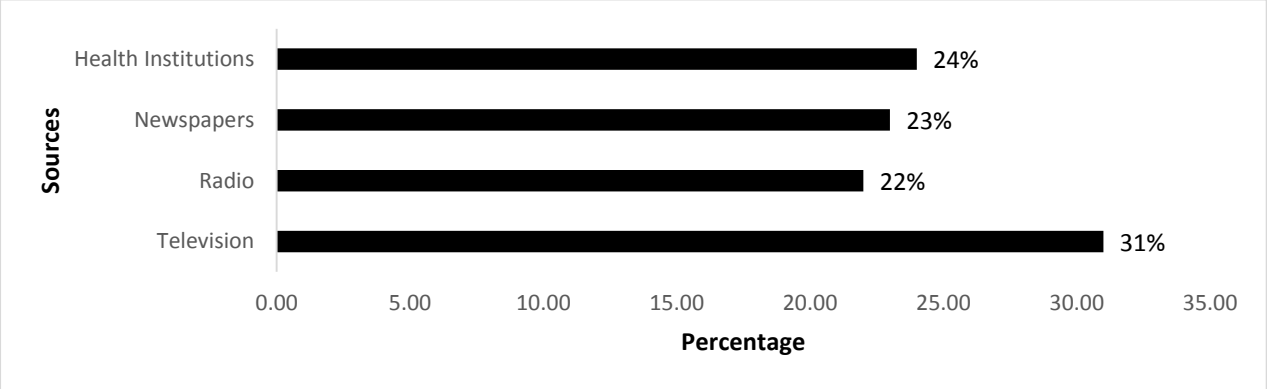

Figure 4. 5: Sources of nutrition information amongst households

Source: Survey Data (2016)

These results are similar to those of Motadi *et al*. (2016), where the most widely used media were television, newspaper, and radio in the Limpopo province. Motadi *et al*. (2016) also reported that media marketing was a vital aspect in the marketing of food fortification in 2004; the results further showed that although households were using different media, few were aware of the nutritional value, vis-à-vis food fortification. This suggests that marketing for food fortification is low and hence households are unaware of their benefits.

4.3 Relationship between employment status, educational level and purchasing of fortified foods in urban areas

Fortified food items were listed and presented to respondents to allow them to identify the foods they were purchasing. These food items were brown and white bread, maize meal, wheat flour and maize meal cereal. Respondents were divided by the employment status and the educational level of the household head to determine the significant factors influencing the purchasing of fortified food products. Tables 4.1 and 4.2 presents the results.

4.3.1 Employment statuses vs Fortified food purchases

There was no significant association between the employment statuses and purchasing of brown bread, wheat flour and maize meal based cereal. Most households purchase fortified foods regardless of the employment status of the household head or the awareness of fortified foods. This shows the effects of the government policy of fortifying foods that poor people eat. Results showed a statistical association in the purchasing of white bread across employment status. A household with employed heads purchased fortified white bread than those who were unemployed. The results suggest that this may either be because of taste preference, the price between white and brown bread or lack of nutritional knowledge.

4.3.2 Education levels vs fortified food purchases

Results showed a significant association between the educational level of the household head and purchasing of brown bread. There is no significant association between the educational level and purchasing of white bread, wheat flour, maize meal and breakfast cereal. Household heads with a higher level of education were associated with a higher frequency of purchasing fortified brown bread than non-fortified. All households sampled purchased fortified maize meal. A household head that has some form of education is more resourceful in items purchased for a household's food basket and is more likely to purchase nutritious foods.

Table 4. 1:Relationship between employment status and purchasing of fortified foods in urban areas

Item	**Fortification**	**Unemployed (%) n= 52**	**Full time (%) n= 45**	**Part time (%) n= 20**	**Informal work (%) n= 14**	**Self -employed (%) n= 6**	**Pension (%) n= 73**	**X^2 sig. level**
Brown Bread	Fortified	55	60	50	57.	100.	67	ns
	Not fortified	45	40	50	42	0.	33	
White Bread	Fortified	47	56	0	33	0	71	*
	Not fortified	53	44	100	67	0	29	
Cake Flour	Fortified	89	95	92	91	100	94	ns
	Not fortified	11	5	8.	9	0	6	
Maize meal breakfast Cereal	Fortified	64	61	40	67	100	72	Ns
	Not fortified	36	39	60	33	0	28	

*= significant at the 0.1 level ns= not significant n= 200 households

Source: Survey data (2016)

Table 4. 2 : **Relationship between educational level and purchasing of fortified foods in urban areas**

Item	Fortification	None (%) n=16	Primary (%) n=50	Secondary (%) n=120	Tertiary (%) n=14	X^2 sig. levels
Brown Bread	Fortified	71.40	55.80	57.90	92.90	*
	Not fortified	28.60	44.20	42.10	7.10	
White Bread	Fortified	77.80	55.60	50.00	100.00	ns
	Not fortified	22.20	44.40	50.00	0.00	
Cake Flour	Fortified	93.30	91.10	92.50	100.00	ns
	Not fortified	6.70	8.90	7.50	0.00	
Maize meal breakfast Cereal	Fortified	75.00	55.60	65.80	75.00	Ns
	Not fortified	25.00	44.40	34.20	25.00	

*=significant at the 0.1 level; ns= not significant; n= 200 households

Source: Survey data (2016)

4.3.3 Relationship between socio-demographic factors and knowledge of food fortification

Households were assessed on their knowledge of food fortification; a Chi-square test was used to analyze whether their socio-demographics had determined their food fortification knowledge. It was found that about 73 percent of the sample were unaware of food fortification whilst only about 27 percent were aware. This corroborates with results found by the Global Alliance for Improved Nutrition (GAIN) (2016) whereby 53 percent of consumers knew about food fortification in Tanzania. GAIN (2016) also showed that consumers had a negative perception of food fortification and its affordability. The household education level, employment status, and total household income significantly determined household awareness of food fortification as shown in table 4.3.

According to Motadi *et al*. (2016), education provides knowledge and skills to acquire different behaviour and increase individual empowerment and is the center of social and economic development. Lack of knowledge of dietary requirements and nutrition value of food items becomes the main cause of widespread malnutrition. This is similar to the results in this study as

no or primary education had fewer households who were aware of food fortification, while household heads educated to tertiary level had a higher probability of being aware of food fortification. Results showed a significant association across household income, where households earning less than R1000 per month had no knowledge of fortified foods, compared to 43.4 percent of households who earn greater than R5000 who had knowledge of food fortification.

Table 4. 3: Relationship between employment status, household income, gender, educational level and knowledge of food fortification

Employment status of household head	**Knowledge of food fortification**		**X^2 sig. level**
	Yes (%)	**No (%)**	
Unemployed (n= 52)	13.5	86.5	***
Full time employed (n= 45)	26.7	73.3	
Part time employed (n= 20)	28.6	71.4	
Informal work (n= 14)	9.1	90.9	
Self-employed (n= 6)	80.0	20.0	
Pension holder (n= 73)	37.0	63.0	
Gender			
Male (n= 79)	29.1	70.9	ns
Female (n= 121)	26.4	73.6	
Total Household Income Ranges			
<R1000 (n= 60)	0	100	***
R1000-R5000 (n= 75)	22.4	77.6	
>R5000 (n= 65)	43.4	56.6	
Educational Level of Household Head			
None (n= 16)	12.5	87.5	**
Primary (n= 50)	38.0	62.0	
Secondary (n= 120)	22.5	77.5	
Tertiary (n= 14)	27.5	72.5	

*=significant at the 0.1 level **= significant at the 0.05 level ***= significant at the 0.01 level ns= not significant N= 200 households (Source: Survey data, 2016)

4.4 Purchasing of fortified versus non-fortified maize and wheat-based products by awareness of food fortification

Table 4.4 represents the purchasing patterns of households who are aware and unaware of fortified foods. The food items chosen are maize and wheat-based products that were chosen as vehicles to decrease the number of individuals with micronutrient deficiencies in South Africa by the DOH in 2003 (Pretorius and Schoenfeldt, 2010). There is an association in the purchasing patterns between households who are aware and unaware of fortified foods. Households who are aware of fortified foods have a higher percentage who purchase fortified flour and bread whilst unaware households have a higher percentage of households who purchase non-fortified flour and bread.

Table 4. 4: **Purchasing of fortified versus non-fortified maize and wheat-based products by awareness of food fortification**

	Aware Group n= 145		**Unaware Group n= 55**	
Item	**Fortified (%)**	**Unfortified (%)**	**Fortified (%)**	**Unfortified (%)**
Flour	89.80	10.20	27.90	72.10
Brown Bread	53.20	43.80	65.60	34.40
White Bread	60.90	39.10	54.70	45.30
Maize meal Based Cereal	55.20	49.80	76.50	23.50

Source: Survey data (2016)

South Africa lacks empirical information on consumer awareness of food fortification and it affects their purchasing patterns. The study suggests that consumers who are aware of food fortification are more likely to purchase such items as they can identify them. Several ways were used to determine awareness of households, these include household head educational level, employment status, the frequency of shopping in supermarkets, identification of food fortification logo, reading of food labels and use of media that is television, radio, and newspapers. The results suggest that those who were able to identify the food fortification logo, read food labels, had higher media use, higher frequency of shopping, was employed and had a

secondary to tertiary level education were aware of food fortification and hence purchased these food items because of their nutritional value. Households who are unaware of food fortification, as shown in Table 4.4 tended to purchase unfortified wheat flour. This suggests that a greater effort should be taken to educate different areas of the benefits of food fortification.

4.5 Calories consumed at the household level

According to the FAO (2002), for a healthy, balanced diet, an average male required an estimate of 2500 kilocalorie and 2100 kilocalories for an average female, daily. Results showed that 72 percent of households consume much less than the recommended daily intake. An increase in household size resulted in decreased kilocalories consumed by individuals per day. Figure 4.6 presents the different household sizes and their corresponding average calories consumed.

These results coincide with those reported by Jacobs (2009), where households were found to be consuming small amounts of food due to low income and a high number of household members. FAO (2002), also discusses the importance of adequate daily calories, and emphasized that when an individual does not consume enough food it leads to a lack of significant nutrients, vitamins, and minerals that the body requires and without this sufficient nutrition, adults and children are more prone to diseases, less efficient and fatigued.

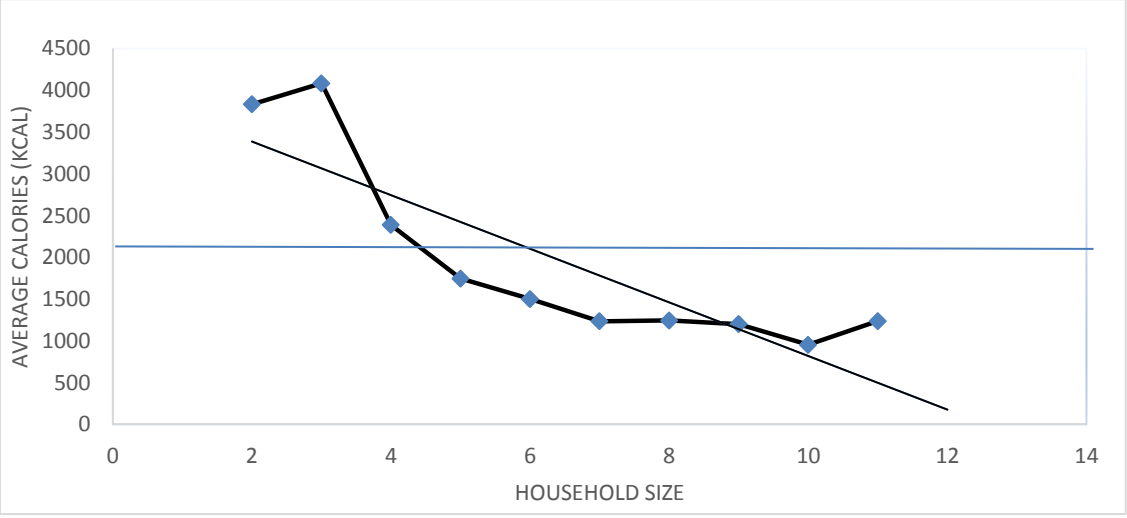

Figure 4. 6: Average calories consumed per individual across different household size

Source: Survey data (2016)

4.6 Survival food items amongst households in urban areas

Households were interviewed on the food item that is the most important in their household food basket. Respondents listed the food items they cannot survive without. Figure 4.7 shows the different food items important to households. The highest percentage of households (4746%) listed maize meal as a survival item. The results are in line with Jacobs (2012) who found that starch staple-type of food, namely maize, bread and rice comprise about half of the typical South African consumer's grocery budget. Maize meal is popular amongst low-income households as the impact of rising food costs typically decreases the amount and quality of food a household may purchase (Jacobs, 2009).

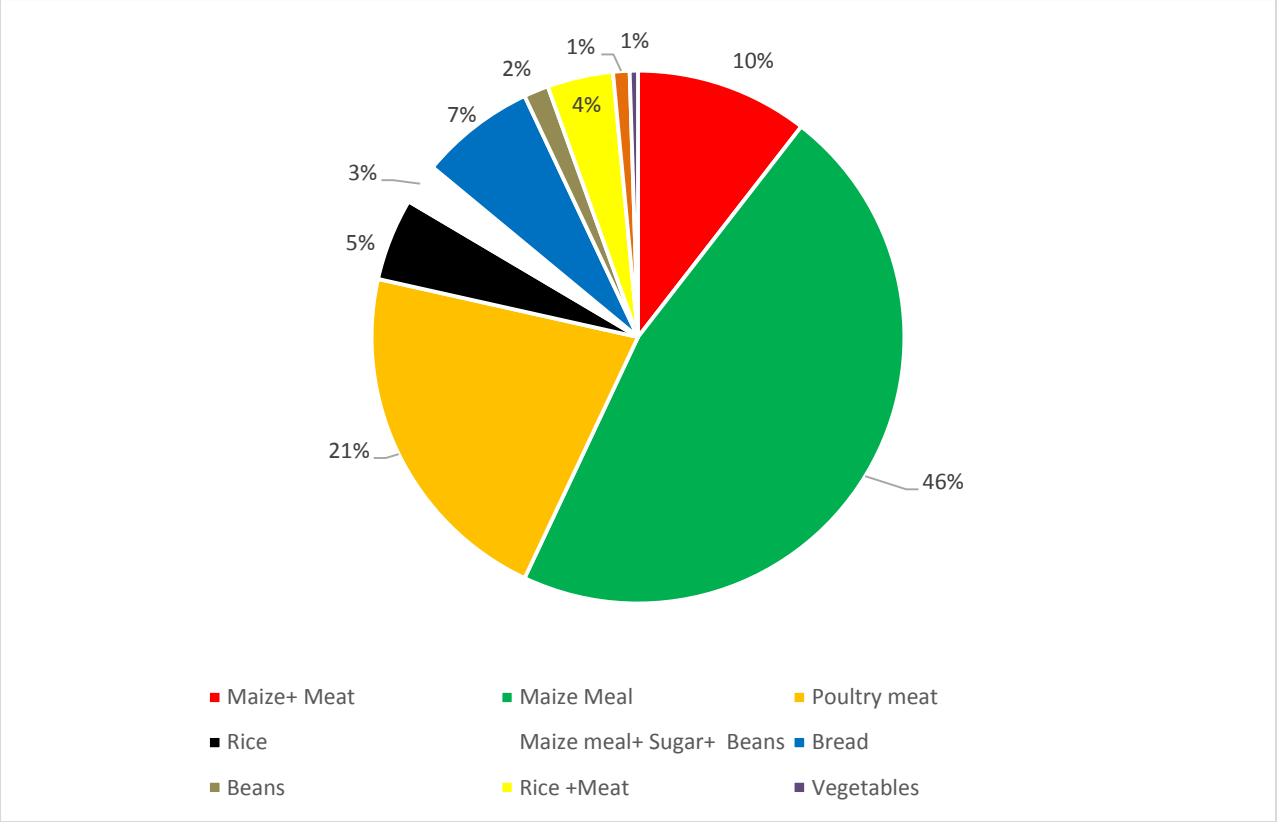

Figure 4. 7: Food items important amongst urban households

Source: Survey data (2016)

4.7 Factors that influence household food basket choices

Respondents indicated factors determining importance when purchasing monthly food baskets. Respondents were given the following factors; the price of food items, supermarket specials, child preferences, nutrition, cultural preferences and health benefits. A scale was utilized as the rating tool where; 1 = most important, 2 = important, 3 = less important, 4 = not important. Households indicated the factors they perceived to be important when purchasing their food baskets.

About 78 percent of respondents rated price as 'very important' followed by supermarket specials (about 57%), most respondents identified child preferences, and brands, nutrition, and food taste were by as 'not important' Figure 4.8. These results can be compared to those of Pambo *et al.* (2014) who reported that consumers perceive price as more important when faced with a choice between fortified and non-fortified sugar in Kenya, whilst nutrition is ranked low value when compared to food price. The results in this study suggest that price is an important factor with supermarket specials contradicting prior expectations nutrition and taste were listed as less important.

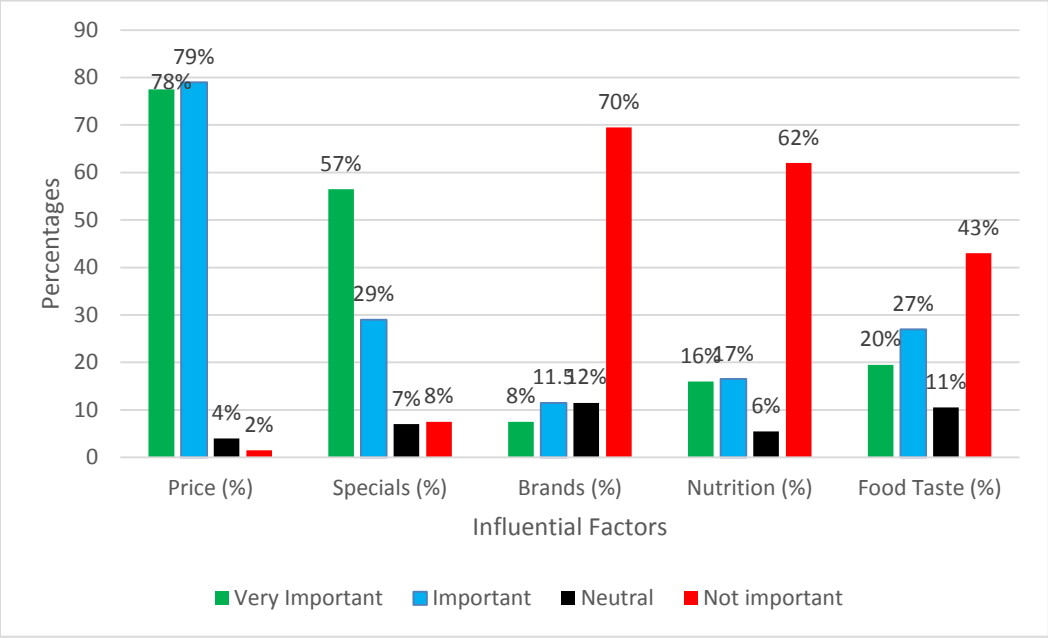

Figure 4. 8: Factors that influence household food baskets

Source: Survey data (2016)

4.8 Preferred shops

In households, the majority of foods consumed is purchased from supermarkets (Nord, 2010). Households were also assessed on which supermarkets they purchased their food baskets. Shops were divided into three categories, namely conventional supermarkets, thrifty supermarkets and both (conventional and thrifty supermarkets). Households were then asked for reasons for preferring these different types of supermarkets. Figure 4.9 and Table 4.5 represent preferred food stores and reasoning for the choices.

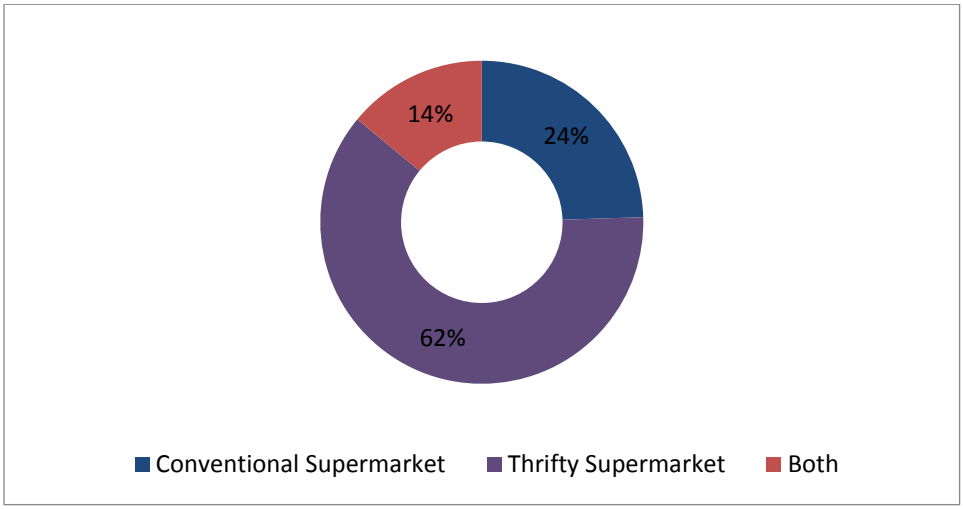

Figure 4. 9: **Preferred supermarkets amongst respondents**

Source: Survey data (2016)

A high number of households (62%) prefer to purchase their food baskets in thrifty supermarkets, where the most general reasoning behind this choice is the cheaper prices (61%). It was found that there is a significant association between where respondents purchase their household food basket and reasoning behind the choices. Purchasing in bulk is another reason that was offered by respondents (15%) as to why they purchase in thrifty supermarkets. This may be due to households having many members and purchasing in bulk which assists in food items being enough for a large household. Thrifty supermarkets allow consumers to purchase their household food basket items at a lower cost, expanding their limited budget which makes them

popular amongst households especially low-income ones. Most respondents place price of food items as the most important factor when purchasing their food basket. The reasoning behind purchasing in conventional supermarkets was found to be similar to that of purchasing in thrifty supermarket. Table 4.5 shows the different reasoning behind food purchasing patterns of respondents.

Table 4. 5: Reasoning behind preferred supermarkets

Preferred Shop	**Reasoning for purchasing shop**					
	Cheaper Prices (%)	**Bulk Purchasing (%)**	**Convenient (%)**	**Fresh Produce (%)**	**All of the above (%)**	**X^2 sig. level**
Conventional Supermarket (n=60)	51	4	4	10	31	***
Thrifty Supermarket (n=120)	61	15	6	3	15	
Both (n=20)	25	32	11	7	25	

***= significant at the 0.01 level

Source: Survey data (2016)

4.9 Household diet diversity, food fortification awareness and demographics relationships

There are a variety of statistically significant relationships between household food security status and demographic factors across awareness of food fortification as presented by table 4.6.

Table 4. 6: The effect of demographic factors in food security amongst food fortification aware and unaware respondents

Variable	Variable description	Aware			Unaware		
		Food Secure	Food Insecure	X^2 sig. Level	Food Secure	Food Insecure	X^2 sig. Level
Education	Has schooling **(%)**	75	25	**	78	22	ns
	No schooling **(%**	0	100		77	23	
Gender	Male **(%)**	83	17	ns	77	23	ns
	Female **(%)**	58	42		79	21	
Marital Status	Married (%)	94	6	***	79	21	ns
	Not married (%)	57	38		77	23	
Employment Status	Employed (%)	62	38	ns	70	30	ns
	Unemployed (%)	69	31		82	18	
Household Medical Issues	Has medical problems (%)	73	27	ns	88	12	***
	Does not have (%)	59	41		75	25	
No. of household members	0-3	100	0	ns	100	0	*
	4-6	67	33		76	24	
	>6	63	37		74	26	

Garden Owners	Does grow (%)	87	13	**	70	30	***
	Does not (%)	55	45		85	15	
Media	Watches TV (%)	54	46	**	86	14	**
	Does not (%)	80	20		69	31	
	Radio Listener (%)	52	48	**	94	6	***
	Does not (%)	83	17		70	30	
	Newspaper reader (%)	50	50	**	63	37	***
	Does not (%)	81	19		87	13	
	Attends health facilities (%)	46	54	**	75	25	**ns**
	Does not (%)	89	11		80	20	
Preferred Shop	Conventional supermarket (%)	72	28	***	94	6	***
	Thrifty Supermarket(%)	82	18		78	22	
	Both (%)	12	88		55	45	
Purpose of planting	Selling (%)	55	45	***	85	15	***
	Household	61	39		63	37	

	Consumption (%)						
	Both (%)				86	14	
Price consideration	Does consider (%)	71	29	**ns**	78	22	**ns**
	Does not (%)	100	0		100	0	
Market Specials	Does consider (%)	62	38	**	77	33	**ns**
	Does not (%)	100	0		100	0	
Brands	Does consider (%)	58	42	**ns**	90	10	**
	Does not (%)	74	36		73	27	
Nutrition	Does consider	58	42	**ns**	83	17	**ns**
	Does not (%)	74	36		74	86	
Age	<30 years	67	33	**ns**	35	65	***
	30-50 years	55	45		65	35	
	>50 years	80	20		87	13	
Cost of Food Basket	<R1000			***	31	69	***
	R1000- R1500	59	41		63	37	
	>R1500	80	20		100	0	

*, **, *** = significant at 0.1, 0.05 and = 0.01, respectively ns= not significant

Source: Survey data (2016)

Household Medical Issues

The relationship of household medical problems and food security had statistically significant outcomes. In the unaware group, those that had medical problems 88% were found to be more likely to be food secure than 75% of those who did not have any medical problems. This implies that medical problems in the household are an incentive for household members to consume a proper diverse diet and those that do not have medical problems have less urgency to keep their health status constant. This coincides with Wilde *et al*. (2006) who reported that although medical issues tend to increase household expenses, it may lead to household members being nutritionally educated hence making better diet choices.

Number of household members

A number of factors influence household food security include an increase in household size causes a decrease available to overall household members and may lead to micronutrient deficiencies (Zhou *et* al., 2016). The number of household members were found to have a significant effect on food security, only in the unaware group. Household members who were interviewed and had 0-3 members in a household were more likely to be food secure (100%). Households with members between 4-6 had a lesser percentage of 76% of households who were found to be food secure, which was similar for those who had household members greater than six individuals. This implies that as the number of household members increase, the chances of household members being food secure decreases.

Garden Owners

Participating in planting a garden has been widely promoted as a food insecurity intervention. Community gardens are said to improve household food security through uninterrupted access to diverse nutritious foods, increased purchasing power from savings of food expenses as well as income from selling produce (Shisanya and Hendricks, 2011) The relationship of households who own gardens and food security was significant in both groups of aware and unaware households of food fortification. In the aware group, those who own gardens were found to be more likely to be food secure (80%) than food insecure (13%) whereas those who do not own gardens had a lower chance of being food secure (55%). The results were similar for those in the

unaware group. This suggests that owning a garden increases the likelihood of a household to be food secure.

Media

Media has been found as an influential means of communication across countries and worldwide. The relationship between media and food security was found to be significant across both groups who are aware and unaware of food fortification. In the aware group it was found that those who watch television are less likely to be food secure (54%) than food insecure (46%). Households that do not watch television were also found to be more likely to be food secure (80%) than food insecure (20%). This implies that although television may not assist in households being food secure, when households are aware of food fortification. This concurs with Kamara (2017) who reported that media plays a significant role in creating awareness and influence policies within a country, therefore proper communication is vital, however there is a limited media coverage in communicating these issues.

Contrasting this, in the unaware group those who watch television have a higher chance of being food secure (80%) than food insecure (14%). Those who do not watch television are more likely to be food secure but at a lesser percentage (69%) than being food insecure (31%). This implies that for households who watch television although they are unaware of food fortification, are able to be equipped with knowledge and may make better food choice or diversify their diet leading to a better food security status than those who do not watch television and unaware.

Households who were in the aware group and listen to the radio were found to be less likely to be food secure (52%) whereas those who did not listen to the radio were found to be more likely to be food secure at a higher rate (83%). This implies that for households aware of food fortification, listening to the radio does not have any significant impact on their food security status or does not communicate enough information about nutrition for individuals to learn about diversifying their food. On the other hand households who were unaware and listened to the radio were found to be more likely to be food secure (94%) whereas households who did not listen to the radio and unaware were found to be less likely to be food secure.

Newspaper reading was found to have a small impact on whether a household is food secure or insecure, as households who do not read the newspaper and were aware were found to be more

food secure (81%). Those households who do read the newspaper were found to have a lesser chance of being food secure than food insecure. Similarly, those who were unaware and read the newspaper were also found to be less likely to be food secure (67%) than those who did not read the newspaper (87%). Attending health facilities had no significant impact on food security for households in the unaware group only. For the aware group, households who do not use health facilities were found to be more likely to be food secure. This implies that for aware households frequent attending of health facilities increases the likelihood of food insecurity whereas keeping a healthy balanced diet.

Shop Preferences

Preference of shops were separated into three categories; those who use conventional supermarkets, those who use thrifty supermarkets and those who use both conventional and thrifty supermarkets was found to have an effect on the food security status of a household. In the aware group households that use conventional supermarkets were found to be less likely to be food secure (72%) than Households that use thrifty supermarkets who were found to be more likely to be food secure (82%) , in contrast households who use both conventional and thrifty supermarkets were found to be least likely to be food secure (88%). This implies that the use of either conventional or thrift supermarkets increases the likelihood of a household being food secure whereas the use of both kinds of supermarkets places a household at risk to be food insecure, when aware of food fortification.

In the unaware group, households who use conventional supermarkets were found to be most likely to be food secure (94%). This implies that purchasing from conventional supermarkets suggests that may have a better chance of purchasing a nutritious food basket. Households that use thrifty supermarkets were found to be second placed in being food secure (78%). This implies that the use of thrifty supermarkets allows a household to be able to afford a diversity of food products/consumables for a certain number of household members with respect to household monthly income. The use of both supermarkets from the unaware group led to the lowest possibility of being food secure.

Purpose of planting

Efficient land use and healthy soils are important for food security. Household plant crops for either the diversification of diets or to sell produce to expand the household's income which can improve household food security (Shisanya and Hendricks, 2011). Purpose of planting was categorized in to three groups; those who grew crops for selling purposes, those who grew for household consumption and those who grew for both.

In the aware group, households who planted crops for household consumption or selling were statistically significant and were less likely to be food secure whereas in the unaware group households who planted crops for selling produce were most likely to be food secure. There were no households found who grew crops for the purposes of both selling and household consumption. This implies that planting crops for household consumption may increase the chances of a household to be food secure than any other purpose in aware households. In the unaware group, households who planted crops for selling or both selling and household consumption increase their chances to be food secure than any other purpose. This implies that although unaware of food fortification, these households once owning a garden can produce crops that have the required vitamins to improve their food basket while being able to afford other food items that cannot be produced either with selling the produce or with total household income. This also suggests that planting in the unaware group is more of an advantage to a household's food security status than when compared to the aware group.

Market Specials

Supermarkets use different types of strategies to attain a high number of customers. One of these strategies is called supermarket specials. Market specials are food products that are advertised for customers to show a decrease in the amount of money they usually spend on a food item in their food basket in order for them to purchase them in bulk (Bonki-Ankomah, 2001). Market specials in the aware group were found to give the likelihood that a household will be food secure if they do not consider them than compared to 62% if they considered them.

This implies that as households who do not consider market specials become food secure due to supermarkets placing market specials on unhealthy food, food that is about to expire or unfortified wheat and maize products (e.g. readymade store bread) . Households who do not

consider child preferences and aware of food fortification when purchasing for their food basket were found to be more likely to be food secure. Households who do consider child preferences were found to be more likely to be food insecure (77%). The results were similar for households who were unaware of food fortification. This may be because children require certain foods when still developing which cost more than commonly available adult consumables. This may lead to a shortage of food in the household if done so or an increase in the cost of the food basket.

Brands

Among the unaware group, households who were found to consider brands when purchasing food were more likely to be food secure (90%) whilst households who do not consider brands when purchasing although found to be food secure (73%). This could be because of common brands adhering to food product acts (e.g. food fortification), hygiene and consumer acts. This may lead to an increased chance of household members receiving the required minerals and vitamins they should be consuming from their food portions.

Age

Age was categorized into three groups; level one included household heads less than 30 years of age; level two applied to those who were above 30 to 50 years of age and level 3 applied to those above the age of 50. Age of the household head in the unaware group was found to have more likelihood to be food secure as age increased. This contradicts Mohajeri *et al.* (2015) who reported that age is important to nutrition education as younger individuals are more likely to grasp this knowledge and utilize properly than older individuals.

Food Basket Cost

Cost of food basket in the household had a significant effect on food security. In the aware group, no households spent less than R1000 for a food basket. Those who spend more than R1500 were found to be more likely to be food secure (80%). Households who spent an amount between R1000-R1500 for their household food basket were found to be less likely to be food secure (59%). This suggests that as the amount spent on the household food basket increases so does the chances of being food secure.

Households in the unaware group were found to have similar results. Households who spent less than R1000 on their food basket were found to be most food insecure (69%). Households who spent between R100-R1500 were found have better chances to be food secure (63%). Households who spent greater than R1500 were found to be food secure (100%) although unaware of food fortification. This corresponds with Brinkman *et al.* (2010) who reported that food access is determined by the price of food and the total household income which leads to members of any household decreasing their dietary diversity when responding to higher food prices. Similarly, Smith (2013) found that the cost of a basic food basket in South Africa increases annually and are found in some of the most important food items in the food basket such as maize meal.

4.10 Fortified food product awareness

This section presents the results of the different socio-economic factors associated with fortified food product awareness among respondents(households), the relationship between the awareness of fortified foods and the different factors that determine fortified food awareness that is that is education, employment status among others, as well the determinants of fortified food purchases amongst households.

4.10.1 Factors associated with fortified food product awareness among respondents.

The Chi-square test was used explore the relationship between factors that may affect fortified food awareness among respondents. Respondents were placed into two categories, that is., those aware of fortified foods and not aware. Differences in socio-demographic characteristics by awareness of household heads are shown in Table 4.7.

Statistically significant associations were observed between awareness of fortified food and the employment status, educational level and monthly income of the household head, on the other. This implies that the employment status, educational level and household monthly income of the household head are related to fortified food awareness of household. A larger proportion of the sample (about 73%) was unaware of fortified foods. Household heads who are employed may have the resources to purchase the necessary food items but that does not necessarily translate to a household being food secure (Altman *et al.,* 2009). Significant associations were found between food fortification awareness and the employment status ($p = 0.004$). From table 4.8, unemployed household heads are more likely to be unaware of food fortification whilst

household heads with some form of employment tend to be aware of fortified foods. In contrast to expectations, it was observed that there is a distinct number of pension holders who were found to be aware of food fortification.

Table 4. 7: Differences in socio-demographic characteristics of households by awareness of fortified foods

	Fortified food awareness		
Variables of the Household Head	**Aware (percent) n=55**	**Unaware (percent) n=145(72.5percent)**	**X^2 sig. level**
Gender			
Female (n= 121)	58	61	
Male (n=79)	42	39	ns
Marital Status			
Single (n=85)	53	39	
Married (n=75)	31	40	ns
Widowed (n=38)	16	19	
Divorced (n=2)	0	3	
Employment Status			
Unemployed (n=52)	13	31	
Full time employed (n= 45)	22	23	
Part-time (n= 20)	7	7	***
Informal-work (n= 14)	2	7	
Self-employed (n=6)	7	1	
Pension Holder (n=73)	49	32	
Educational Level			
None (n= 16)	4	10	
Primary (n=50)	35	21	**
Secondary (n=120)	49	64	
Tertiary (n= 14)	13	5	
Household Head Monthly Income			
R0.00- R3000 (n=60)	76	83	
R3001-R5000 (n=75)	5	9	**
>R5000 (n= 65)	18	8	
No. of household Members			
1-5 (n= 54)	53	52	
6-10 (n= 111)	47	45	ns
>10 (n=35)	0	3	

*, **, *** = significant at 0.1, 0.05 and = 0.01, respectively ns=not significant

Source: Survey data (2016)

Education is vital to the improvement of society (De Muro and Burchi, 2007) thus having some form of education exposes a household head to better life choices including healthy choices. A significant association was observed between the educational level of the household head and food fortification awareness (p=0.022). From table 4.7 there is a higher percentage of household heads who never attended school and those who have a secondary education who were unaware of food fortification. It was also observed that there was a higher percentage of household heads who have a primary and tertiary education who were found to be aware of food fortification.

A significant association was observed between household income and food fortification awareness (p=0.028). Households with a low income a high percentage of unaware household heads whereas households with a high income were found to have a higher percentage of aware household heads. A higher income allows households to be able to purchase a healthier food basket whereas a low income restricts households from attaining a substantial household food basket (Williams, 2010).

4.10.2 Factors that determine awareness of fortified food products among respondents

Binomial regression was used to assess the determinants of awareness of fortified foods across urban areas. The dependent variable is dichotomous and asked whether a respondent had any knowledge of fortified food. Using the Hosmer and Lemezhow test, the chi-square must not be statistically significant to prove that the model has accurate predictions, if the chi-square value is significant it shows misspecifications in the predictive capacity of the model. The chi-square value for the model was 0.129.

The Nagelberke R squared was 0.572, showing that the independent variable accounted for about 57 percent of the variability in the dependent variable. The data results fit the data well. Marginal effects were used to understand how fortified food awareness is affected by the various independent variables. Only significant variables are discussed below; The reference category for the dependent variable is “aware” of fortified foods. Table 4.8 represents the determinants of fortified food awareness.

Table 4. 8: **Determinants of fortified foods awareness**

Dependent variable is Fortified Food Awareness					
Variable	**Coefficient**	**Marginal Effect**	**Odds Ratio**	**Std. Error**	**Sig**
Gender	1.40	0.066	3.342	0.047	ns
Age	-1.83	-0.002	0.954	0.001	*
Marital Status	-2.52	-0.106	0.079	0.041	**
Employment Status	-2.80	-0.109	0.063	0.039	***
Total household income	1.95	5.820	1.000	0.000	*
Education	-0.29	-0.020	0.687	0.070	ns
Number of Household Members	1.95	0.015	1.373	0.007	*
Home gardens	-0.68	-0.020	0.639	0.030	ns
Television	-1.70	-0.063	0.279	0.037	*
Radio Listeners	0.63	0.023	1.583	0.036	ns
Newspaper Readers	0.38	0.011	1.280	0.031	ns
Health Institutions	1.78	0.083	4.262	0.047	*
Constant			0.401	0.827	ns

*, **, *** = significant at 0.1, 0.05 and = 0.01, respectively ns= not significant

Source: Computed from SPSS Survey data (2016)

The age of the household head had a statistically significant value (p=0.067) and a negative marginal effect value (-0.0022). Additional year decreases the likelihood of being aware of fortified foods this implies that as the age of the household head increases, the higher the chances of the household head being unaware of fortified food, holding all other variables constant. The results coincide with the hypothesized result. The age variable is important to the awareness of fortified foods. Mohajeri *et al.* (2015) reported that an increase in age generally leads to a systematic decline in cognitive processing. Younger individuals are expected to easily grasp the importance of nutrition education than older ones. In addition, the younger generation may have the need to sustain healthier bodies than older individuals.

The marital status of the household head had a statistically significant value (p=0.012) and negative marginal effect value (-0.105665). All other variables held constant, moving from being unmarried to married decreases the likelihood of being aware of fortified foods.. This could be due to single household heads being more attentive to what they eat as well as for their children. This contradicts Olayemi (2012), where it was reported that households headed by male unmarried spent a significantly greater amount of their food budget on fast food items whereas households headed by women regardless of their marital status were found to spend much less on fast food items.

The household head employment status had a statistically significant value (p=0.005) and negative marginal effect (-0.1092). All other variables held constant moving from being unemployed to employed decreases the likelihood of being aware of fortified foods. These results contradict the hypothesized result in that employment was expected to increase the likelihood of awareness of fortified foods, as an increase in income broadens food choices. Employment status and awareness of fortified foods vary in relationship as there are different categories of employment status. Luomala (2007), propose that unemployed household heads are more expected to read and be aware of nutritional knowledge than the employed. They additionally explain that retired or unemployed or retired and unemployed household heads may have more time to focus on issues related to their health.

The total household income variable was statistically significant (p=0.052) and had a positive marginal effect value. All other variables held constant, an increase in total household income by one unit increases the likelihood of a household being aware of fortified foods by 5.82 percent. The results coincide with the hypothesized result. A higher income increases food resources in the household to diversify the household's diet within the household members. According to Jacobs (2012), food prices position a barrier for consumers who are trying to maintain a nutritious food basket with affordability. Households tend to sacrifice healthy food items for energy-dense foods when total household income decreases. Higher income households are then more able to purchase whole grains, seafood, lean meats and low-fat milk.

The household members variable was statistically significant (p=0.051) and had a positive marginal effect value (0.01467). All other variables held constant, an increase in household members by one unit increases the likelihood of being aware of food fortification by 1.45

percent. The results contradict the hypothesized result, this could be due to Altman *et al.* (2009), an increase in household members may trigger household member to be more aware as to what they have in their diet, where the focus will not be on quantity but the nutrition.

The television variable was statistically significant (p=0.090) and had a negative marginal effect value (-0.06323). All other variables held constant, moving from not watching television to watching television decreases the likelihood of being aware by 6.32 percent. Media is an effective outlet to utilize for individuals to be more aware of current issues. According to Verbeke (2008), communication and information supply efforts can have an impact in terms of changing consumers' knowledge, molding their attitudes and re-managing their decision-making process in food choice and dietary product. Since television has a negative impact on food fortification awareness, it does coincide with the results reported by Pambo *et al.*(2014) that different forms of media can be influential to eating habits as households are exposed to several advertisements per day, where most of these advertisements focus on foods such as sugar-sweetened cereal, candy, sugar-based beverages and fast food and not on promoting healthy eating/ food fortification.

Nutrition education is any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition-related behaviors conducive to health and well-being. The health institution variable was statistically significant (p= 0.075) and a positive marginal effect (0.08315). All other variables held constant, moving from not attending health institutions to attending health institutions increases the likelihood of being aware of food fortification. The results coincide with the hypothesized result. According to Farrell (2014), nutrition education is delivered through multiple venues and involves activities at the individual, community, and policy levels, Health institution nutrition education-based programs can play an important role in promoting lifelong healthy eating. This is because dietary factors contribute substantially to the burden of preventable illness amongst other factors in households.

The determinants of fortified food awareness as found above (that is. age, marital status, employment status, number of household members, watching television, and attending health institutions) are similar to what is reported by Jacobs (2009) and Pambo *et al*. (2014) about the factors that limit the attainment of a nutritional food basket. This suggests that food fortification

awareness may also be one of the underlying problems of micronutrient deficiencies and food security. One can infer that households who have an unstable income cannot attain the necessary food items for the household and also tend to focus more on prices of food and bulk purchasing for quantity due to a large number of household members, this can lead to a monotonous diet as well as micronutrient deficiencies. Household food baskets that only contain staple food products as important items also suggest a lack of nutrition education.

4.11 Fortified food purchasing

Binomial regression was used to assess the determinants of fortified food purchasing in peri-urban and urban areas. The dependent variable is dichotomous and asked whether a respondent were purchasing any kind of fortified foods. Using the Hosmer and Lemezhow test, the chi-square must not be statistically significant to prove that the model has accurate predictions, if the chi-square value is significant it shows misspecifications in the predictive capacity of the model. The chi-square value for the model was found to be 0.129 and Table 4.9 presents the results thereafter.

4.11.1 Factors that determine purchasing of fortified food

This section presents the results of the different socio-economic factors associated with fortified food purchasing among respondents (Table 4.9). The section describes the different socio-demographics of positive and negative associations of fortified food purchasing. Each variable was chosen due to certain relationship expectations in the context of fortified food purchasing. Significant variables are discussed below.

Age of the household head

Age has been shown to be a significant variable in food choice decisions, individuals less than 35 are the most concerned about their health. In addition, respondents aged 35–54 are less knowledgeable about dietary issues than younger individuals (Darnton-Hill *et al.*, 2005). This indicates that there is a negative relationship between an increase in age and purchasing of fortified food products as younger consumers are known to be more careful in what they purchase in their household food basket. The age variable had a negative marginal effect and a

significant value (p= 0.012). All other variables held constant, an increase in age decreases the probability of household members purchasing fortified food products by 0.7 percent. This implies that the older a household head becomes, the less likely they purchase fortified food products although they were found that they do.

Table 4. 9: **Determinants of purchasing fortified food products**

Dependent variable is Fortified Food Purchasing					
Variable	**Marginal Effect**	**Coefficient**	**Odds Ratio**	**Std. Error**	**Sig**
Gender	0.022	0.26	1.140	0.082	ns
Age	-0.007	-2.40	0.956	0.003	***
Employment Status	-0.221	-2.51	0.221	0.077	***
Education	-0.156	-0.86	0.447	0.207	ns
Food Money	0.000	0.97	1.000	0.000	ns
Price Consideration	0.211	2.47	64.776	0.046	***
Food Labels	-0.033	-0.92	0.812	0.037	ns
Health Considerations	0.034	0.40	1.232	0.085	ns
Food Fortification Logo	0.892	6.32	405.424	0.036	***
Number of Household Members	0.046	2.22	1.330	0.201	**
Constant		2.00	0.009	0.022	**

*, **, *** = significant at 0.1, 0.05 and = 0.01, respectively ns= not significant

Source: Computed from SPSS Survey data (2016)

Price consideration

The cost of a food basket is an important predictor of whether a household may purchase fortified food items. This is because the total cost of a food basket is determined by the number of household members, different preferences of household members as well as the price of food items being purchased. Households may sacrifice other food items due to their price or choose a cheaper alternative to decrease the food basket expenditure. The price consideration when

purchasing a household's food basket had a positive marginal effect and significant value (p= 0.000) in households who assume they do not and do purchase fortified foods. All other variables held constant, an increase in price consideration when purchasing a household food basket by one unit increases the probability of a household falling into the category of assuming they do purchase fortified food items by 21 percent. This implies that as the cost of a household's food basket increases, it is more likely a household will assume they purchase fortified foods as compared to not knowing whether they purchase them or not purchasing them.

Household head employment status

The employment status of the household head plays a significant role in the kind of food being purchased in the household, this is due to affordability issues that may lead to a household only focusing on cheaper food items. The employment status of the household head variable had a negative marginal effect and significant value (p=0.004). All other variables held constant moving from unemployment to being employed decreases the likelihood of assuming fortified foods are being purchased. This implies that the employment status of the household head does not improve whether a household will know if they purchase fortified food products. This may be due to time constraints of employed individuals and financial constraints of unemployed individuals.

Food fortification logo identification

Most of the time a packaged item's labeling influences consumer purchasing behaviour. The reason behind this notion is that consumers have been found to evaluate food products through packaging. Since packaged food label contains multiple items like text, colour, and image, each item of the label has a different message for consumers. The text provides the processing techniques, nutritional information, price, manufacturing date and expire date whereas colour and image strike the cognition (Sablah *et al*., 2013). This report is similar with the results found in this study as respondents were asked whether they are able to recognize the food fortification logo to identify whether they pay attention to the messages conveyed to them through different food item labeling. All other variables held constant, the ability to identify the food fortification logo had a positive marginal effect and significant value (p=0.000). A household who is able to identify the food fortification logo increases the likelihood of purchasing fortified food.

Household members

The household members variable had a positive marginal effect and significant value (p=0.021). All other variables held constant, an increase in household members by one unit increases the likelihood of households assuming they purchase fortified foods by 4.6 percent. This challenges studies that have shown a decrease in the quantity and quality of foods accessed by households due to the increase of household size (Jacobs, 2012; Temple and Steyn, 2009). According to Flagg *et al.* (2014), household size may have mixed results in its bearing to food access, this is because an increase in household size does not necessarily mean a decrease in nutritional food consumed by households as other factors such as household income and level of education of household head play a role in food choice decisions.

Age, employment status, price consideration of food items, the ability to identify the food fortification logo and number of household members assist in predicting whether households may or may not purchase fortified foods as found in this study. From this information, one can infer that households that are not exposed to nutrition education and the benefits of it tend to have poor food choices in their food baskets or may not be able to utilize their food basket items in a proper manner. It can also be suggested that food choice may not be dictated by whether or not the household has knowledge of fortified foods but by the household income and how prices of food items affect the food basket expenditure. Households that place price of food items as an important influence are restricted in their food basket to purchase fruits and vegetables although they are important, and this coincides with reports from D'haese *et al.* (2013) and De-Cock *et al*. (2013) where low-income households tend to purchase less fruit, vegetables, and meat and purchase more of maize meal.

4.12 Summary

A high number of households are unaware of fortified foods and their intended benefits, most households purchased fortified food items however they were not aware of the fortification processes. Socio-demographic profiles of household heads and media avenues are critical in whether a household is aware or unaware of fortified foods, as this may lead to misuse of food even though it may contain enough nutrients for the household due to lack of knowledge and

skills to apply the knowledge. Results from the binomial regression also showed that numerous media avenues are not being utilized well enough for households to be aware of these important nutritional additions in the foods that they buy.

Households who were found to assume they do not purchase fortified foods or uncertain whether they purchase any kind of fortified food items were found to be mostly purchasing fortified bread, maize meal, and salt. The results show that the affordable maize and wheat-based products that were chosen as vehicles to implement the policy of households consuming fortified foods have been properly distributed to most supermarkets. Maize and wheat-based fortified products are being purchased by consumers, yet these consumers are not aware of what they are purchasing. Households are used to purchasing these items because they are affordable and have been purchased for years before they were fortified. Households are not aware that these products have been fortified and why they have been fortified.

The purchasing of maize meal and salt were constant variables as all respondents purchased fortified maize meal and salt hence was not included in any of the regression models. Households purchasing these fortified foods showed that most supermarkets are in accordance with the policy of only selling fortified maize meal and salt. Furthermore, cake flour was not included as most households who purchase cake flour purchased nonfortified wheat cake flour because consumers lack knowledge of the difference between fortified and non-fortified food items. Households only concern about how white the cake flour can produce items such as “jeqe” and “amagwinya” that are used as substitutes for bread. They are unaware that this type of flour is not fortified. Results from the binomial regression also showed that numerous media avenues are not being utilized well enough for households to be aware of these important nutritional additions in the foods that they buy.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Hidden hunger, also known as micronutrient deficiency, is defined as a form of undernutrition that occurs when intake and absorption of vitamins and minerals such as zinc, iodine, and iron are too little to support good health and development. Women and children from resource-poor households usually suffer from at least one micronutrient deficiency. Micronutrients deficiencies are widespread and have negative consequences for human growth and development. This occurrence is the highest in provinces with large rural populations. These vitamin and mineral deficiencies impose a considerable disease burden on the affected persons and on their societies. Adverse functional outcomes include stunting, increased susceptibility to infectious disease, physical impairments, cognitive losses, blindness and premature mortality. Factors that contribute to micronutrient deficiencies include poor diet, increased micronutrient needs during specific life stages such as pregnancy, lactation and health problems such as diseases, infections, and parasites. Therefore, food fortification was introduced in South Africa in 2003 to avert the micronutrient deficiency, but the problem persists, which could be due to the existence of about 73 percent of households who were unaware of food fortification and how to utilize its benefits, especially among low-income households.

The first objective of the study was to determine the food basket consumed at the household level, secondly, the study aimed to assess the awareness of fortified foods across different wealth groups and lastly to determine factors underlying preferences and choices of different food basket types.

Using a sample of 200 households, generated through simple random sampling, data analysis involved both descriptive and econometric techniques. Descriptive analysis used chi-square tests as well as graphs for visual interpretation, while econometric analysis involved binary logistic models. This chapter presents the main conclusions of the study. Based on the results, the chapter draws policy recommendations and also presents suggested areas for further investigation.

5.2 Summary of key results and conclusions

Descriptive statistics provided information related to demographic and socio-economic characteristics. There were more female-headed households (about 61%) and most household heads had a secondary educational level. Households that own gardens had a variety of vitamin A-rich crops, which assisted them to diversify their food basket and also to save money. However, fewer households of about 60 percent planted the vitamin A-rich vegetables.

Despite the introduction of food fortification in South Africa in 2003, only about 28 percent of the sampled households were aware of it. There was a significant association in the purchasing patterns of fortified foods and household awareness of such foods. Households who were aware of fortified foods had a higher percentage purchasing fortified flour and bread whilst unaware households had a higher percentage of purchasing non-fortified ones. Households purchased Fortified maize meal and maize-based cereal regardless of their awareness of food fortification. Households who are unaware and aware of food fortification differed in their food choices and thus had different food baskets due to lack of knowledge and socio-demographic background.

The analysis of household food baskets showed that price is the fundamental influential factor that determines what is purchased or included in a food basket. Nutrition, tastes, and brands were less important influential factors. Food choice reasoning was mainly based on price considerations than health or nutrition considerations because households were unaware of the long-term effects of less nutritious food baskets. Furthermore, most households in the study were affected by inflation of staple food products as households (46 %) listed maize meal as their survival food item for every month while only 1 percent listed vegetables as an important food item in their food basket. This leads to the conclusion that although households may receive income to purchase food items, price inflation may limit households to attain a nutritional food basket. Diversified household gardens improve diet diversity and may enhance the total household income available for purchasing food items.

Income limits household purchases of proper household food basket that utilized for the intended duration. The situation prevails because income is also used to other domestic needs that is. water and electricity bills, school fees, clothes and traveling expenses. On the other hand, having only one person who acquires income, mainly via pension grants, while having many household

members limits households, and results in their members not having the necessary amount of food daily. This intensifies the problem of micronutrient deficiencies.

Binary logistic regression showed that the significant determinants of food fortification knowledge as age, employment status of the household head, household medical problems, media, attending health institutions, the frequency of shopping, food basket decision-maker, and monthly income. On the other hand, age and employment status of the household head, price consideration, food fortification logo identification and household size determined the purchasing of fortified food. It was concluded that the limited awareness of fortified foods could be indirectly contributing to hidden hunger because the focus is on quantity rather than the quality of foods, especially with less diversified gardening systems.

The relationship between household size and calories consumed per household was explored. Results showed that as household size increased, the calories consumed decreased. It was concluded that increase in household size negatively affects the availability of food and therefore their diet at the household level.

5.3 Recommendations

Based on the findings, the following recommendations are made:

- Government needs to implement additional programs need to ensure the awareness of the population regarding micronutrient deficiencies. The ultimate objective of the staple food fortification program is to assist the South African population to receive the necessary quantities of the micronutrients needs via the purchasing and consumption of the chosen food items.

- There is a need for intervention programs to empower nutrition education. The intervention program should include nutrition counseling and strong public awareness that will focus on dietary diversity, food fortification, and food security. Public nutrition educational programs which are intended to assist in creating and maintaining food fortification awareness need to be made to target all types of consumers and specific areas that are similar to Sweetwaters and Edendale. It is recommended that schools,

health facilities, and media be used for the distribution and maintenance of nutritional education with special focus on the benefits of food fortification. It was clear, in the study, that such information has not yet transcended ages, educational levels, and employment statuses. Consistency on impacting knowledge to consumers about the benefits of food fortification may improve household diets and food utilization in the long run.

- Government should promote activities that can generate income for households, to assist in attaining a proper food basket. Most households in the study were found to be either female-headed, single and unemployed or single and a pensioner who generally have low incomes. This suggested that households face challenges to access the proper nutritional food basket. Government and suitable stakeholders may also train communities to efficiently utilize the space they have to plant vitamin A rich vegetables in order to prevent vitamin A deficiencies.

5.4 Suggestions for future research direction

The lack of food fortification awareness presents a number of challenges in relation to food and nutrition security for the area of the uMsunduzi Municipality. Further studies in the impact of fortified food vehicles on South African households, their diets, and its progress since 2003 to address micronutrient deficiencies is vital and could assist by becoming an intervention for hidden hunger. An investigation on proper and positively influential media communication of fortified foods, nutrition education and balanced diets is required. Research should further include physical aspects such as food intake, levels of micronutrient intake with special focus on vitamin A before and after the consumption of fortified foods and its relationship to household food security to provide a more significant outcome. How individuals perceive and value any concept such as food fortification can be understood better by examining households of different socio-demographic profiles.

REFERENCES

Abdu-Raheem K.A and Worth S.H (2011). Household food security in South Africa: Evaluating extensions paradigms relative to the current food insecurity and development goals. *South African Journal of Agricultural Extension* vol. 39 (2): 91-103

Ajao K.O, Ojofeitimi E.O, Abedayo A.A, Fatusi A.O and Afolabi O.T (2010). Influence of family size, household food security status of under five children in Ile-ife Nigeria. *African Journal of Health* 117:126

Aliber M (2009). Exploring statistics South Africa's national household's surveys as sources of information about food security and subsistence agriculture. *HRSC: Centre for poverty, employment, and growth*

Altman M, Hart T, Jacobs P (2009). Food Security in South Africa. *HRSC and Centre for Poverty, Employment, and Growth*

Arimond M and Ruel M.T (2004). Dietary diversity is associated with child nutritional status: Evidence from 11 demographic and health surveys. The American Society for Nutritional Sciences. *Journal of Nutrition* 134 (10): 2759-2585

Baiphethi M.N and Jacobs P.T (2009). The contribution of subsistence farming to food security in South Africa. *Agrekon* 48 (4): 459-482

Babbie E and Mouton J (2011). The practice of social research. Cape Town: Oxford *University Press*

Barnard P (2014). The PACSA ideal food basket. *Pietermaritzburg Agency for Community Social Action.*

Bashir K.M, Schilizzi S and Pandit R (2012). The determinants of rural household food security for landless households of the Punjab, Pakistan. [www document] http://ageconsearch.umn.edu/bitstream accessed on 10 August 2017

Battersby J (2012). Beyond the food desert: Finding ways to speak about urban food security in South Africa. *Geografia Annaler Series B, Human Geography* 94 (2): 141-159

Becquey E, Prevel-Martin Y, Traissac P, Dembele B, Bambara A and Drlpeuch F (2010). The Household Food Insecurity Access Scale and an index-member dietary diversity score contribute valid and complementary information on household food insecurity in an urban West African setting. *Journal of Nutrition* 140 (2): 2233-2240

Berg B.L (2004). *Qualitative research methods for social sciences.* Pearson education

Bickel G, Nord M, Price C, Hamilton W, Cook J (2000). Guide to measuring household food security. United States Department of Agriculture [www document] http://www.fns.usda.gov/sites/default/files/FSGuide.pdf accessed 26 January 2016

Bonki-Ankomah S (2001). Addressing food insecurity in South Africa. The National Institute for Economic Policy: Paper presented at the SARPN conference on Land Reform and Poverty Alleviation in Southern Africa Pretoria. [www document] http://www.sarpn.org/EventPapers/Land/20010605Bonti.pdf accessed 29 August 2015

Brinkman H, De-Pee S, Sanogo I, Subran L Bloem L.W (2010). High food prices and global financial crisis have reduced access to nutritious food and worsened nutritional status and health. *The Journal of Nutrition* 140 (1): 153-161

Budlender D and Woolard I (2006). The impact of the South African Child Support and Old Age Grants on children's schooling and work. International Labour Office and the International Programme on the Elimination of Child Labour. [www document] http://www.ilo.org/ipecinfo/product/download accessed 2 September 2015

Burchi F, Fanzo J and Frison E (2011). The Role of Food and Nutrition System Approaches in Tackling Hidden Hunger. *International Journal of Environmental Research and Public Health* 8: 358-373

Campbell C.C (1991). Food insecurity: A nutritional outcome or predictor variable? *Journal of Nutrition* 121 (3): 408-415

Carletto C, Zezza A and Banerjee R (2013). Towards better management of household food security: Harmonizing indicators and the role of household surveys. *Global food security* 8 (2): 30-40

Caswell J.A and Yaktine A.L (2013). Supplemental Nutrition Assistance Program: Examining the evidence to define benefit adequacy. Institute of Medicine and National Research Council

[www document] http://www.ncbi.nlm.nih.gov/NBK206911/ accessed on 29 January 2016

Caracher M, Diocon P, Lang T and Carr-Hill P (1998). Access to healthy foods part one: Barriers to accessing healthy foods; Differential by gender, social class income and mode of transport. *Health Educational Journal* 57 (3): 191-201

Census (2011). Pietermaritzburg, Sweetwaters statistics. [www document] http://census2011.adrianfrinth.com/place/566003 accessed on 02 May 2016

Coates J, Swindale A and Bilinsky P (2007). Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide. Food and Nutrition Technical Assistance (FANTA) and United States Agency for International Development (USDA) [www.document]http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf accessed 12 February 2016

Daurice A, Grossniklaus R.N, Dunbar S.B and Frediani J (2010). Psychological factors are important correlates of dietary pattern in overweight adults. *The Journal of Cardiovascular Nursing* 25(6): 450-460

Darnton-Hill-Hill I, Webb P, Harvey P.W.J, Hunt J.M, Dalmiya N, Chopra M, Ball M.J, Bloem M.w and Benoist B (2005). Micronutrient deficiencies and gender: social and economic costs. *American Journal of Clinical Nutrition* 81: 1198-1205

Department of Agriculture (2002). Agricultural Annual Report. [www document] htttp://www.nda.agric.za/foodsecurity/strategy/annual/reports.pdf accessed on 17 May 2018

Department of Health (2003). Food fortification: Food facts. [www document] http://www.foodfacts.org.za/food-fortification.pdf accessed on 12 June 2017

De-Cock N, D'Haese M. D, Vink N, Van-Rooyen C.J, Staelens L, Schonfeldt H.C and D'Haese L (2013). Food security in rural areas of Limpopo province South Africa. *The Science, Sociology, and Economics of food production and access to food* 5: 268-282

Department of Agriculture (2006). Food insecurity in Sekhukhune: Food insecurity and vulnerability information management system. [www document] http://www.nda.agric.co.za/docs/policy/FoodSecurityStrat.pdf accessed on 11 March 2016

Department of Health (2007). A reflection of the South African Maize meal and wheat flour fortification programme. *UNICEF*. [www document] http://www.unicef.org/southafrica/SAF_resources_wheatfortificationn.pdf accessed 2 October 2015

De Muro P and Burchi F (2007). Education for rural people and food security: A cross-country analysis. Food and Agricultural Organization.

D'haese M, Vink N, Nkunzimana T, Van-Damme E, Van-Rooyen J, Remaut A, Staelens and D'haese L (2013). Improving food security in the rural areas of KwaZulu-Natal province, South Africa: Too little, too slow. *Development Southern Africa* 4 (5): 468-490

Du-Toit D.C (2011). Food Security. Department of Agriculture, Forestry, and Fisheries Report

Dewing S, Tomlinson M, Roux I.M, Chopra I.C.T (2013). Food insecurity and its association with co-occurring postnatal depression, hazardous drinking and suicidality among women in peri-urban South Africa. *Journal of Affective Disorders* 150: 460-465

Drewnowski A. (2001). The science and complexity of bitter taste. *Nutrition* 136 (5): 1449-1452

Dwyer J.T, Woteki C, Bailey R, Britten P, Carriquiry A, Gaine A.P, Miller D, Moshfegh A, Murphy M.M and Edge M.S (2014). Fortification: New findings and implications. *Journal of Nutrition* 72:127-141

Faber M, Venter S.L, Benade A.J.S (2001). Increased vitamin A intake in children aged 2-5 years through targeted home gardens in a rural South African community. *Public Health Nutrition* 5 (1): 11-16

Faber M (2004). Complementary foods consumed by 6-12-month-old rural infants in South Africa are inadequate in micronutrients. *Public Health Nutrition* 8 (4): 373-381

Faber M, Kvalsvig J.D, Lombard C.J and Benade A.J.S (2005). Effect of a fortified maize-meal porridge on anemia, micronutrient status and motor development of infants. *American Journal of Clinical Nutrition* 82 (5): 1032-1039

Faber M and Wenhold F (2007). Nutrition in a contemporary South Africa. *Water SA* 33 (3**)**. [www document] http://www.ajol.info/index.php/wsa/article/viwfile/49122 accessed 20 September 2015

Farrell J.A (2014). The impact of nutrition education on food security status and food-related behaviors. Department of Nutrition, University of Massachusetts.

Feeley A, Pettifor J.M and Norris S.A (2009). Fast-food consumption among 17-year-olds in the Birth to Twenty cohort. *South African Journal of Clinical Nutrition* 22 (3): 118-123

Feinstein L, Sabates R, Tashweka M, Sorhiando A and Hammond C (2005). What are the effects of education on health? [www document] https://www1.oecd.org/edu/innovation-education/37425753.pdf accessed 20 February 2017

Fiedler J.L, Lividini K, Bermudez O.I and Smitz M.F (2012). Household Consumption and Expenditure Surveys (HCES): A primer for food and nutrition analyst in low and middle-income countries. *Food Nutrition Bulletin* 33: 5170-5184

Food and Agricultural Organization (1981). Calculation of the energy content of foods. [www document] accessed http://www.fao.org/docrep/006/y5022e/y50222e04.htm on 14 September 2016

Food and Agricultural Organization (1996). Food and Agricultural Organization. World Food Summit, Rome, Italy

Food and Agricultural Organization (1997). The food system and factors affecting household food security and nutrition. Agriculture, food, and nutrition for Africa. Rome, Italy

Food and Agricultural Organization (2001). Food insecurity in the world. [www document] http://www.fao.org/docrep/003/y1500/y1500e00.htm accessed on 16 August 2016

Food and Agricultural Organization (2002). The state of food insecurity in the world. Rome, Italy

Food and Agricultural Organization (2004). Uses of food consumption and anthropometric surveys in the Carribean: How to transform data into decision-making tools. Food and Agricultural Organization of the United Nations: Rome, Italy

Food and Agricultural Organization (2005). Committee on world food security. [www document] http://www.fao.org/docrep/meeting/009/j4968e/j4968e00.htm accessed on 15 September 2017

Food and Agricultural Organization (2006). Food Aid for Food Security? Food and Agricultural Organization of the United Nations. Rome, Italy

Food and Agricultural Organization (2009). The state of food insecurity in the world: Economic crises impacts and lessons learned.

[www document] http://www.fao.org/docrep/012/i0876e/i0876e00.htm accesssed on 14 September 2017

Food and Agricultural Organization, World Food Programme and International Fund for Agricultural Development (2012). The state of food insecurity in the world. Rome, FAOFood Agricultural Organization (2013). Guidelines for measuring households and individual dietary diversity. Nutrition and Consumer Protection Division, Food, and Agriculture Organization of the United Nations. Rome, FAO

Flagg L.A, Bisakha S, Kilgore M.L and Locher J.L (2014). The influence of gender, age, education, and household size on meal preparation and food shopping responsibilities. *Public Health Nutrition* 17(9): 2061-2070.

Garrett J.L and Ruel M.T (1999). Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. *World Development* 27 (11): 1955-1975

Global Alliance for Improved Nutrition (2016). How do we achieve urban food and nutrition security with the new urban agenda? [www document] http://www.gainhealth.org/knowledge-centre-/achieving-urban-food-nutrition-security-new-urban-agenda/ accessed on 14 April 2017

Godfray H.C.J, Beddington J.R, Crute I.R, Haddad L, Lawrence D, Muir J.F, Pretty J, Robinson S, Thomas S.M, Toulmin C (2010). Food Security: The challenge of feeding 9 billion people. *Science* 327: 812-818

Govender L, Pillay K and Mabhaudhi T (2017). Food and nutrition insecurity in selected rural communities of KwaZulu- Natal, South Africa- Linking human nutrition and agriculture. *International Journal of Environmental Research and Public Health* 14(1): 17

Grebmer K, Saltzman A, Birol E, Wiesmann D, Prasai N, Yin S, Yohannes Y and Menon P (2014). Global Hunger Index: The challenge of hidden hunger. Welt Hunger Life and The International Food Policy Research Institute

Habicht, J.P., Pelto, G., Frongillo, E. and Rose, D. 2004. Conceptualization and instrumentation of food insecurity. Paper prepared for National Academy of Sciences workshop. [www document] http://www.nap.edu/openbook.php?recordid=11578andpage=41
accessed 30 November 2015

Hart T.G.B (2011). The significance of African vegetables in ensuring food security for South Africa's rural poor. Centre for poverty, employment, and growth of the Human Sciences Research Council. *Agriculture and Human Values* 28(3): 321-333

Harvey P (2010). Determining the dietary patterns of Ugandan women and children. The USAID micronutrient and child blindness project. Washington DC

Hatloy A, Torhem L.E and Oshoug A (1998). Food variety- A good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. *European Journal of Clinical Nutrition* 52:891-898.

Heerlen H.J (2010). Hidden Hunger. DSM Bright Science. [www document] https://www.dsm .com/content/dam/dsm/cworld/en_US/documents/hidden-hunger.pdf accessed 10 June 2015

Hefferon K.L (2015). Nutritionally enhanced food crops, progress, and perspectives. *International Journal of Molecular Sciences:* 3895-3914

Heinrich C, Hoddinott J, Samson R, MacQuene K, Niekerk I and Renaud B (2012). The South African Child Support Grant Impact Assessment: Evidence from a survey of children, adolescents, and their households. Department of Social Development, the South African Child Support Grant Assessment and United Nations Children Fund of Pretoria South Africa

Hendricks S.L (2005). The challenges facing empirical estimation of household food insecurity in South Africa. *Development of Southern Africa* 22 (1): 103-123

Hendriks, SL and Msaki, MM, 2009. The impact of smallholder commercialization of organic crops on food consumption patterns, dietary diversity and consumption elasticities. *Agrekon* 48 (2): 184–99

Hoddinott J and Yohannes Y (2002). Dietary diversity as a food indicator. International Food Policy Research Institute (FCND). Discussion paper number 136. Food and Nutrition Technical Assistance Project, Washington.

Hurrel (1997). Preventing deficiency through food fortification. *Nutrition Reviews* 55 (6): 210-222

Inglis V, Ball K and Crawford D (2009). Does modifying the household food budget predict changes in the healthfulness of purchasing food choices among low or high income women? *Apetite* 52 (2): 273-279

Institute for Health Metrics and Evaluation (2013). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013 [www document] http://www.health data.org/research-article/global-regional- and-national-prevalence-overweight-and-obesity-children-and-adults accessed on 14 September 2015

IPSOS (2010). Consumer Awareness, Attitudes and behaviours to fortified foods: Prepared for food standards Australia New Zealand [www document] http://www.foodstandards.gov.au/publications/documents/fortificationpercent20reportpercent20-percent20qualitative.pdf accessed 12 February 2016

Ivers L (2009). HIV/AIDS, Undernutrition and Food Insecurity. *Clinical Infectious Diseases: Infectious Diseases Society of America* 49 (7): 1096-1102

Jackson L.S and Lee K (1991). Microencapsulated iron for food fortification. *Journal of Food Science* 56 (4): 1047-1050

Jacobs P.T (2009). The status of household food security targets in South Africa. *Agrekon* 48 (4): 410-433

Jacobs P.T (2012). Protecting food insecure households against rapid food price inflation. Human Sciences Research Council. [www document] http:// www.hsrc.ac.za/en/research-data/view/5854 accessed on 29 January 2016

Jenner G (2001). Tourism research 2nd edition, Australia: John Wiley and Sons

Jooste P.C and Zimmerman M.B (2008). Progress towards eliminating iodine deficiency in South Africa. *South African of Clinical Nutrition* 21 (1): 108-114

Kamara V (2017). Strengtning the media abilities to effectively communicate on food security and nutrition. World Food Programme [www document] http://insight.wfp.org/strengthning-the-media-ability-to-effectively-communicate-on-food-security-and-nutrition-1769310da3b3

Labadarios D, Swart R, Maunder E.M.W, Kruger H.S, Gericke G.J, Khuzwayo P.M.N, Ntsie P.R, Steyn N.P, Schloss I, Dhansay M.A, Jooste P.L and Dannhauser A (2008). Executive summary of the National Food Consumption Survey Fortification Baseline (NFCS-FB-I) South Africa, 2005. *South African Journal of Clinical Nutrition* 21(3): 247-300

Labadarios D, Steyn N.P and Nel J (2011). How diverse is the diet of adult South Africans? *Nutritional Journal* 10-33

Labadarios D, Steyn N.P, MacIntyre U, Gericke G, Swart R, Huskisson J, Dannhauser A, Vorster H.H, Nesmvumi A.E and Nel J.H (2005). The National Food Consumption Survey, South Africa of 1999. *Public Health Nutrition* 8 (5): 533-543

Loring P.A and Geralch S.C (2009). Food, culture and human health in Alaska: An integrative health approach to food security. *Environmental Science Policy* 12 (4): 466-478

Luomala H.T (2007). Exploring the role of food origin as a source of meanings for consumers' and as a determinant of consumers' actual food choice. *Journal of business research* 60: 122-129

Luthringer C.L, Rowe L.A, Vossenaar M, Garret G.S (2015). Regulatory monitoring of fortified foods: Identifying barriers and good practices. *Global Health: Science and Practice* 3 (3): 446-461

Lynman A.L.T, Valpiani N, Sun K, Semba R.D, Klotz L.L, Kraemer K, Akhter N, Peer S, Pioneer M, Sari M and Bloem M (2010). Household Diet Diversity and food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. *American Society of Nutrition* 140 (1): 1828-1885

Macias Y.F and Glasauer P (2014). Guidelines for assessing nutrition-related knowledge, attitudes and practices. Food and Agricultural Organization of the United Nations: Rome

MacMahon B and Weld G (2015). The cost of a minimum essential food basket in the Republic of Ireland: Study for six household types. [www document] https://www.budgeting.ie/images/stones/Publications/Safefood_VPSJ2015The_Cost_of_a_Minimum_Essential_Food_Basket_ROI.pdf accessed 10 October 2015

Mangusho G (2013). Socio-Economic Manifestations of Hidden Hunger in School children in Sub-haran Africa. *International Journal of Nutrition and Food Sciences* 2 (1): 17-23

Marshall T.A, Stumbo P.J, Warren J.J and Xie X.J (2001). Inadequate nutrient intakes are common and are associated with low diet variety in Rural, Community-Dwelling elderly. *American Society for Nutritional Sciences* 131 (8): 2192-2196

Matuschke I (2009). Rapid urbanization and food security: Using food density maps to identify future food security hot spots. *Food and Agricultural Organization: Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China.*

Maxwell D and Caldwell R (2008). The coping strategy index: Field methods manual, second edition. United States Agency for International Development and World Food Program

Motadi S.A, Mbhatsani V and Shilote K.O (2016). Food fortification knowledge in women of child-bearing age at Nkowankowa township in Mopani District, Limpopo Province, South Africa. *African Journal of Primary Health Care and Family Medicine* 8 (2): 2071-2928

Mohajeri M.H, Wittwer J, Vargas K, Hogan E, Holmes A, Rogers P.J, Goralczyk R and Gibson E.L. Chronic treatment with a tryptophan-rich protein hydrolysate improves emotional processing, mental energy levels and reaction time in middle-aged women. *Journal of Nutrition* 113 (2): 350-365

Moursi M (2015). Dietary diversity and biofortification. *International Food Policy Research Institute* [www document] http://www.ifpri.org/blog/dietary-diversity-and-biofortification accessed 15 April 2016

Mugendaa O.M and Mugenda A.G (2003). Research methods: Qualitative and quantitave approaches. Nairobi Kenya, ACTS Press

National Agricultural and Marketing Council (2015). Food Price Monitor: Markets and Economics Research Center. [www document] www.namc.co.za/upload/food_price_monitoring/NAMCpercent20Pricepercent20/Monitoring_February_percent202015.pdf accessed 26 October 2015

National Institute of Health: Office of Dietary Supplements. [www document] https://ods.od.nih.gov/factsheets/vitamin-A-health-professional accessed 26 October 2015

National Institute of Health: Office of Dietary Supplements. [www document] https://ods.od.nih.gov/factsheets/vitaminA-consumer/ accessed 26 October 2015

National Institute of Health: Office of Dietary Supplements. [www document] https://ods.od.nih/gov /factsheets/iodine-consumer/ accessed 26 October 2015

National Institute of Health: Office of Dietary Supplements. [www document] https://www.thyroid.org/iodine-deficiency accessed 26 October 2015

Nestel P, Bouis H.E, Meenakshi J.V and Pfeiffer W (2006). Symposium: Food fortification in developing countries. International Food Policy Research Institute. *Journal of Nutrition* 136: 1053-1054

Neuman W.L (2003). *Social research methods: Quantitative and qualitative approaches* (5th edition). Boston: Allyn and Bacon

Ngwenya T and Magongo B (2013). Civil society organizations participation in food security activities in South Africa. Human Sciences Research Council.

Nord M (2010). Household food security in the United States, 2009. Food security and nutrition research program. [www document] http://www.ers.usda.gov/briefing/foodsecurity.htm accessed on 20 July 2018

Oketch J.A, Paterson M, Mounder E.W and Rollins N.C (2011). *Health Policy* 99: 267-276

Olayemi A.O (2012). Effects of family size on household food security in Osun state, Nigeria. *Asian Economic and Social Society* 2 (2): 136-141

Oldewage-Theron W.H, Dicks E.G and Napier C.E (2006). Poverty, household food insecurity, and nutrition: coping strategies in an informal settlement in the Vaal Triangle, South Africa. *Journal of the Royal Institute of Public Health* 120: 795-804

Oldewage-Theron W and Kruger R (2011). Dietary diversity and adequacy of woman caregivers in a peri-urban informal settlement in South Africa. *Journal of Nutrition* 27:420-427

Oxfam Research (2014). Hidden Hunger in South Africa: The faces of hunger and malnutrition in a food secure nation.
[www document] http://www. Oxfamlibrary.openrepository.com/Oxfam/bitstream/10546/332126/1/rr-hidden-hunger-south-Africa-131014.pdf accessed 09 November 2015

PACSA Food Price Barometer (2014). [www document] https://www.pacsa.org.za/research/research-reports-foodprice-barometer accessed on 24 May 2016

Pambo K.O, Otieno D.J and Okello J.J (2014). Consumer awareness of food fortification in Kenya: The case of vitamin A-fortified sugar. International Food and Agribusiness Management Association. [www document] https://ageconsearch.umn.edu/bitstream/173483/2/IFAMA Food2014.pdf accessed on 12 December 2016

Pereira L.M (2014). The future of South Africa's Food System: What is research telling us? South African Food Laboratory.

Pillay J (2016). Problematic child-headed households: The need for children's participation in early childhood interventions. *South African Journal of Childhood Education* 6 (1): 359-368

Pretorius B and Schonfeldt H.C (2010). Vitamin A content of fortified maize meal and porridge as purchased and consumed in South Africa. *Food Research International* 47 (2): 128-133

Rose D, Meerschoek S, McEwan M (2002). Evaluation of a rapid field tool for assessing household diet quality in Mozambique. *Food and Nutrition Bulletin* 23:181-189

Rosegrant M.W and Cline S.A (2003). Global food security: Challenges and policies. *Science* 5652: 1917-1919

Ruel M.T (2003). Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. *Food consumption and Nutrition Division Discussion Paper* (140). Washngton D.C: international Food Policy research Institute.

Ruel M.T (2006). Animal source food to improve micronutrient nutrition and human function in developing countries. Operationalizing dietary diversity: A review of measurement issues and research priorities. *Journal of Nutrition* 113 (11): 3911-3926

Russel R, Beard J.C, Cousins R.J, Dunn J.T, Ferland G, Hambridge K.M, Lynch S, Penland J.G, Ross A.C, Stoeker B.J, Suttie J.W, Turnlund J.R, West K.P, Zlotkin S.H (2001). Dietary reference intakes for vitamin A, vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc. *Food and Nutrition Board, Institute of Medicine*. National Academy Press.

Sablah M, Grant F and Fiedler J (2013). Food Fortification in Africa: Progress to date and priorities moving forward. Sight and Life 27 (3): 18-24

Salganik J.M and Heckathorn D.D (2006). Sampling and estimation in hidden populations using respondent driven sampling. *Sociological Methodology* 34: 193-239

Schatz E, Madhavan S and Williams J (2011). Female-headed households contending with AIDS-related hardship in rural South Africa. *Journal of Health and Place* 17: 598-605.

Schwingshack L and Hoffman G (2015). Diet quality as assessed by the healthy eating index, the alternate healthy eating index, the dietary approaches to stop hypertension score and health

outcomes: a systematic review and meta-analysis of cohort studies. *Journal of academic nutrition diet* 118 (1): 74-100

Sebolaaphuti K (2005). The effect of HIV/AIDS on household food security: A case study of Bokaa, a rural area in Botswana. [www document] http://scholar.sun.ac.za / handle/10019.1/1620 accessed on 11 November 7

Shepherd R (1999). Social determinants of food choice. *Proceedings of the Nutrition Society* 58:807-812

Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Dhansay A, Reddy P, Parker W, Hossain E, Naidoo P, Hongoro C, Mchiza Z, Steyn NP, Dwane N, Makoae M, Maluleke T, Ramlagan S, Zungu N, Evans M.G, Jacobs L and Faber M (2014). The South African National Health and Nutrition Examination Survey (SANHANES-1). Human Sciences Research Council

Shisanya S.O and Hendricks S.L (2011). The contribution of community gardens to food security in the Maphephethini uplands determined by the Household Food Insecurity Access Scale. *Development Southern Africa* 28 (4): 509-526

Smith P (2013). Delivering food security without increasing pressure on land. *Global food security* 2 (1): 18-23

Statitics South Africa (2009). Monthly earnings of South Africans. [www document] http://www.statssa.gov.za/publications accessed on 17 May 2017

Statistics South Africa (2011). Income and expenditure of household 2010/2011. [www document] http://www.statssa.gov.za/p01002011 accessed on 12 November 2017

Statistics South Africa (2012). Census 2011 Municipal report KwaZulu-Natal [www document] http://www.STATS SA.gov.za/census/census_2011/census_products/KZN_Municipal_Report.pdf (accessed 02 March 2016)

Statistics South Africa (2013) {www document] http://www.STATS SA.gov.za/?p=944

accessed 26 August 2015

Statistics South Africa (2014). General Household Survey 2013 [www document] http://www.STATS SA.gov.za/publications/P0318/P03182013.pdf (accessed 29 February 2016)

Statistics South Africa (2015). Income distribution. [www document] http://www.statssa.gov.za/?s=income+distribution&sitem.htm accessed on 05 December 2017

Statstics South Africa (2016). Statistics South Africa annual report. [www document] http://www.statssa.gov.za/?page_id=368 accessed on 02 October 2017

Stein J and Qaim M (2007). The human and economic cost of hidden hunger. *Food and Nutrition Bulletin* 28 (2): 125-134

Steyn N.P, Wolmarans P, Nel J.H and Bourne L (2007). National fortification of staple foods can make a significant contribution to micronutrient intake of South African adults. *Public Health Nutrition* 11 (3): 307-313

Steyn N.P, Nel J and Labadarios D (2008). Will fortification of staple foods make a difference to the dietary intake of South African children? *South African Journal of Clinical Nutrition* 21 (1): 22-26.

Steyn N.P, Labadarios D and Nel J.H (2011). Factors which influence the consumption of street foods and fast foods in South Africa: A national survey. *Nutritional Journal* 10:104-111

Stuijvenberg M.E (2005). Using the school feeding system as a vehicle for micronutrient fortification: Experience from South Africa. *Food and Nutrition Bulletin* 26 (2): 213-219

Swindale A and Bilinsky P (2006). Development of a universally applicable household food insecurity measurement tool: Processing current status and outstanding issues. *The journal of nutrition* 136 (5): 1449-1452

Temple N.J and Steyn N.P (2009). Food prices and energy density as barriers to healthy food patterns in Cape Town, South Africa. *Journal of Hunger and Environmental Nutrition* 4 (2): 203-213.

Tladi L.S (2006). Poverty and HIV/AIDS in South Africa: an empirical contribution. *SAHARA-J: Journal of Social Aspects of HIV/AIDS* 3 (1): 369-381

Thabethe N, Mbatha Z and Mtapuri O (2016). School based programmes as a new form of the family for orphans and vulnerable children in the province of KwaZulu Natal, South Africa. *Journal of comparative studies* 47 (3): 357-368

Tladi L.S (2006). Poverty and HIV/AIDS in South Africa: An empirical contribution. *Journal of social aspects of HIV/AIDS.* Human Sciences Research Council

United Nations International Children's Emergency and Food Fortification Initiative (2014). Monitoring of flour fortification: The case of South Africa. New York, USA [www document] http://www.ffinetwork.org/monitor/Documents/SouthAfricaCS.pdf accessed on 22 February 2017

United Nations International Children's Emergency (UNICEF) (2010). Nutrition in emergency [www document] http://www.unicef.org/nutrition/training accessed 29 February 2016

United States Agency for International Development (1995). Food Aid and Food Security Policy Paper. Washington D.C

Verbeke W (2008). Impact of communication on consumers food choices. *Proceedings of the nutrition society* 67: 281-288

Vermeulen U (2016). Looking for food security? Folllow the money. [www document] http://www.vafs.cgiar.org/blog/looooking-food-security-follow-money/WzIWS/SVRbqB accessed on 12 February 2018

Victoria CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, Sachdev HS (2008). Maternal and child undernutrition: consequences for adult health and human capital. *Lancet* 371: 340-57

Vorster H.H (2010). The link between poverty and malnutrition: A South African perspective. *Health South Africa 15(1)* [www document] http://www.hsag.co.za accessed 25 August 2015

Weisberg S (2005). *Applied linear regression* 3rd Edn. John Wiley and Sons.

Wetenhoefer J (2005). Age and gender dependent profile of food choice. *Journal of nutrition* 57:44-51

Wilde E.P, Peterman J.N (2006). Individual weight change is associated with household food security status. *The journal of nutrition* 136 (5): 1395-1400

Williams P (2010). Monitoring the affordability of healthy eating: A case study of 10 years of the Illawarra Healthy Food Basket. *Nutrients* 2 (11): 1132-1140

Wolmarans P (2010). Characteristics of the South African food composition database: an essential tool for nutrition fraternity in the country. Nutritiona Intervention Research Unit and Medical Research Council. *South African journal of clinical nutrition* 21 (4): 308-313

World Health Organization (2009). Global prevalence of vitamin A deficiency in population at risk: Summary of the global prevalence of vitamin A deficiency in populations at risk *[www document] http://* www.who.int/vmnis/database/vitamin/x/en accessed on 15 September 2015

World Health Organization (2015). Nutrition and food security. [www document] http://www.who.int/foodsafety/areas_work?nutrition/en/ accessed on 15 October 2017

World Health Organization (2017). The state of food security and nutrition in the world: building resilence for peace and food security. [www document] http://www.who.int/nutrition/publications/ foodsecurity/state-food-security-nutrition-2017/en accessed on 18 July 2017

Zakari S, Ying L and Song B (2014). Factors influencing household food security in West Africa: The case of Southern Niger. *Sustainability* 6:1191-1202.

Zhou D, Shah T, Ali S, Ahmad W, Din I and Ilyas A (2016). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi society of Agricultural Sciences* 118-125

Zielinska E.B (2006). Role of psychological factors in food choice-A review. *Polish Journal of Food and Nutrition Sciences* 4: 379-384

Zimmerman M.B and Hurrel R.F (2007). Nutritional Iron Deficiency. *Laboratory for Human Nutrition* 370: 511-520 [www document]

http://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf?_ga=1.46332847.985193247.1472558587 accessed on 02 October 2016.

APPENDIX 1: SURVEY QUESTIONNAIRE

University of KwaZulu Natal

Research Questionnaire

Name of Enumerator: _____

Research Project Information

This study will be conducted by Nomfundo Shelembe, Student number 2105 05559 who is a postgraduate student (Master of Agriculture in Food Security) at the University of KwaZulu-Natal. The aim of the research project is to identify the key reasons behind consumer behaviour in the different purchasing patterns of their food baskets, as to what drives the food choices and what kind of preferences come into play when purchasing their household food basket. The study will also shed light on the awareness of consumers on fortified food products and if their purchasing patterns have any significance in their household food security.

Declaration

The following was clearly explained to me before the study, I understand the contents of the questionnaire and the nature of the research and I have agreed to participate in this research: All information provided for the study will be treated with STRICT CONFIDENTIALITY; anonymity will be ensured where appropriate through coding and questionnaires will be destroyed afterwards; participation in the study is voluntary and participants are free to withdraw from the study at any time without any negative or undesirable consequences to themselves. Due to the nature of the study and the budget for this research, the researcher is not promising any benefits for the participation in the research.

For any queries please contact me on (073 931 2327) or by email 210505559@stu.ukzn.ac.za. You can also contact my supervisor Dr. M. Mudhara on 033 260 5518, Email: Mudhara@ukzn.ac.za at the African Centre for Food Security and Prof U. Kolanisi Tel: 035 902 6003, Email: KolanisiU@unizulu.ac.za

Consent Form

I _____ confirm that I have clearly read and understood the information from the previous page. I understand that participation is voluntary, and I may withdraw at any given time without penalty and without having to give any reason. My personal information will remain anonymous.

Participant's signature: _____ Date: _____

Analysis of food baskets and their implications for household food security in the uMsunduzi Local Municipality

Part 1: Household Demographics

1. Respondent's location?

   _____

2. Name of respondent: _____

3. Gender of household head: Male ☐ female ☐

4. Age of household head: _____years

5. Marital status of household head: Single ☐ Married ☐ Widowed ☐

6. What is the employment status of the household head?

Status	**Mark**
Unemployed	
Full time employed	
Part-time employed	
Informal Work	
Self-employed	
Pension Holder	

7. What is the household head's monthly income? R_____

8. Total estimated household income R_____

9. What is the educational level of the household head?

   None ☐ Primary ☐ Secondary ☐ Tertiary ☐

10. The literacy level of household head

    Please rate from 1 to 5 (1= Illiterate; 2= Primary; 3= Secondary; 4= Tertiary)

Skill	**Scale**
Reading	

Writing	

11. Please list any medical problems that any member of the household is suffering from

_____

12. Number of household members: _____

13. Household members information (excl. household head)

	Gender	**Age**	**Schooling? Yes/No**	**Educational level**	**Income Source**	**Relationship to household head**	**Grant recipient? If so, Please specify what kind**
1							
2							
3							
4							
5							
6							
7							
8							
9							

Age Ranges: 1<12; 2 = 12-17, 3 = 18-35; 4 = 36-65, 5= >65

Gender: 1=Female; 2= Male

Schooling: 1= Yes; 2= No

Educational Level: 0=None; 1= Primary; 2= Secondary; 3= Tertiary

Income source: 0=Unemployed; 1= Full-time; 2=Part-time; 3= Informal work 4= Pension Holder

14. Do you plant any crops? Yes ☐ No ☐

15. Please indicate the size of your plot(s) along with means of ownership and land quality

Plot I. D	**Size of plot (Ha)**	**Means of ownership (Allocated/Inherited/ Borrowed/Leasing/ Bought/ Other)**	**Quality of land (Poor/Good/ Very Good)**
1			
2			

*One hectare= one soccer field

16. Which crops do you plant? (Please mark with X)

Crop	**Mark**
Maize	
Cabbage	
Sugarcane	
Potatoes	
Carrot	
Spinach	

Crop	**Mark**
Beans	
Butternut	
Lettuce	
Beetroot	
Peas	
Pepper	

17. Do you sell any of these crops? Yes ☐ No ☐

18. How much money do you make from these crops? R_____

19. Purpose of planting: Selling ☐ Household Consumption ☐ Both ☐

20. Water source (Please mark where applicable)

Household Tap	
Community Tap	
Borehole	

Water tank	
Other (Please specify)	

21. How much is spent on food per month? R_____

22. Sources of nutrition information:

Sources	Mark
Television	
Radio	
Cellphone	

Sources	Mark
Newspapers	
Health institutions	
Other (please specify)	

Part 2: Fortified foods awareness and nutrition knowledge

1. Where do you usually purchase your food basket items?

Store	Mark
Pick n' Pay	
Woolworths	
Game	
Shoprite	
Checkers	

Store	Mark
Spar	
Boxer	
Super Save	
SAVE!	
Other	

2. Why this particular shop?

_____
_

_____
_

_____
_

3. Frequency of grocery shopping: Daily basis ☐ Weekly ☐ Three times per month ☐ Twice a month ☐ Once a month ☐
4. Dates of shopping: Around the 3rd of each month ☐ the 15th of each month ☐ 25th of each month ☐ 30th of each month ☐

5. What do you consider when purchasing your food basket?

   (Rating; 1= Most Important; 2=Important; 3=Less Important; 4: Not Important)

Item	Mark	Rating
Price		
Supermarket Specials		
Children Preferences		
Known or Trusted Brands		
Nutrition		

Item	Mark	Rating
Taste		
Health		
Cultural Preferences		
Other (please specify)		

6. Do you know about fortified foods? (Yes ☐ No ☐
7. If yes, where did you hear about fortified foods from? Friends ☐ Television ☐ Newspapers ☐ Other ☐

   Other (Please specify) _____

8. Do you buy fortified foods? Yes ☐ No ☐
9. Do you read food labels before buying? (Probably not ☐ Maybe ☐ Quite Likely ☐ Definitely ☐
10. Who decides what to buy on the food basket list?

	Mark
Head of household	
Mother	
Daughter	
Son	

11. Can you identify the food fortification logo? Yes ☐ No ☐
12. How much does it cost you to travel to and from the supermarkets you purchase from if any? R_____

Part 3: What do you purchase in your food basket? (Please tick where applicable and specify brand name)

Food Items	Mark	Brand Name	Quantity of product usually purchased	Frequency bought per month	Alternative

			(specify units that is. kg)		
Wheat Products					
Brown Bread					
White Bread					
Cake Flour					
Pasta					
Breakfast Cereal					
Maize Products					
Maize Meal					
Samp					
Breakfast Cereal					
Cereal Grain					
Rice					
Sunflower Products					
Brick Margarine					
Medium Fat Spread					
Sunflower Oil					
Processed Vegetables					
Canned Peas					
Canned Baked Beans					
Canned Butter Beans					
Baby Carrots					
Frozen Vegetables					
Canned Tomato and Onion Mix					
Fresh Vegetables					
Carrots					

Onions					
Potatoes					
Sweet Potatoes					
Cabbage					
Tomatoes					
Lettuce					
Pumpkins					
Cauliflower					
Processed Meat					
Polony					
Pork Sausages					
Canned Meatballs and Gravy					
Picnic Ham					
Unprocessed Meat					
Pork Chops					
Lamb					
Beef (Brisket, Chuck, Mince, Stew, Rump Steak, T-bone)					
Whole Chicken					
Chicken Portions					
Dairy Products					
Full cream milk					
Low-fat milk					
Skimmed Powder Milk					
Cheese					
Yoghurt (Full cream/Low fat)					
Fruits					

Apples					
Bananas					
Oranges					
Madumbe					
Grapes					
Naartjie					
Fish Products					
Tinned Tuna					
Frozen Fish					
Tinned Sardines					
Other					
King Korn					
Iodized Salt					
Mahewu					
Sorghum-meal					

Part 4: Food Consumption Patterns

1. How many meals do you consume a day?

   One ☐ Two ☐ Three ☐

2. Which food items can the household not survive without?

   _____

3. **Household Dietary Diversity Score**

Which type of food groups have you consumed in the past seven days and how many times?

Food Groups **Have you consumed any of the following?**	**0=No** **1= Yes**	**Number of times in the last 7 days**
A= Cereals (Bread, Noodles, any food made from maize, wheat, rice, sorghum)		
B= Roots and Tubers (Potatoes, yams etc.)		
C= Any Vegetables		
D= Any Fruits		

E= Meat (Beef, Pork, Lamb, Goat, Rabbit, Liver, Kidney, Heart) / Poultry (Chicken)		
F= Eggs		
G= Fish and Seafood		
H=Pulses/Legumes/Nuts (Beans, Peas, Lentils, Any type of nut)		
I= Milk and Milk Products		
J=Oil/ Fats		
K= Sugar/ Honey		
L= Miscellaneous		

4. In a **normal day**, what composes your household's meals?

Breakfast:
_____

Lunch:
_____

Dinner:
_____

In between –meals (if you have):
_____

_____