Changes in household food security, nutrition and food waste along an agro-ecological gradient and the rural-urban continuum in mid-sized South African towns

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ABSRACT

The lack of dietary diversity is a severe problem experienced by most poor households globally. Most poor communities are at high risk of inadequate intake of micronutrients resulting from diets dominated by starchy staples. The present study considered the diets, dietary diversities and food security of women of reproductive age between 15-49 years, households and communities along the rural-urban continuum in three mid-sized towns situated along an agro-ecological gradient in South Africa. A 48-hour dietary recall was performed across two seasons (twice in summer and once in winter) and focus group discussions were held to gather all information including food abundance, seasons of food scarcity as well as coping strategies which households employ during periods of food shocks. Households were further asked to quantify any type of food waste that they could have generated in the previous 48 hours. Nutritional status of children under the age of five in all three towns was also measured using height-for-age (HAZ) and mid-upper arm circumference (MUAC) as indicators of stunting and wasting respectively. The household surveys were conducted with 554 women randomly selected in rural, peri-urban and urban locations of Richards Bay, Dundee and Harrismith. For nutritional status, the sample consisted of 216 children who were randomly selected from the sampled households in rural, peri-urban and urban locations of the study sites. Household Dietary Diversity Scores (HDDS) and Women's Dietary Diversity Scores (WDDS) were calculated from the food items consumed by each household and each woman over a two-day period, respectively. Household food access was also measured for each household using Household Food Insecurity Access Scale (HFIAS).

The mean WDDS and HDDS for the wettest site of Richards Bay (3.8±0.29 and 8.44±1.72, respectively) was significantly higher than at Dundee (3.4±0.30 and 7.76±1.63, respectively) and Harrismith (3.5±0.27 and 7.83±1.59, respectively) which were not different from one another. The mean HFIAS for Dundee (9.39±7.13) was significantly higher than that in Richards Bay (5.57±6.98) and Harrismith (6.43±6.59) which were not significantly different from one another. Dietary diversity scores were also significantly higher in urban locations than in peri-urban and rural ones whilst HFIAS was significantly lower in the urban locations than peri-urban and rural locations. There was lower dependence on food purchasing in Richards Bay compared to Dundee and Harrismith where the majority of the population was purchasing most of their food. The majority of Richards Bay households were involved in

subsistence agriculture and also produced a surplus for sale, as well as collecting wild foods, which improved food security, unlike Dundee and Harrismith. Food insecurity was higher in rural and peri-urban areas compared to urban areas. In all towns, food was always available throughout the year but was beyond the reach of many households. In urban areas food was readily available and only limited by access, whereas rural populations have limited access to affordable food and face higher prices. The peri-urban populations were more food insecure because of high levels of poverty, unemployment and lack of access/entitlements to land. Peri-urban dwellers are therefore more sensitive to changes in incomes and food prices because they lack safety nets to absorb income or price shocks as they purchase more, rather than growing their own food. Household dietary diversity was significantly negatively correlated with household food access, that is households with low HDDS had higher HFIAS scores.

Due to high levels of food insecurity, a greater percentage of children under the age of five years were stunted (35 %) and wasted (18 %). There were no significant differences in stunting along the agro-ecological gradient, along the rural-urban continuum and sex of child. However, significant differences were observed in child wasting along the agro-ecological gradient with Harrismith having more wasted children than the other two towns, which were not significantly different from each other. Significant differences were also observed between MUAC and sex of child where male children had higher MUAC than females. Wasting was significantly negatively associated with HDDS, with children from households with low HDDS tending to have large MUAC thus showing an inverse association among HDDS and obesity. However, further studies are needed to confirm this finding.

In general food insecurity was closely associated with low wealth, food expenditure, large household size and limited access to land. The study did not find any significant role in the use of wild foods and social grants in improving food security for those households who were consuming wild foods and those receiving social grants. Although a greater percentage of households were food insecure, significant amounts of unprepared food (495±179 g per household) were wasted in Richards Bay alone in 48 hours mainly because the food had passed the best before date or had visibly gone bad. The amount of food waste was closely significantly negatively associated with household size. In general, the prevalence of food insecurity and wasting followed the agro-ecological gradient, with households in Richards Bay where the area

is coastal, wet with longer growing seasons and where rain fed agriculture is viable, were less affected. However, this was not true for the rural-urban continuum as a greater percentage of households who were food insecure, wasted and stunted were from the peri-urban locations although this was not significantly different from the rural percentages.

Key Words: dietary diversity, agro-ecological gradient, rural-urban continuum, reproductive age, food insecurity, stunting, wasting, wild foods.

DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that all other sources used or quoted have been fully acknowledged and referenced. The work has not been submitted before for the award of any other degree at any other university.

Signature: ..... Date: .....

DEDICATION

This thesis is dedicated to my husband, Albert,

for all his unconditional love, encouragement and support throughout my studies,

my daughters Rutendo for understanding, Makatendeka for being brave at such a young age

and

my parents Otilia & Fanuel Mataruse

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LIST OF ABBREVIATIONS

AFSUN	African Food Security Urban Network
AIDS	Acquired Immunodeficiency Syndrome
CSG	Child Support Grant
CSIR	Council for Scientific and Industrial Research
DRC	Democratic Republic of Congo
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
GIS	Geographical Information System
GPS	Geographical Positioning System
HAZ	Height-for-Age Z-scores
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HIV	Human Immunodeficiency Virus
HSRC	Human Sciences Research Council
IDP	Integrated Development Plan
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
KZN	KwaZulu Natal
lFRC	International Federation of Red Cross and Red Crescent Societies
LUNA	Livelihoods, Urbanisation, Natural resources in Africa
MUAC	Mid-Upper Arm Circumference
NVF	New Variant Famine
SASSA	South African Social Security Agency
SD	Standard Deviation
Stats SA	Statistics South Africa
UN	United Nations
UN_HABITAT	United Nations Human Settlements Programme
UNDP	United Nations Development Program
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USA	United States of America
WDDS	Women's Dietary Diversity Scores
WFP	World Food Program
WHO	World Health Organisation
WRAP	Waste and Resources Action Programme

Chapter One

Introduction

1.1. Background

1.1.1. Global trends in food security

The world faces growing challenges of widespread food insecurity and malnutrition (Rosegrant and Cline, 2003; Iram and Butt, 2004; FAO, 2009; Godfray et al., 2010). While some progress has been made over the past years to reduce global food insecurity or chronic undernourishment, food insecurity is real for almost one billion people facing hunger on a regular basis (FAO, 2010; Poppy et al., 2014a) and more than two billion people suffering from micronutrient deficiencies (Pinstrup-Andersen, 2009; Barrett, 2010). Rapid population growth, rising food prices globally and economic crises increased the number of food insecure people from 845 million in the early 1990s to 873 million people between 2004 and 2006. Globally, the number of undernourished people has declined to about 795 million people, which is from almost 19% in 1990–1992 to about 11% in 2014–2016, reflecting fewer undernourished people in a growing global population (FAO et al., 2015). The decline is more pronounced in developing regions but the economic crisis and political instability in some developing countries is hindering the process, especially in Central Africa and Western Asia (FAO et al., 2015). While there was a marginal decline in the proportion of undernourished people between 2014-2016 in other regions, the number of those who are affected by hunger and the undernourished has increased in sub-Saharan Africa as about 23% of the population is estimated to be undernourished and about 220 million people are hungry (FAO et al., 2015).

There are serious concerns, especially in sub-Saharan Africa where poverty and hunger are getting worse (FAO, 2009; WFP, 2010; FAO et al., 2012; 2015; Salami et al., 2011). This is being driven by several factors, including rapid population growth, urbanisation, rising food prices, changing diets and food consumption patterns, environmental and climate change and reduced access to food primarily due to loss of employment, cash income and remittances (Brown, 2009). High HIV/AIDS prevalence have also been reported to have worsened the food insecurity crisis in many households in Africa, particulary for the poor in both rural and urban areas (Clover, 2003; Bukusuba et al., 2007; Drimie and Casale, 2009; Masuku and Sithole, 2009; Cohen and Garrett, 2010; Drimie and Gillespie, 2010). For example, data from

Swaziland have shown that the current food security crisis in that country was mainly due to increased vulnerability exacerbated by HIV/AIDS (Naysmith et al., 2009). This is because the high prevalence of HIV/AIDS affects all aspects of food security, that is access, availability, utilisation and vulnerability (Twine and Hunter, 2011). However, several recent studies show increasing prevalence of food insecurity in urban areas (Ericksen, 2008; Brown, 2009; Frayne et al., 2010; Crush et al., 2011; Battersby, 2012), which is mainly experienced at household and individual levels (Misselhorn, 2005).

The prolonged problem of human energy deficiencies has made it a continued focus of global efforts to deal with the issue of malnutrition (Ingram et al., 2010; McDonald, 2010). In 1996, at the World Food Summit, more than 180 nations agreed on eradicating hunger and reducing the number of undernourished people by half by 2015 (FAO, 2006). The first Millennium Development Goal (MDG) in 2000 also sought to "eradicate extreme poverty and hunger" by 2015 and also halve the proportion of those suffering from hunger (UN, 2008). Food and agricultural systems productivity was increased to meet the needs of all people in the world (Gregory et al., 2002), but this did not assure food security for all (Iram and Butt, 2004; Poppy et al., 2014b) as the situation is getting worse, especially in sub-Saharan Africa (WFP, 2016). For example, WFP (2016) has reported that about 31.6 million people in southern Africa have been affected by the poor rainy season caused by El Niño between 2015-2016. This has led to a regional scale drought which could increase the number of people experiencing food insecurity in the region as food prices across the region have risen sharply. Cases of acute malnutrition have been reported in Zimbabwe where almost three million people are estimated to be food insecure, in Malawi and Mozambique where almost half a million people are food insecure and also in southern Madagascar (WFP, 2016).

Food security exists "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Achieving food security requires four aspects to be met, which are availability (domestic production, distribution and exchange), access (affordability, preference and allocation or entitlements for obtaining food), effective biological utilisation (nutritional diversity, health status and food safety) and stability of food supplies (seasonality, food is accessed at all times even during natural, economic or political crisis) (FAO, 1996;

Barrett, 2010; Ingram, 2011; Grote, 2014). Availability, access and utilisation form a hierarchy, as food availability does not ensure access to sufficient, safe and nutritious food for all and when a person has access to food, it does not ensure that the food would be utilised effectively (Webb et al., 2006; Pinstrup-Andersen, 2009). For example, there is sufficient food available worldwide (Ingram, 2011; Salami et al., 2011; Gebrehiwot and van der Veen, 2014; Grote, 2014) but hunger remains a pervasive problem (Gebrehiwot and van der Veen, 2014; FAO et al., 2015; WFP, 2016) which implies that a key issue to food security is access and distribution.

For example, in 2010 about 925 million people had to go to bed hungry and about 12 % of the world's population was chronically undernourished in terms of energy intake. FAO et al. (2015) define undernourishment as when a person is not able to acquire enough food to meet the daily minimum dietary energy requirements, over a period of one year. Most undernourished people live in developing countries (FAO et al., 2012; Gebrehiwot and Van Der Veen, 2014; FAO et al., 2015). Research has also shown that the FAO (2010) estimate of 925 million people who are food insecure might be a gross underestimate as some two billion people are iron-deficient worldwide and in 2012 about 97 million children under the age of five were underweight (WHO, 2013). Although FAO et al. (2015) reported a decline in the global number of the undernourished, the number remains high as sub-Saharan Africa remains particularly exposed to what has become known as "hidden hunger". "Hidden hunger" is the lack of, or inadequate, intake of micronutrients, resulting in different types of malnutrition, such as iron-deficiency anaemia and vitamin A deficiency (FAO et al., 2015). This indicates that people in this region are still facing challenges in accessing food (Diouf, 2005; Omotesho et al., 2006). Access to food is therefore the central component rather than availability, and inability to access food is the main cause of food insecurity in general.

1.1.2. Global urbanisation and its effect on food security

Globally urbanisation is being driven by rapid growth of the urban population, concurrent with stagnating growth of the rural population and therefore the world's population is increasingly concentrated in urban settlements (UN, 2014). Urbanisation is one of the major social changes sweeping the globe and is high in the less developed regions (Chen, 2007) because the developed world is already largely urban. Urbanisation occurs through a number of different

processes such as natural population increase (e.g. Latin America (Bhattacharya, 2002)), rural-urban migration (e.g. sub-Saharan Africa (Bhattacharya, 2002)) as well as annexation (Cohen, 2006). The world's urban population continues to grow at a higher rate than both the rural population and the average growth rate of the global total population (Satterthwaite, 2006; United Nations, 2014). More than half of the world's total population lived in urban areas as of 2008 (Montgomery, 2008; FAO, 2009; UN, 2009). The urban population is anticipated to grow at an average rate of between 2 and 3% per year in developing regions, especially Africa and Asia (United Nations, 2009). It is predicted that by 2050, about 70% of the world's population will be urban (FAO, 2009), thus almost all of the world's future population growth is expected to be absorbed by the urban areas of the less developed regions (UNFPA, 2004; UN, 2005; Cohen, 2006). The majority of urban migrants are moving to smaller and medium-sized urban towns of 500 000 inhabitants or less (UN-HABITAT 2006; World Bank 2009; Lerner et al., 2011). These small urban centres play an important role in urbanisation processes as they absorb more than half of the world's urban population (Cohen, 2006; Satterthwaite, 2006; UN-HABITAT 2006; Matuschke, 2009; World Bank 2009).

The economic, social and environmental consequences of urbanisation are often more immediate and noticeable in relatively small- and medium-sized towns. These towns have largely been neglected in urban studies in both South Africa and other parts of the world (Nel and Rogerson 2007; Nel et al., 2011). Rapid urbanisation has produced an 'invisible crisis' of urban food insecurity for example in southern Africa (Crush and Frayne, 2010; Frayne et al., 2010; Battersby, 2012). Rapid urbanisation may be associated with poverty, crime, overburdening of social services, public health risks linked to poor sanitation and increases in child malnutrition, especially in developing countries (Fotso, 2007; Misselhorn et al., 2012). Many people living in urban areas face under-nutrition mainly due to their lack of income rather than to a lack of capacity to produce food (Satterthwaite et al., 2010). The health and nutritional status of urban populations with very low incomes are at risk from price rises in staple foods. This became evident with the rising hunger among urban populations after the food price rises in 2007 and the first half of 2008 (Cohen and Garrett 2009). Urban poverty and inequality are fast becoming major issues within many developing regions and urban growth is increasingly associated with the development of slums (UN-HABITAT, 2006). Urbanisation is probably the greatest factor influencing dietary change and subsequent changes in nutritional status of urban dwellers (FAO, 2004a).

1.1.3. Urbanisation and food security in South Africa

In South Africa, two-thirds of the population live in urban areas (Kok and Collinson, 2006; Archer et al., 2010, Stats SA, 2014) and the majority of the population is in the process of transition from rural to urban lifestyles. This is accompanied by nutritional transition whereby undernutrition and overnutrition coexist, affecting the majority of the population (Chopra et al., 2009; Crush, 2011; Faber et al., 2011; Labadarios et al., 2011). Poor people tend to cope with poverty by adopting unvaried diets mainly of starch staples, such as maize meal, with limited vegetable and fruit intake (Schönfeldt et al., 2010; Faber et al., 2011). South Africa is amongst the top 20 countries internationally with the highest burden of undernutrition (Altman et al., 2009; Vorster, 2010; Drimie and McLachlan, 2013). South Africa is listed by the World Health Organisation (WHO) as one of 36 high burden countries (Faber et al., 2010), with stunted growth and underweight being considered to be the major nutritional disorders in the country (Chopra et al., 2009; Drimie and Ruysenaar, 2010). Furthermore, the greater proportion of the population (especially the urban poor) tend to consume energy rich and processed foods, including refined grains, and foods higher in saturated fat, sugar and salt which can lead to individuals being overweight (Ruel and Garrett, 2004; Faber et al., 2011; Drimie et al., 2013). This is mostly affecting poor households who depend on less formal means of securing food such as from the informal markets and relying on informal social safety nets (Battersby, 2011).

Although South Africa may be food secure at a national level, large numbers of households within the country are food insecure (HSRC, 2004; Hendriks, 2005; Aliber, 2009; Hendriks, 2014). About 20% of South African households were estimated to have inadequate or severely inadequate access to food (Stats SA, 2009) and due to low incomes, recent reports have shown that about 30-50% of the population has insufficient food or consume imbalanced diets (Hendriks, 2014). In South Africa, 14.3 million people are defined as vulnerable to hunger (not having enough food intake) and 43% of the households are vulnerable to poverty (De Klerk et al., 2004; Drimie and Ruysenaar, 2010). The 2005 survey indicated that 52% of households experienced hunger, 33% people were at risk of hunger and only 20% people appeared to be food secure (Chopra et al., 2009; Labadarios et al., 2009). The prime causes of household food insecurity in South Africa are widespread chronic poverty and unemployment (HSRC, 2007) which also weaken informal safety nets, especially in urban areas (Drimie et al., 2013).

Rising food prices, particularly of maize and wheat, which are the staple items for poor South Africans, pose serious problems for the urban and rural poor as most are net buyers of food (Altman et al., 2009; Drimie and Ruysenaar, 2010). For example, in many cases, purchased food constitutes up to 90% percent of rural household diets accounting for 60 to 80 percent of total household expenditure (Baiphethi and Jacobs, 2009). Therefore, "the poor are facing higher food prices but no greater income, and they begin to starve" (Sen, 2008) through the reduction of purchasing power (Altman et al., 2009). It is difficult for most South African households to purchase enough food to feed the entire household because most struggle to sustain a decent income with the estimated average income of the poor being less than R524 per month per person (National Planning Commission, 2012). This has a negative impact on a large proportion of households already vulnerable to food insecurity, thereby increasing hunger and malnutrition (Altman et al., 2009). In South Africa, people are being advised by health workers to increase vegetable consumption (Modi et al., 2006), but food security for the rural poor is compromised with price and availability being barriers to a healthier diet (Temple et al., 2010). Affordability and availability, have been suggested as the major constraints to the consumption of vegetables and fruit by the rural and urban women in KwaZulu-Natal and the Western Cape (Love et al., 2001; Faber et al., 2009). This is exacerbated by a decline in smallholder agriculture (Hebinck and Lent, 2007; Shackleton et al., 2013) and the majority of the population is accessing food commercially through markets (FAO, 2008a), although there are some urban households who are growing vegetables primarily for their own consumption and may sometimes sell any surplus (Shackleton et al., 2010).

Studies have also shown that HIV/AIDS also intensifies the food insecurity of many communities in southern Africa (Gillespie and Kadiyala, 2005a,b; Modi et al., 2006; Drimie and Casale, 2009). In South Africa, more than five million people are infected with HIV with a resultant high AIDS burden (Kaschula, 2008). KwaZulu-Natal province is the most affected with a prevalence rate for adults aged 20-64 years of 28% (Dorrington et al., 2006). Households affected by the disease may face a food insecurity crisis mainly due to:

i. reduced production and income because of household-level labour shortages due to adult morbidity and mortality (Maunder and Wiggins, 2006; Twine and Hunter, 2008; Naysmith et al., 2009);

ii. increased number of dependents and the burden of caring for sick adults and children orphaned by AIDS (De Waal and Whiteside, 2003; Naysmith et al., 2009);
iii. loss of assets and skills due to adult mortality (De Waal and Whiteside, 2003; Naysmith et al., 2009);
iv. undercutting the ability of households to cope with shocks (Naysmith et al., 2009);
v. the vicious cyclical interaction between malnutrition and HIV (De Waal and Whiteside, 2003; Naysmith et al., 2009); and
vi. the need to pay for medical services or funeral expenses due to HIV/AIDS may decrease the income available for household expenditure on food. This increases the need for households to sell their assets, such as livestock, thus pushing them into deeper poverty and food insecurity (Masuku and Sithole, 2009; Shackleton and Shackleton, 2012).

Therefore, food insecurity and HIV/AIDS are intertwined in a vicious cycle that heightens vulnerability to, and worsens the severity of each condition (Anema et al., 2009). Households affected by HIV are generally more sensitive to livelihood shocks and food-related shocks (Mdladla et al., 2003). Therefore, significant attention has been given to the relationship between food security and HIV/AIDS in the southern African region (Hendriks, 2005; Ncube, 2013).

1.1.4. The rural-urban continuum and the importance of agriculture in food security

Globally, food insecurity is often misleadingly seen as an issue that only affects rural populations because the highest and deep levels of food insecurity are commonly noted in rural areas, for example in South Africa (Jacobs, 2009; D'Haese et al., 2013; De Cock et al., 2013). Hence, there is a strong bias in promoting food security programmes among rural populations (Crush and Frayne, 2010; Frayne et al., 2010; Battersby, 2012). Yet, due to increasing urbanisation and rising food prices, food insecurity is increasingly prominent in urban settings (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012). Over the last century, increases in urban transformation has resulted in the emergence of complex settlement systems, often blurring the distinction between urban and rural areas (Cohen, 2004; Tacoli, 2006; Satterthwaite, 2014). These areas are called "peri-urban" and are found in transitional zones between rural and urban (Tacoli, 2003; UNFPA, 2007). Peri-urban areas contain elements of both traditional urban and rural areas, although activities in these areas have created areas/zones between cities and rural areas that cannot be clearly defined as one or

the other (Cohen, 2004). Most small urban centres in low to middle income countries are associated with having a mix of both urban and rural characteristics (Satterthwaite, 2006). Rural, peri-urban and urban areas form a linked system which is complex, with the peri-urban environments playing a mediating role between the rural and the urban (Iaquinta and Drescher, 2000).

A variety of activities occur in the peri-urban areas, including farming and animal husbandry, cottage industries to industrial expansion, residential urbanisation and waste disposal (UNFPA, 2007). Goods such as food, energy, water and building materials can also be delivered in peri-urban areas (UNFPA, 2007). Rural and urban areas are therefore linked through the flow of people and goods, money and information, as well as social exchanges that encourage socio-economic and cultural transformation (Tacoli, 2006). Iaquinta and Drescher (2000) argued that the relationship between food production and food insecurity should be evaluated across the entire rural, peri-urban and urban system, because neither are no longer solely the domain of rural areas. The rapid urban expansion in many countries which is causing the growth of peri-urban areas that combine the "urban" and "rural" characterisctics also present challenges to the management of urban growth (Tacoli, 2006) and food security as a whole. Although peri-urban environments play a significant role in alleviating food insecurity and enhancing the nutritional status of urban poor through urban-peri-urban agriculture (UPA) (Drescher and Iaquinta, 1999), the majority of the people in these areas are still living in high levels of poverty with high rates of unemployment and lack of access/entitlement to land. Hunger and nutrient deficiencies are now common in urban and peri-urban informal settlements, including in South Africa (Oldewage-Theron and Slabbert, 2008; Oldewage-Theron and Kruger, 2011). However, some households may use natural resources as a source of cash income to alleviate poverty and limit food insecurity through use of wild foods (Kaoma and Shackleton, 2014; Ward and Shackleton, 2016).

Urban and peri-urban agriculture has also been used as a mitigation strategy for food insecurity in urban and peri-urban households (Schlesinger et al., 2015). The urban poor households have been benefiting from this practice (Thornton, 2008; Crush et al., 2010; Webb, 2011) and urban agriculture has been increasing, especially in developing countries particularly in Africa where an estimated 70 % of the urban population are engaging in this practice (Bryld, 2003). Urban agriculture in Africa can be practiced by both middle-income to wealthy households (Lee-Smith, 2010; Mkwambisi et al., 2011) and low income (Drakakis-Smith et al., 1995; Maxwell

et al., 1998; Crush et al., 2010) members of the community. Despite high levels of poverty in South African urban households, urban agricultural practices are limited in poor urban households as many are relying on social grants from the government (Thornton, 2008). However, Maxwell et al. (1998) showed that urban agriculture had a significant impact on improving child nutritional status in Kampala which is an outcome indicator of food security. Baiphethi and Jacobs (2009) also argued that increased subsistence production has the potential to improve the food security of poor households in both rural and urban areas through the increase of food supply and reducing the dependency of households on food purchasing.

1.1.5. Coping strategies and maladaptation to food insecurity

Households have different coping strategies to reduce the risks to their lives and livelihoods and some households may be able to cope with some shocks and stresses better than others. Poorer people with fewer resources tend to have less capacity for coping with external stresses and shocks (IFRC, 2006). Some poorer communities resort to the use of wild foods. Wild foods provide nutrients to a diet and they can also contribute to the alleviation of household food insecurity (Legwaila et al., 2011; Mavengahama et al., 2013). Wild foods are especially important to the more vulnerable members in the communities, that is, those that are at risk of food insecurity make greater use of them for income and food (Shackleton et al., 2007; Vinceti et al., 2008; Oluoch et al., 2009; Völker and Waibel, 2010; Arnold et al., 2011). Other coping strategies which are specific to South Africa include the use of social grants as a way of alleviating food insecurity. There is evidence showing how social grants have played an important role in improving household food security since 2001 in the poorest households in South Africa (Van der Berg, 2006; Schatz and Ogunmefun, 2007; Altman et al., 2009).

However, for households under stress; some coping strategies to food insecurity are maladaptive and further jeopardise future livelihoods. For example, children are removed from school to relieve costs associated with school attendance or to use them for labour which undermines human capital (IFRC, 2006; Drimie and Casale, 2009). Some households reduce food intake and dietary diversity to deal with food shortages which can lead to declining health and nutritional status (IFRC, 2006; Drimie and Casale, 2008). In other households, adults may forego meals or even eat less balanced meals to ensure that children have access to healthy food. Some women put themselves in danger of contracting HIV as they engage in transactional

and unprotected sex to secure food for themselves and their children (IFRC, 2006; Weiser et al., 2007). Other maladaptive coping strategies include sale of household assets which may reduce the future productive capacity of the household (Shackleton and Shackleton, 2000; Twine et al., 2003; Wessels et al., 2013). However, in some households, especially those with poor access to food, bulk buying is employed when food is being sold at lower prices when resources permit. If the food is of poor quality and has a short shelf life, then households are likely to waste the food when it has expired or is spoilt before being used. The availability of cheap food may encourage overbuying and hoarding of food which may result in food waste (Exodus, 2006; Griffin et al., 2009).

Food waste refers to wholesome edible material intended for human consumption, arising at any point in the food supply chain that is instead discarded, lost, degraded or consumed by pests (FAO, 1981). Food waste may include food loss before, during or after meal preparation in the household, as well as food discarded in the process of manufacturing, distribution, retail and food service activities. Globally, the food which is wasted is four times the amount needed to solve world hunger. Thus, the vast amount of food which is wasted could potentially feed the almost one billion people worldwide (13% of the global population) who are classified as undernourished (Gustavsson et al., 2011). Large quantities of food which are going to waste are aggravating problems of hunger and food insecurity, especially in poorer countries (Gustavsson et al., 2011). A food waste study by WRAP (2008) showed that consumers in the United Kingdom throw away about one third of the purchased food and 61 % of this food would still be suitable for human consumption which can be classified as avoidable food waste (WRAP, 2009; Partiff et al., 2010; Lebersorger and Schneider, 2011). In South Africa, it is estimated that close to one and a half million tonnes of food are wasted per annum (Nahman et al., 2012) yet the country faces a food security challenge with large numbers of households within the country being food insecure (HSRC, 2004; Hendriks, 2005; Aliber, 2009; Chopra et al., 2009; Labadarios et al., 2009; Hendriks, 2014).

1.2. Problem statement and justification

Urban populations are growing much faster than rural populations (United Nations, 2004; Satterthwaite, 2006) and the majority of urban migrants are moving to smaller and medium-

sized urban towns of 500 000 inhabitants or less (UN-HABITAT, 2006; World Bank, 2009). These urban centres play an important role in urbanisation processes as they absorb more than half of the world's urban population (UN-HABITAT, 2006). However, concerns on rapid urbanisation tend to focus on larger cities, yet approximately 52% of the world's population live in urban towns with less than 500 000 inhabitants (Satterthwaite, 2006; UN-HABITAT, 2006; World Bank, 2009). The effects of urbanisation, which include the economic, social and environmental consequences, are often more immediate and noticeable in relatively small- and medium-sized towns (Drakakis-Smith, 1995), but these towns have largely been neglected in urban studies in both South Africa and other parts of the world (Nel and Rogerson, 2007; Nel et al., 2011).

Urban and rural areas are often viewed as separate entities and are defined individually in terms of their functions and characteristics (Tacoli, 2006). Urban areas are associated with settlements with 20 000 or more inhabitants where much of the economically active population derive their living from secondary and tertiary sector activities (Satterthwaite, 2006). Urban areas are also associated with the use of technology, administrative or political status, and concentrations of services and infrastructure (Tacoli, 2006). Rural areas are typically associated with primary production such as agriculture and forestry and the populations of rural settlements range from farmsteads to a few hundred inhabitants (Satterthwaite, 2006; Tacoli, 2006). Population size, concentration, and the importance of non-agricultural economic activities increases from rural to urban settlements (Satterthwaite, 2006) with many migrants settling in the peri-urban areas which are transitional zones between the rural and urban areas (UNFPA, 2007). Hunger and nutrient deficiencies are now common in urban and peri-urban informal settlements across South Africa (Oldewage-Theron and Slabbert, 2008; Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Oldewage-Theron and Kruger, 2011; Battersby, 2012) with two-thirds of the population now living in urban areas (Archer et al., 2010). Most studies on food security in South Africa have focused on either the rural (Jacobs, 2009; D'Haese et al., 2013; De Cock et al., 2013) or urban areas (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012) as separate entities but Iaquinta and Drescher, (2000) suggested that studies should focus on the rural-peri-urban-urban (R-PU-U) system to fully understand the nature and processes occurring along the gradient. Iaquinta and Drescher (2000) argued that the relationship between food production and food insecurity should be evaluated across the entire rural, peri-urban and urban system, because neither are

no longer solely the domain of rural areas as some urban dwellers are also involved in activities that used to be considered for rural habitants only.

To date no study in South Africa has compared the nature and relative magnitude of household and individual food security and coping strategies along the rural-urban continuum of small- and medium-sized towns yet that is where the bulk of urbanisation is happening (UN-HABITAT, 2006). Most food security research in urban areas has been done in big cities (Frayne et al., 2009; Battersby, 2011; 2012), thereby overlooking the situation in small- and medium-sized towns characterised by higher poverty and lower capacities of municipal agencies (Nel and Rogerson, 2007; Nel et al., 2011). As food security is an increasing challenge, the use of rural-urban linkages potentially plays a crucial role towards food security for some households through the flows of people, commodities and services, especially between rural areas and small towns. The limited information regarding the changes in household food security and nutrition along agro-ecological gradients as well as along the rural-urban gradient provides the foundation for this research. Also, as the world faces a food security challenge with undernourished people and some starving daily, it is believed that at least 33% of food produced for human consumption is lost or wasted along the food chain between farm and fork (Bloom, 2007; Lundqvist et al., 2008; Meeusen and Hagelaar, 2008; Ridoutt et al., 2010; Gustavsson et al., 2011; FAO, 2013). As many South African households are greatly affected by food insecurity, no research has been done to explore if these households are also contributing to the amounts of the food that is being wasted globally as is reported in developed countries.

1.3. Aims of study

The aims of the study were to explore changes in household food security between sites along an agro-ecological gradient as well as along the rural-urban continuum in each town in medium-sized South African towns. A range of food security indicators such as household and individual dietary diversity using household dietary diversity scores (HDDS) and women's dietary diversity scores (WDDS) respectively, household food insecurity access scale (HFIAS) as well as determining differences in nutritional status through the use of child anthropometry were used. The relationships between the dietary diversity scores, HFIAS, anthropometric

indicators, household socio-economic characterictics such as wealth and food expenditure and household size were explored along the gradients. The study also aimed to compare the sources of food, coping strategies which households employ during food shortages periods, extent of wild food usage, extent of use of social grants as well as quantifying household food waste along the agro-ecological and rural-urban gradients. Furthermore, this study aimed to identify vulnerable groups and the factors that make them vulnerable to food insecurity.

To address these aims, the following key questions were posed:

1. How do households' food security and nutrition change along the agro-ecological gradient and rural-urban continuum in relation to food access, food diversity and food abundance? This was addressed in Chapters Two, Three and Four.
2. Which household members suffer most from food insecurity and why? (Chapters Two, Three and Four).
3. What do communities perceive as a healthy diet? What are the drivers and the barriers to attaining a diverse diet? (Chapter Four)
4. How do households cope with food insecurity? Do they use wild foods and/or produce their own food as coping strategies that allows them to limit food shortages? (Chapters Four and Five).
5. Are social grants alleviating food security in the households receiving them? (Chapter Five)
6. What types and quantities of food are being wasted in households, by who and why? (Chapter Six).

1.4. Conceptual and theoretical framework

The study used the theoretical framework of the determinants of household food security and nutritional status adapted from UNICEF undernutrition conceptual framework (Black et al., 2008) and Turner's vulnerability framework (Turner et al., 2003). The framework shows all four dimensions of food security, namely food availability, access, utilisation and stability, as well as the three components of vulnerability which are composed of exposure, sensitivity and resilience variables (Figure 1.1).

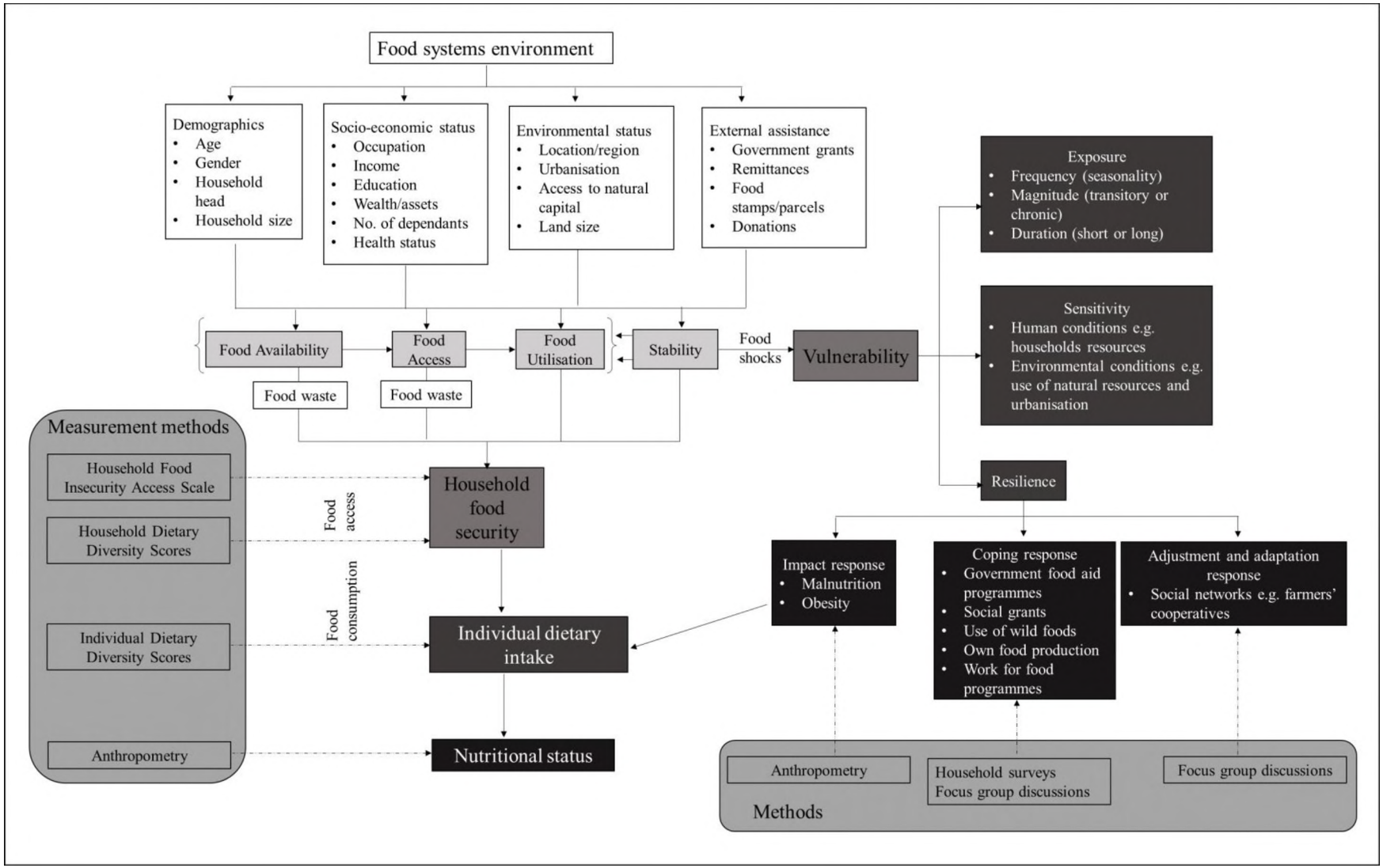

Figure 1.1. Conceptual framework showing the determinants of household food security, nutritional status and household vulnerability to food insecurity.

The three major determinants of food security which are food availability, food access and food utilisation are interlinked as one affects the other. That is, food availability does not ensure access to sufficient, safe and nutritious food for all and when a person has access to food, it does not ensure that the food would be utilised effectively (Webb et al., 2006; Pinstrup-Andersen, 2009). Food availability refers to the availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid) and this should be within the reach of households (FAO, 2006). Food availability also determines factors such as food distribution, exchange, consumption and food waste. Food access refers to the access by individuals or households to adequate resources for acquiring sufficient quantity and quality foods for a safe and nutritious diet (FAO, 2006). The main determinants of access are affordability, allocation and preference and at household level, mostly household resources (income and land), food prices as well as food preferences and access to natural resources determine food access (Hoddinott, 2012). That is, given the households' resources, the quantity and quality of the food which a household acquires depends on the food prices and household income and these in turn determine the preference and type of food an individual may acquire and consume. Food utilisation is largely about an individual's dietary intake which is mostly realised through adequate diet (sufficient quantity and quality), clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met (FAO, 2006). Food utilisation encompasses nutritional value, social value and food safety.

Stability is a cross-cutting dimension which affects all three pillars of food security. It mainly points out that food must be available and accessible as well as being utilised adequately at all times and households should not worry about being food insecure sometimes and risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity) (FAO, 2006). However, when households face food shocks due to limited access to food for various reasons, for example, increase in food prices, loss of employment, lack of income and drought, they may become vulnerable to food insecurity. Therefore, the study incorporated the 'Turner model' of vulnerability (Turner et al., 2003) and in this model, the definition and analytical framework of vulnerability is composed of exposure, sensitivity and resilience variables (Figure 1.1).

Vulnerability is viewed in the context of a coupled human-environmental system and, exposure, coping response, impact response, adjustment response and adaptation response are parts of vulnerability (Turner et al., 2003). The conceptual framework also includes the concept of adaptation which is an element that promotes resilience. In the Turner model, exposure allows the determination of the component at risk (individuals and households) and it includes the characteristics of the shock (frequency, magnitude and duration). This conceptual framework is useful for this study as the households and individuals affected by food insecurity or whose vulnerability will be reduced by increased physical, social or economic access to sufficient, safe and nutritious food needed to be identified. As food insecurity can either be transitory (short-term decline in access to food) or chronic (long-term inadequate diet caused by a continual inability of individuals or households to meet their daily food requirements (Brown, 1994; IFRC, 2006; WFP, 2007)), all three elements of exposure which are frequency (at what rate of occurrence), magnitude (to what extent) and duration (for how long) were used for this study.

The human-environment conditions of the system determine its sensitivity to any set of exposures (Turner et al., 2003). These conditions include both social and biophysical capital which can be interacting within a feedback loop system and these conditions influence the coping mechanisms which take effect as the impacts of the exposure are experienced, as well as those coping mechanisms adjusted or created because of the experience (Turner et al., 2003). Resilience has been defined as the system's ability to cope or respond to disturbances and the capacity of a system to maintain its structure and function after the disturbance (adjustments or adaptations) (Turner et al., 2003). The resilience of the system is determined in terms of the amount of change a given system can undergo and still remain within the state of natural or undesirable condition (Turner et al., 2003). The components of resilience include coping, impacts, adjustment and adaptation and all are related to responses. In the present study, resilience was determined by concentrating on key social and biophysical features that are critical to determine if a household can or cannot maintain its structures and functions prior to disturbance.

The social subsystem included levels of household poverty, levels of marginalisation (gender and age), household and individual ability to deal with food insecurity, and support from government (social grants and food aid). The biophysical subsystem included households' use of wild foods to limit food insecurity and access to land. A list of variables which may influence household food security and food insecurity have been used in the analysis and these included household demography, socio-economic factors, environmental welfare and assistance from either government or relatives. The above-mentioned factors may cause a household to be either food secure (which ultimately determines the nutritional status and lifestyle of a household where households may end up having more food items which they do not consume but rather through away) or a household may be vulnerable to food insecurity (households may change diets which also may affect the nutritional status and may use other means to alleviating food insecurity such as through crop production, joining social networks or use of wild foods although these can be part of diet in some communities (Shackleton, 2003; Fa et al., 2003; Shackleton and Shackleton, 2004; de Merode et al., 2004; Bell et al., 2009; Kümpel et al., 2010; McLain et al., 2014)).

1.5. Structure of thesis

Chapter One introduces the theoretical background and research gaps to the theme of this study. An examination of the definition and dimensions of food security, the current trends in food security on the global scale and in sub-Saharan Africa in particular are discussed. The extend and effects of urbanisation on global food security are discussed and focusing on these processes in South Africa. The purpose of the study with an emphasis on the role of agro-ecological regions in food security and the differences along the rural-urban continuum was presented.

Chapter Two has compared the nature and relative magnitude of individual food security particularly women along an agro-ecological gradient and rural-urban continuum in three mid-sized towns in South Africa by using women's dietary diversity scores (WDDS). The chapter determined the differences in women's dietary diversity between the towns and along the rural-urban gradient in each town and explored the relationships between WDDS and selected household characteristics.

Chapter Three measured household food insecurity and determined the nutritional status of children in the three towns and along the rural-urban gradient in each town. Households at varying degrees of food insecurity were differentiated and most vulnerable households were identified. Chapter Three also explored the links between household food security, household dietary diversity and nutrition status of children and determined if there were any associations between these indicators.

Chapter Four used focus group discussions to capture information on the 'hidden' constraints in the measures of physical and economic access and availability of food which may affect the dietary quality of households in the study sites. Chapter Four sought to understand food insecurity from the perspective of community members who experienced it as well as understanding the community perceptions about food security, food abundance in their area, farming, self-reported, healthy diets and perceptions and feelings on how and where they access food. The perceptions of communities about food insecurity and the barriers to household food security as identified by the community members along an agro-ecological gradient are presented. Chapter Four also explored if there were any strategies that households were using to cope with food shortages and their perceptions on improving their food security status along the gradient.

Chapter Five presented the role of two widespread strategies, i.e. consumption of wild foods and receipt of social grants in improving household food security in medium-sized towns. Chapter Five explored the extent of use of different wild foods among households and addressed whether their use was following the agro-ecological gradient and rural-urban continuum and the same with social grants. The study compared and determined the differences in food security between the households who were consuming wild foods and those who were not and between the households who were receiving social grants and those who were not.

Chapter Six analysed household food waste both along the agro-ecological gradient and rural-urban continuum because this has a negative effect on food security. The types of food that households throw away were quantified and the reasons for wasting food are presented. Differences in food waste along the agro-ecological gradient and along the rural- urban continuum are presented in this chapter. Finally, Chapter Seven provides a synthesis of the five

preceding results chapters. It also highlights on the key findings of the study. Recommendations for food security monitoring and interventions are made in this chapter.

1.6. Study Area

The study was carried out in three medium-sized towns in South Africa, namely Richards Bay, Dundee and Harrismith. Richards Bay and Dundee are in the KwaZulu-Natal province whilst Harrismith is in the Free State province (Figure 1.2).

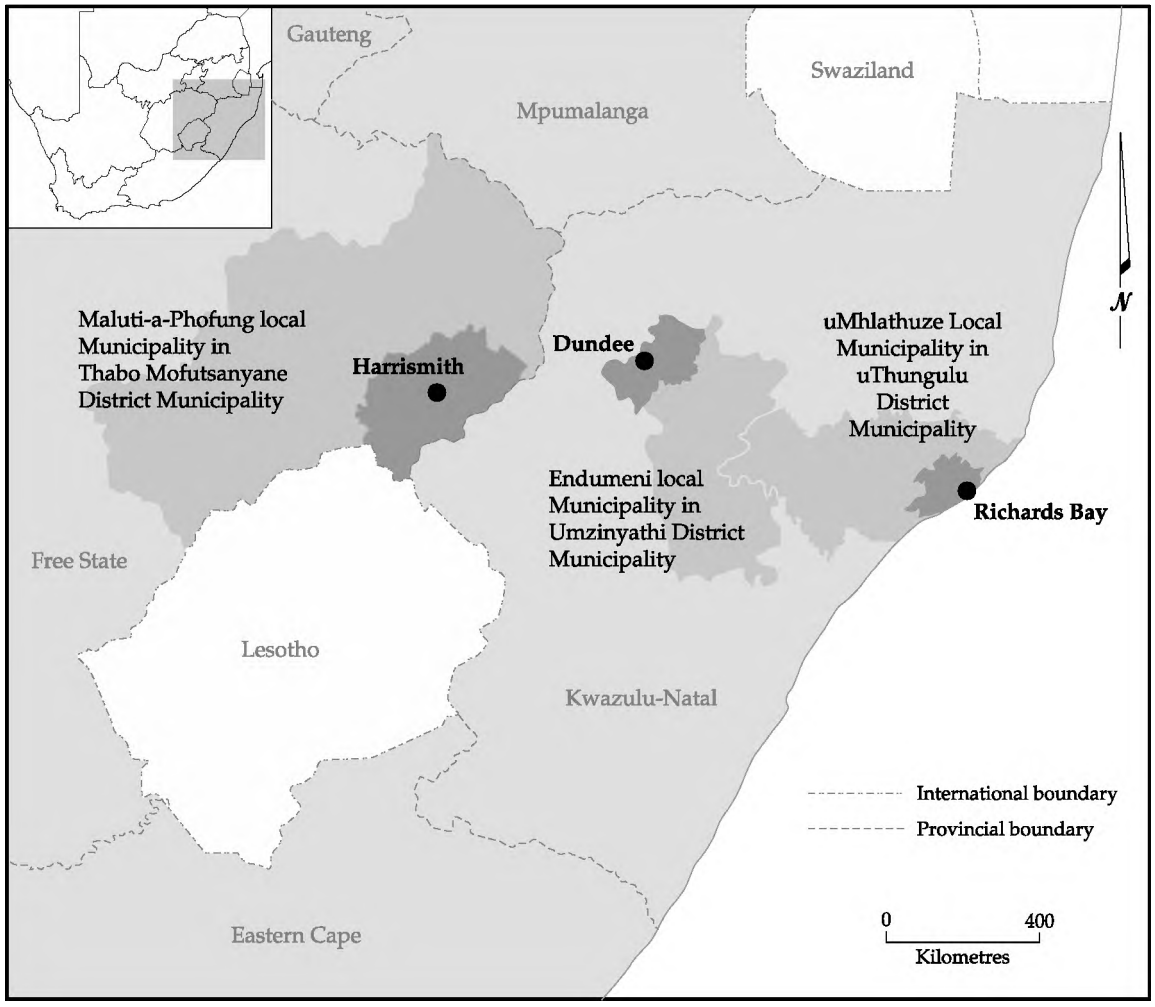

Figure 1.2. Location of study towns in South Africa.

Agro-ecological zones (AEZs) are geographical areas exhibiting similar climatic conditions that determine their ability to support rain-fed agriculture. These are influenced by latitude, elevation, and temperature, as well as seasonality, rainfall amounts and distribution during the

growing season (HarvestChoice, 2010). The study towns were selected according to their position along an agro-ecological gradient, with Richards Bay being a coastal and relatively wet town (approximately 970 mm p.a.) while Harrismith is an inland and dry town (approximately 622 mm p.a.) and Dundee being intermediate (inland and 683 mm p.a.). The seasonality of the rainfall increases along this gradient, along with the severity of winter temperatures. Thus, the gradient also reflects one of declining suitability for rain-fed agriculture, from high in Richards Bay to low in Harrismith where rural farms mostly practice cattle ranching. The agricultural regions of South Africa are shown in Figure 1.3 where Richards Bay falls in the region that specialises mostly in sugarcane production whilst cattle ranching is mostly suitable in Dundee and Harrismith. Each study site consisted of the rural, peri-urban and urban complex and data was collected along the rural-urban continuum.

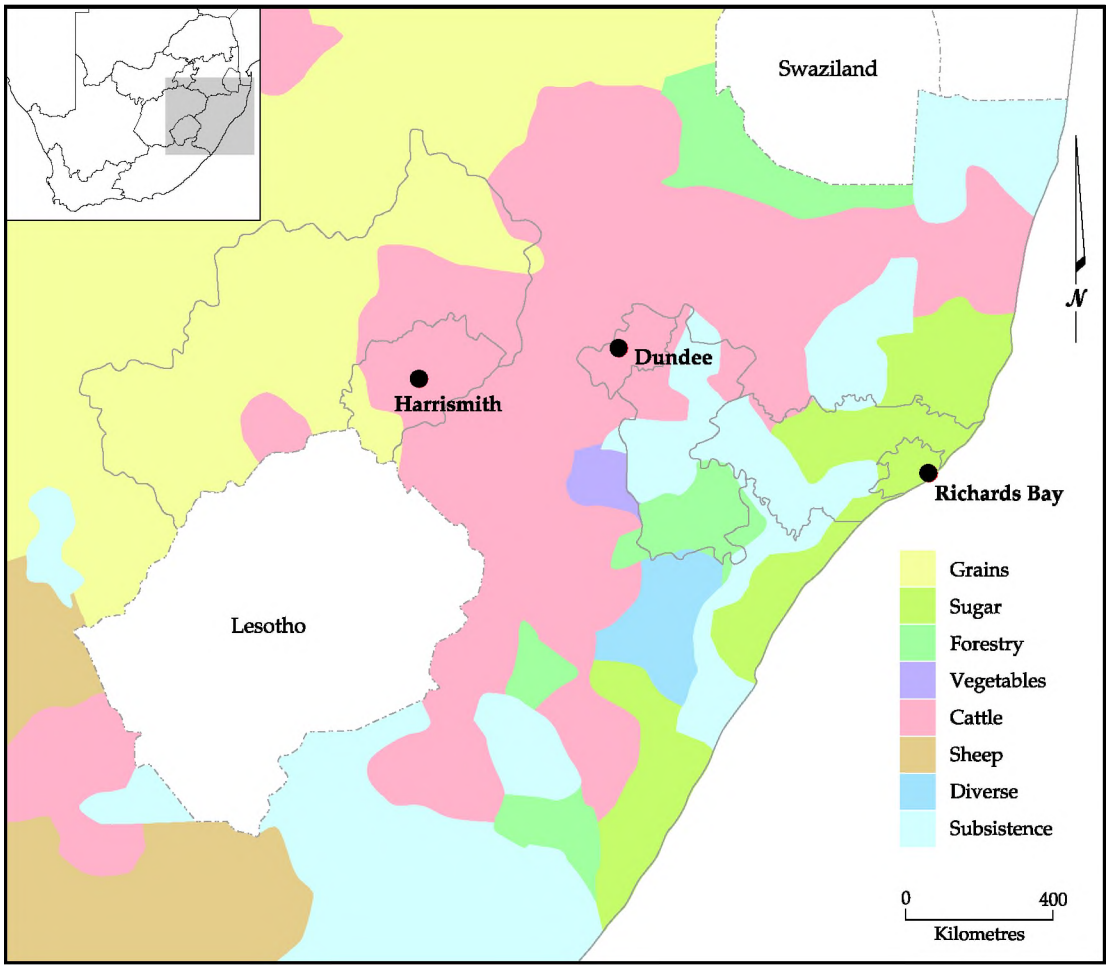

Figure 1.3. South Africa's agricultural regions.

1.6.1. Richards Bay

Richards Bay is a small coastal town in KwaZulu-Natal province of South Africa. Richards Bay has a population of approximately 50 533 people (Stats SA, 2012). It is characterised by a subtropical climate with warm wet summers and mild, moist to dry winters, which are frost-free. Rainfall occurs throughout the year with much of the precipitation occurring in summer between October and March. The mean annual rainfall of the town is approximately 970 mm and average annual temperature is 21.5 °C.

Richards Bay is in the uMhlathuze local municipality and covers an area of approximately 290 km^2 which is 36.5 % of the municipality. uMhlathuze local municipality is characterised by highly developed urban areas which are surrounded by poor and undeveloped rural areas. The municipality has an estimated total population of 349 576 comprising 82 972 households, with an average household size of four persons. The age category with the highest population is between the ages of 20-24 which is 14 % of the total population. The youth (15-35 years) constitute up 41.6 % of the total population of uMhlathuze municipality and therefore there is a huge demand for social and economic opportunities. The municipality is faced with high levels of unemployment (40 %) mainly due to lack of skills and widespread poverty, especially in rural areas. This is due to poor basic services, limited access to social services and employment opportunities as well as the impacts of HIV/AIDS (uMhlathuze Municipality, 2012/2017). Only 2.7 % of the population is aged 65 years and above and these depend on social grants for sustenance.

Average household income for the uMhlathuze municipality is R121 177 per annum (Stats SA, 2012) and the highest percentage of people (15.5 %) earn between R19 601-R38 200 per annum. The percentage of people who do not report any cash income is 15.2 % (Stats SA, 2012). The majority of the population in uMhlathuze are poorly educated. The percentage of the population older than 20 years with higher education is only 8.5 % and that of people with a level of education less than Grade 12 very high at 52.4 %. Most households in the municipality are male-headed and only 42.3 % are female-headed and 0.7 % child-headed (Stats SA, 2012).

1.6.2. Dundee

Dundee is a well-developed urban area which houses the Umzinyathi District Municipality, supporting the agricultural, tourism and manufacturing economic base of the district (Umzinyathi District Municipality, 2012/13). Dundee is a coal mining town situated in the Endumeni municipality in KwaZulu-Natal province. Endumeni local municipality is home to a population that is predominantly urban and only 16.8 % of the population lives in non-urban areas. Dundee has a population of approximately 34 924 people. The area is in the Biggarsberg Valley in the foothills of the Drakensburg Mountains and the average elevation of Dundee is 1 260 meters above sea level. Dundee has a subtropical, highland climate with pleasant summers and cool, dry winters. The average annual temperature is 18.6 ^{o}C and average annual rainfall is 683 mm. Rainfall occurs during summer mainly between October and March with December and January receiving the highest rainfall.

Endumeni local municipality has an estimated total population of 64 862 and about 16 851 households with an average household size of four persons. The municipality has significantly higher educational levels than those of other municipalities with only 7 % of people aged 20 years and older reported to have had no education. About 31.9 % of the population aged 20 years and older have completed matric. However, there are high levels of unemployment in the municipality (26.4 %). The unemployment rate among the economically active youth (15-34 years) in the municipality is 36.2 %.

Average household income for the Endumeni municipality is R87 430 per annum (Stats SA, 2012) and the highest percentage of households (19.4 %) earn between R9 601-R19 600 per annum. The percentage of households who do not have any cash income is 12.4 % (Stats SA, 2012). However, the individual monthly income statistics show that approximately 45% of people within the municipal area have no access to cash income and more than 31 % of people earn between R400-R6 400 per month. More than 60 % of the population in Endumeni municipality are living below the poverty line. Most households in the municipality are male-headed and only 40.7 % are female-headed and 0.7 % child-headed (Stats SA, 2012).

1.6.3. Harrismith

Harrismith is a town situated in the Maluti-a-Phofung municipality in the Free State province. The town is situated at about 1 701 metres above sea level and faces the Maluti and Drakensberg Mountains. The town has a central location in relation to the large national cities of Johannesburg, Durban and Bloemfontein, therefore its economy is mainly influenced by various forms of movement flows, transport and related industries (Maluti-a-Phofung Municipality, 2014). It is also a service centre for the surrounding rural areas and a trading belt serving the national N3 road, which links the Gauteng and KwaZulu-Natal provinces. Harrismith is a major employment center and an economic hub for people within the town, from Intabazwe, QwaQwa and Tshiame. It has a population of 35 108 people (Stats SA, 2012). The mean annual precipitation of Harrismith is 622 mm, with most rainfall occurring mainly during mid-summer in January and lowest or no rainfall is received in July. The mean annual temperature is 14.2 ^{o}C with a mean daily maximum of 25.9 ^{o}C in January and mean daily minimum of -0.4 ^{o}C in July.

Maluti-a-Phofung local municipality is geographically the smallest but has the highest population density within the Thabo Mofutsanyane District Municipality in the Free State. The total population of the municipality is 335 784 people with a total of 100 228 households and average household size of three persons per household. The local municipality contains 46 % of the district's total population and 27 % of the population lives in traditional residences. Maluti-a-Phofung is rated as the most poverty-stricken area in the Free State as approximately 60 % of households earn less than R1 650 per month with about 40 % earning an average income of R600 per month (Maluti-a-Phofung Municipality, 2011). The highest percentage of households (23.7 %) earn between R9 601 - R19 600 per annum. The percentage of households who do not report any cash income is 13.5 % (Stats SA, 2012). The municipality has only 9 % of people aged 20 years and older who have no education and 26.8 % of the population aged 20 years and older have completed matric. Only 7.9 % of people aged 20 and above have a higher education. The unemployment rate in the municipality is 41.8 % and the unemployment rate among the economically active youth (15-34 years) is 53 % (Stats SA, 2012). The majority of the population in this municipality depend on subsistence farming and backyard gardens. Half of the households in the municipality are female-headed (50.9 %).

Chapter Two

Women's dietary diversity and food security along a rural-urban continuum in three mid-sized towns

2.1. Introduction

The burden of food insecurity and malnutrition remains a global challenge (Rosegrant and Cline, 2003; Iram and Butt, 2004; FAO, 2009; Godfray et al., 2010), especially in sub-Saharan Africa, where the number of the hungry and undernourished people has increased between 2014-2016 (FAO, 2015). Despite the overall progress to reduce global food insecurity and chronic undernourishment, sub-Saharan Africa remains the most food-insecure region in the world with close to 223 million people undernourished (FAO, 2013; FAO et al., 2015). In South Asia, the limited decline in undernutrition rates has been linked to low levels of household food security (Harris-Fly et al., 2015). This has made it difficult to achieve the first Millennium Development goal (MDG) which sought to "eradicate extreme poverty and

hunger" by 2015 and also halve the proportion of those suffering from hunger (UN, 2008) as more than one in four people are still undernourished (FAO et al., 2015).

The prolonged problem of energy deficiencies has made it a continued focus of global efforts to deal with the issue of malnutrition (Ingram et al., 2010; McDonald, 2010). Food and agricultural systems productivity has been increased through extensification and intensification to meet the needs of all people in the world (Gregory et al., 2002) yet this did not assure food security for all (Iram and Butt, 2004; Poppy et al., 2014). Some poorer societies and communities could not have access to sufficient quantity or quality food (Iram and Butt, 2004) as close to one billion people are facing challenges of not having enough food and two billion are suffering from micronutrient deficiencies (IFPRI, 2015). When food is available, many low-income households consume monotonous diets which are of low quality, cereal based and lack diversity thereby increasing the risk of micronutrient deficiencies which is already high in these resource-poor settings (Ruel, 2002; Arimond et al., 2010; FAO 2013).

2.1.1. Dietary diversity

Promoting dietary diversity has been suggested as one of the strategies to alleviate nutritional problems that occur due to inadequate intake of micronutrients and food insecurity (Kennedy, 2009). The consumption of a wide variety of foods among and within food groups helps in ensuring adequate intake of micronutrients which are essential to nutrient adequacy (Kennedy, 2009). However, in low income regions, low quality, monotonous diets based mainly on grains and lacking vegetables, fruit and animal-source foods dominate the diets of many. Monotonous diets are closely associated with food insecurity (Kennedy, 2009) which is one of the known causes of malnutrition. Therefore, the risk for a range of micronutrient deficiencies is very high and women of reproductive age are the most vulnerable group, yet information on micronutrient deficiencies and dietary patterns among women is scarce (Coates et al., 2007).

According to FAO (2009), dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals. Dietary diversity can be assessed by using tools such as dietary scores which

sum the number of food groups consumed over a reference period and these are good proxies of overall dietary quality (Coates et al., 2007; FAO, 2009) and are useful indicators of household food security (Hoddinott and Yohannes, 2002). Dietary diversity scores are positively associated with the nutritional status of women (Savy et al., 2005; 2006) and children (Aboussaleh et al., 2004; Sawadogo et al., 2006). Therefore, dietary diversity is important for nutrition status of individuals by ensuring nutrient adequacy though the balance of micronutrients. This can help reduce the number of two to three billion people who are malnourished globally, either as deficient in micronutrients and undernourished or overweight (IFPRI, 2015).

However, it is difficult to achieve nutrition security without food security at a household level (FAO, 2009) because food security and nutrition security are closely interrelated and may appear in a vicious cycle. Food and nutrition security can only be achieved when (i) there is enough nutritious food where it is needed, (ii) the food is accessible and affordable to those who need it, (iii) the food is utilised properly so that individuals receive sufficient nourishment after consuming the food and (iv) there is stability regarding the above mentioned conditions (IFRC and IFPRI, 2012). Although food may be available and accessible, nutrition security can only be achieved when the food is consumed and utilised in quality and quantity as well as distributed evenly within households (Reinhard and Wijayaratne, 2000). Therefore, access to secure food also should be followed by an adequate nutrition and sanitary environments for household members to promote good health (Benson, 2004).

2.1.2. Women's dietary diversity

A lack of dietary diversity is a severe problem experienced by the poorest households globally and women of reproductive age, as well as children under the age of five are at high risk (Whitaker et al., 2006; FAO, 2009; WHO, 2012; 2013; Harris-Fly et al., 2015). Women are more vulnerable because it is typically the women's responsibility to make sure the entire household is fed and in many cases there is uneven control of resources in the households which makes the experience of food insecurity to be gender biased (Olson, 2005; Hadley et al., 2008). Sasson (2012) reported serious harmful situations faced by women and female teenagers who receive less food than their male counterparts in the same households during times of food

insecurity. Studies have also shown that when households experience food insecurity, many mothers reduce their own intakes to secure those of infants and small children to avoid child malnutrition (Kuku et al., 2011; Saaka and Osman, 2013) and some women may rely on less expensive foods that are energy rich but nutrient poor (Drewnowski and Darmon, 2005). That is, the diets often contain little or no fresh vegetables and fruit, and are low in animal source foods rich in iron and Vitamin A (Arimond et al., 2010; Nungo et al., 2012). On the other extreme, the diets would be rich in processed foods that are high in sugar and fat (Ruel and Garrett, 2004; Faber et al., 2011). Laraia et al. (2010) also reported that household food insecurity is associated with reduced micronutrient intake among women of reproductive age due to a decrease in fruit and vegetable consumption. Household food insecurity status has also been found to be associated with overweight and obesity among women (Townsend et al., 2001; Kaiser et al., 2004; Wilde and Peterman, 2006; Olson and Strawderman, 2008; Laraia et al., 2010) which could be due to disordered eating patterns (Laraia et al., 2010). However, in low income communities, households may suffer from the double burden of malnutrition from the dual nutritional problems of deficiencies and hunger whilst some may suffer from obesity and related diseases (Pinstrup-Andersen, 2007).

Women's dietary diversity can be measured using the women's dietary diversity scores (WDDS) which aim to reflect individual dietary intake and nutrient adequacy in women of reproductive age (FAO, 2011). Women's dietary diversity scores, which is the sum of food groups consumed by women over a reference period, can also be used as a measure of household access to a micronutrient rich diet (Arimond et al., 2010; FAO, 2011). Therefore, WDDS are noted as a conservative estimate of household nutritional security as well as micronutrient adequacy of the women's diet (Arimond et al., 2010; FAO, 2011). Recent studies have shown that WDDS are associated with household food production (Harris-Fly et al., 2015), wealth (Mascie-Taylor et al., 2010; Arimond et al., 2011; Harris-Fly et al., 2015), knowledge of nutritional requirements and household size (Harris-Fly et al., 2015).

2.1.3. Women's dietary diversity in South Africa

Little is known in South Africa about the dietary diversity of women despite the significant recognition it has in health and nutrition. South Africa is listed by the World Health

Organisation (WHO) as one of 36 high burden countries (Faber et al., 2010) and is amongst the top 20 countries internationally with the highest burden of undernutrition (Altman et al., 2009; Vorster, 2010; Drimie and McLachlan, 2013). Stunted growth and underweight are the major nutritional disorders in South Africa (Chopra et al., 2009; Drimie and Ruysenaar, 2010) because many poor people in the country tend to cope with poverty by adopting monotonous diets as well as processed foods higher in saturated fat, sugar and salt (Ruel and Garrett, 2004; Schönfeldt et al., 2010; Faber et al., 2011; Drimie et al., 2013). Poor households are mostly affected (Battersby, 2011) and this is exacerbated by rising food prices, widespread chronic poverty and unemployment (HSRC, 2007), which is also weakening the informal safety nets, especially in urban areas (Drimie et al., 2013). This increases the proportions of households vulnerable to food and nutrition insecurity as hunger and malnutrition continues to increase in the country (Altman et al., 2009). Many households in South Africa are living ''close to the edge'' below the food poverty line of R321 per month and are said to consume poor quality diets and they alter their consumption routines to fit with their poverty (Stats SA, 2014). The prevalence of food insecurity is increasing in urban areas (Ericksen, 2008; Brown, 2009; Frayne et al., 2010; Crush, 2011; Battersby, 2012) and is experienced at household and individual levels (Misselhorn, 2005) and women of reproductive age are greatly affected.

2.1.4. Study aims

To date no study in South Africa has compared the nature and relative magnitude of individual food security particularly women along an agro-ecological gradient and rural-urban continuum of small- and medium-sized towns. Due to a lack of national dietary data in South Africa, it has not been possible to determine dietary diversity in adult South Africans (Labadarous et al., 2011). The aims of the study were to calculate the dietary diversity scores for women in three mid-sized towns in South Africa. The study also aimed to compare the dietary diversity of women between these three towns, determine the differences between the towns and along the rural-urban (R-U) gradient in each town and explore the relationships between WDDS and household characteristics such as wealth, household size and food expenditure. I hypothesised that:

1. Women's dietary diversity decreases along the agro-ecological gradient with women in Richards Bay having higher scores and those in Harrismith having the lowest WDDS.
2. The peri-urban women would report higher levels of food insecurity than those in more rural and urbanised areas.
3. Monotonous diets would be observed in women from poor households and these will be based mainly on starchy staples, with little vegetables and fruit.
4. The WDDS would be associated with household size, wealth and food expenditure.

2.2. Methods

2.2.1. Study sites

Refer to Chapter One for the detailed information on the study area.

2.2.2. Sampling

All interviews were conducted in the respondent's preferred language of isiZulu in Richards Bay and Dundee, and Sesotho in Harrismith or English. Enumerators were trained on how to conduct interviews using the questionnaire so as to provide full understanding of the administered questions. Ethics approval was granted by the Rhodes University Ethical Standards Committee with permit number RU-HSD-14-08-0012.

Dietary data were obtained through administering questionnaires to randomly selected households at each site. Within each town, 200 households were randomly selected, comprising of 60 rural households, 80 peri-urban households and 60 urban households. Random cluster sampling using ArcGIS software was used with five randomly selected households per cluster. Random cluster sampling was adopted to limit the time and costs of contacting widely scattered households in rural areas. Thus, there were 40 clusters with a minimum of twelve clusters in each of the urban and rural areas and 16 clusters in the peri-urban area. GPS coordinates for the households were generated within each selected cluster. A woman of reproductive age (15-49 years old) and ideally the person in the household who prepares most of the meals was interviewed. If the person who does most of the cooking was a stay out employee (domestic worker), she was required to report on the meals s/he had cooked for the household and not

what she consumed herself. In the case of one or more of the five households within a cluster refusing to participate or no women of reproductive age being available for interview, then the nearest house to the left was interviewed. However, not all selected households agreed to participate in the interviews. This left a total of 183 individuals interviewed in Richards Bay; 173 in Dundee and 198 in Harrismith.

Current diet composition (food consumption) was determined using standard survey schedules, based on the standard 48 hr recall technique (FAO, 2008b). Each household was visited twice during the pre-harvest period (summer) between October and November 2014 and the survey was repeated again in June 2015 during the post-harvest period (winter). The same individual was interviewed during all the visits. The surveys were carried out in two seasons to account for variations in local diets, nutrition and food access between seasons. The questionnaire was designed to measure the food security status of the women through minimum measure of women's dietary diversity score (WDDS) for the person being interviewed on the assumption that the respondent would know all the meals she prepared, served and consumed (FAO, 2008b).

Information on household characteristics such as the household size, age, gender of household head, sources of food, income, land acquisition, wealth (assets acquired by household) and the cost of food purchases per week were also asked. An index of wealth was created by combining information on the household's possessions which included car/truck, motorbike, tractor, bicycle, fridge, television, radio, cattle/goats, chickens, cell phone, house and electricity. For each household, the number of each asset was normalised (by dividing with the highest number obtained in each category for all households) then all summed to get a wealth index per household, which could range from zero to 12.

2.2.3. Dietary diversity scores

Information on the food that was consumed by the women was collected by the 48 hr recall method. The women were asked to recall and name all the food they had consumed for the past two days, that is, all dishes, snacks and drinks. They were encouraged to remember all the food

consumed per meal and in-between meals. The women were also asked to fully describe all the ingredients in mixed dishes, the source of ingredients (bought, grown, collected or donated) and source of energy used to prepare the food. All the ingredients were coded into a list of 17 food groups which are aggregated to nine for analysis (Swindale and Bilinsky, 2006; FAO, 2008b; 2011). The information was used to calculate the women's dietary diversity scores (WDDS) for each woman following FAO (2011). A validation study for this indicator was done by FAO (2008) in Mozambique and several studies have used this indicator in women's nutrition studies (Mascie-Taylor et al., 2010; Arimond et al., 2011; Harris-Fly et al., 2015). Following FAO (2011), WDDS is defined as the sum of food groups consumed by a woman from the total of nine food groups required. The nine food groups included in the calculations are: (1) Starchy staples; (2) Vitamin A rich dark green leafy vegetables; (3) Other Vitamin A rich fruits or vegetables; (4) Other fruits and vegetables (5) Organ meat; (6) Meat and fish; (7) Eggs; (8) Legumes, nuts and seeds and (9) Milk and milk products. The food groups which are included in the WDDS mostly reflect the probability of micronutrient adequacy of the women's diets and fats and oils food group was not included for WDDS because it does not contribute to the micronutrient density of the diet (FAO, 2011). However, as recommended by FAO (2011), the proportion of individuals consuming fats and oils could be calculated as a separate indicator since oil improves the absorption of plant scarotenoids and fat-soluble vitamins and is an important contributor to energy density. Using dietary diversity scores allows grouping women into classes of food secure or insecure.

The assessment of nutritional status of women within the sampled populations was achieved through calculating the WDDS. The WDDS was used as a quantitative variable and women were classified into categories based on the overall distribution of the dietary diversity score from 0-9 for the three towns and locations. These categorical indicators were created to measure levels of dietary diversity and food security. A woman was classified as having poor dietary diversity and food insecure if she had consumed ≤ 3 food groups; average dietary diversity and moderately food secure if she had consumed 4-5 food groups or good dietary diversity and food secure if she had consumed ≥ 6 food groups in the previous 48 hrs (FAO, 2008b).

2.2.4. Statistical analysis

Data were entered and cleaned using Microsoft Excel and all statistical analyses were performed using Statistica version 12 (StatSoft Inc.). Descriptive data are presented as means and standard deviations (SDs) (mean ± SD). Data on dietary diversity scores for each town were tested for normality using a Kolmogorov-Smirnov test and did not meet the assumptions for normality therefore comparisons between dietary diversity scores of first and second visit in summer and again between winter and summer were done using a non-parametric Mann Whitney U test and since there was no significant difference between the medians, data were treated as one data set and was used in all analyses. The differences in dietary diversity scores between towns and locations were tested using a 2-way ANOVA and a post-hoc analysis was performed to provide specific information on which differences were significant. As the data were not normally distributed, associations of the scores with food expenditure, household size and wealth variables were examined through Spearman correlation tests and WDDS was used as the response variable analysed as a function of wealth, household size and food expenditure. Statistical significance was set at $p < 0.05$ for all tests.

2.3. Results

2.3.1. Household characteristics

The sample consisted of 554 women aged between 15-49 years with a mean age ranging from 29±9.0 to 33±10.8 years between the three towns (Table 2.1). The household size for the study sites ranged from 6±2.2 to 8±4.2 persons and almost 60 % of the households were female-headed. More than 80 % of households in Dundee and Harrismith received some form of cash income whilst only 59 % of household in Richards Bay did so. Households in Richards Bay were spending less cash per week on purchasing food (R196±180) than in Dundee and Harrismith with R333±253 and R323±271 per week, respectively. The wealth index was similar for all towns although it was greatest in Richards Bay with Dundee having the smallest. About 73 % of households in Richards Bay had land available for own production whilst only 57 % of households in Dundee and 27 % in Harrismith did so.

Table 2.1: Comparison of household characteristics in study sites

Variable	Richards Bay (n=183)	Dundee (n=173)	Harrismith (n=198)	All (n=554)
Respondent age (mean±sd) (yr)	29±9.0	33±10.8	33±9.9	32±10
Household size (mean±sd) (no. of people)	7±4.6	8±4.2	6±2.2	7±4
Household head (%)				
Male	42	36	47	42
Female	58	64	53	58
Some form of cash income (%)				
None	41	20	9	23
Head or interviewee	49	59	72	60
Head and interviewee	10	21	19	17
Food expenditure (mean±sd) (Rand/week)	196±180	333±253	323±271	284±246
Wealth index (see methods)	2.6±0.6	2.3±1.0	2.5±0.9	2.5±0.8
Households with land for own production (%)	73	57	27	52

In general, although the greatest part of the food consumed by households in the three towns was purchased, more than 70 % of households in Richards Bay produced some of their own food; 66 % collected some of the food from the wild and about 40 % received some food donations. This was different from Dundee and Harrismith where less than 55 % households in Dundee and less than 30% in Harrismith obtained food from other sources (Figure 2.1). The general food acquisition by the households in all sites followed a similar pattern along the agro-ecological gradient. All households purchased food from different sources in all three sites. However, there is a clear trend of a decrease in own production and self-collection with a decrease in agro-ecological potential with Richards Bay having the highest percentage of households practising own production and collecting food from open spaces, Dundee being the intermediate and Harrismith having the lowest percentage of households practising own

production or self-collection. Donations of food to households in the three towns also followed a similar pattern (Figure 2.1).

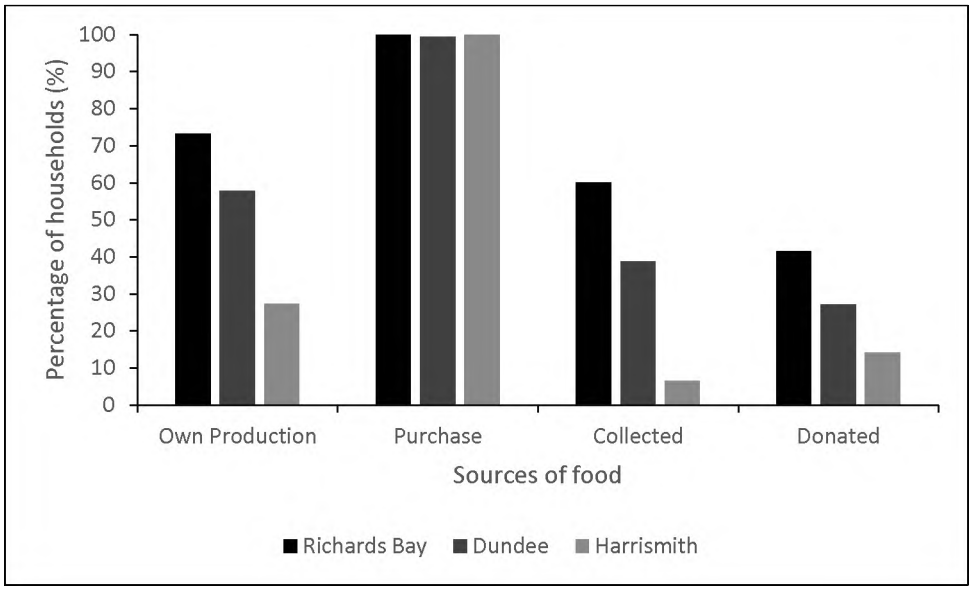

Figure 2.1. Percentage of women obtaining food from different sources.

When using the food poverty line (FPL) (which is the level of consumption below which individuals are unable to purchase sufficient food to provide them with an adequate diet (Stats SA, 2014)) to define households living in extreme poverty, about 36 % of households in Richards Bay were living in extreme poverty, 27 % in Dundee and 41 % in Harrismith. Along the rural-urban continuum, levels of extreme poverty were lower in urban areas at all sites and higher in the peri-urban and rural locations. In Richards Bay and Dundee, the highest percentage of households living in extreme poverty was in the peri-urban zone whilst in Harrismith it was in the rural location with almost 60 % of households living in extreme poverty (Figure 2.2).

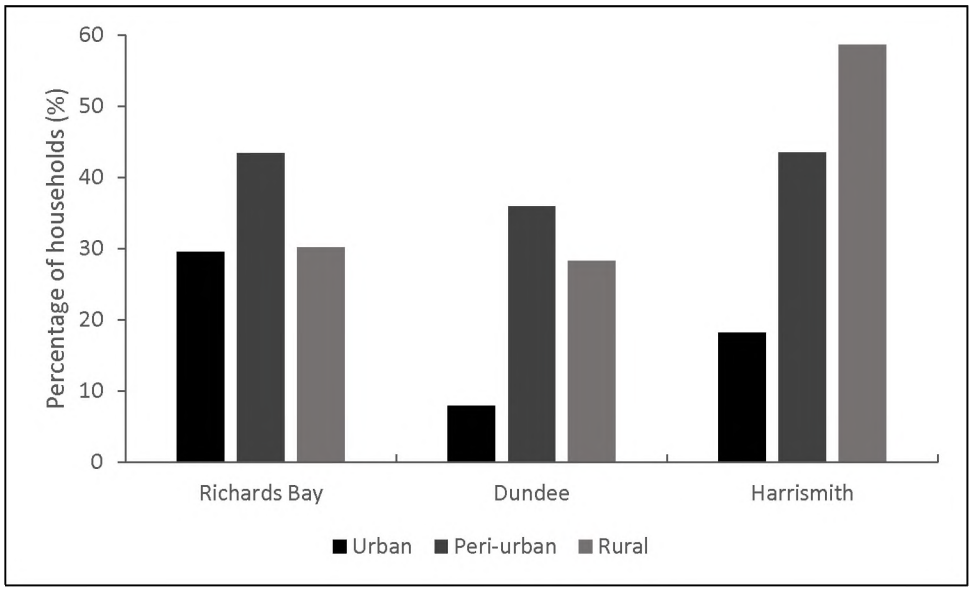

Figure 2.2. Percentage of households living in extreme poverty, i.e. below the South African food poverty line (FPL) of R321 per capita per month as per March 2011 (Stats SA, 2014)

2.3.2. Composition of individual diets

The food groups consumed by at least 50 % of women in all towns were mostly starchy staples (mostly pap (cooked maize-meal)), other fruits and vegetables (mostly cabbage and onion), meat, fish, milk and milk products (Figure 2.3). The greatest percentage of women consuming these food groups was in Richards Bay except for milk and milk products which were mostly consumed in Harrismith. Legumes, nuts and seeds were also consumed by more than 50 % of women in Richards Bay, 40 % in Dundee and only about 20 % in Harrismith. The consumption of other fruits and vegetables and legumes followed the agro-ecological gradient with Richards Bay having the greatest prevalence and Harrismith the least. Eggs were frequently eaten in all towns, by almost 40 % of women in Harrismith, 35 % in Richards Bay and 30 % in Dundee. Generally, in all towns, dark green leafy vegetables and vitamin A rich vegetables and fruit were consumed quite infrequently (<30 % of women). Vitamin A rich vegetables and fruit were mostly eaten in Richards Bay than in Dundee and Harrismith and dark green leafy vegetables were consumed more in Harrismith than the other two. The consumption of organ meat was rare (Figure 2.3).

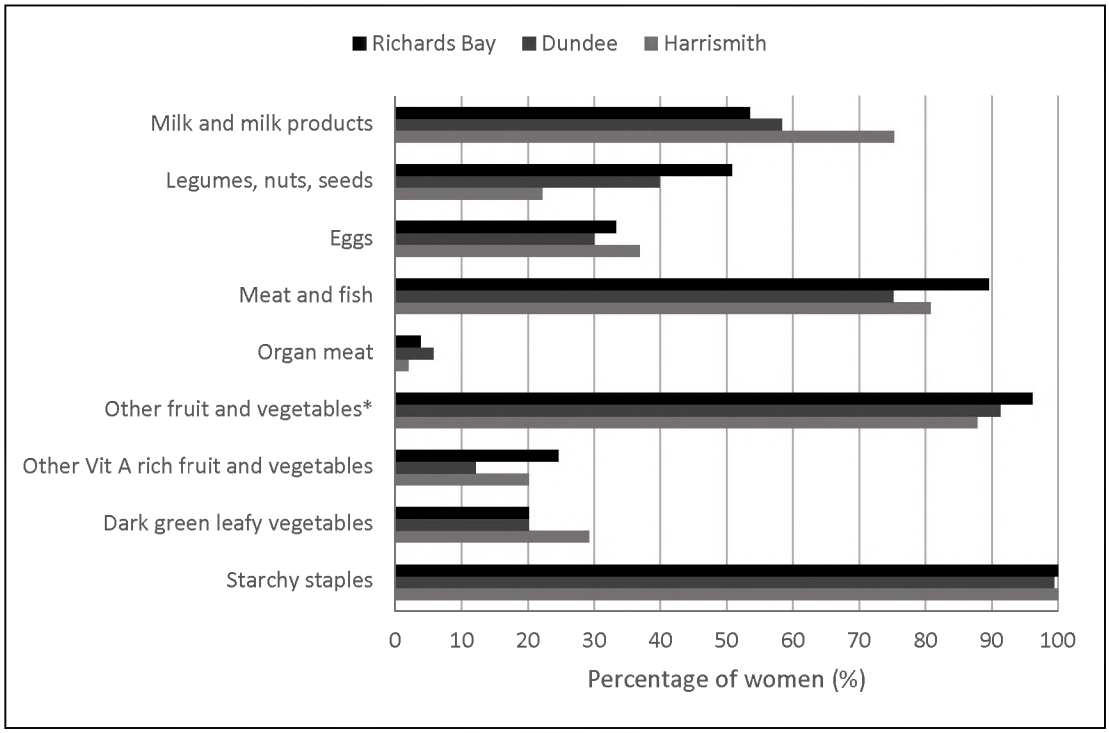

Figure 2.3. The percentage of women consuming different food groups in the last 48 hours, along the agro-ecological gradient. (*Mostly onion and cabbage were consumed in this group).

Women's diets along the rural-urban continuum revealed a clear pattern of higher dietary diversity within the urban and lower in the rural location (Figure 2.4). Meat and fish, eggs, milk and milk products and fruits and vegetables were consumed by most women in the urban location, followed by the peri-urban and the least in the rural location. Legumes and dark green leafy vegetables were mostly eaten in the rural and peri-urban locations and less in the urban. Within the locations, the food groups that were consumed by greater than 50 % of women with low WDDS were mostly starchy staples, other fruits and vegetables and meat and fish (Figure 2.5). Women with a medium WDDS consumed additionally milk and milk products to a greater extent and legumes or eggs to a lesser extent. In the high dietary diversity classification, women added other Vitamin A rich fruits and vegetables (95 %) and dark green leafy vegetables to a lesser extent.

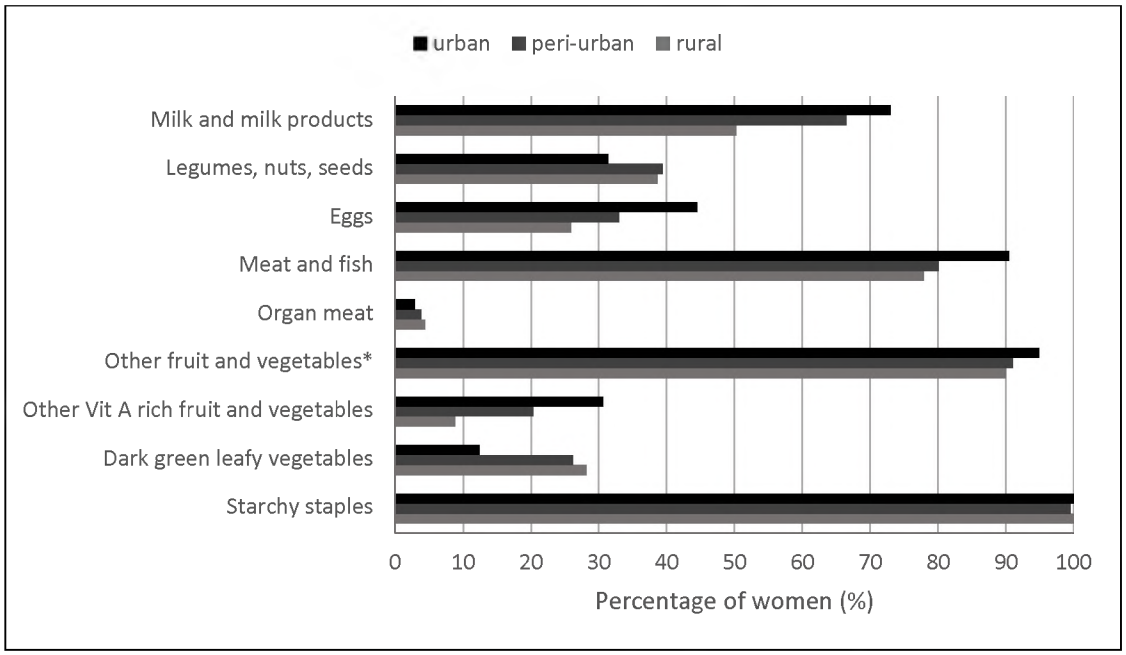

Figure 2.4. The percentage of women consuming different food groups in the last 48 hours, along the rural-urban continuum. (*Mostly onion and cabbage were consumed in this group).

Figure 2.5. The percentage of women in different dietary diversity classes consuming different food groups. (*Mostly onion and cabbage were consumed in this group).

2.3.3. Differences in WDDS between and within towns

The mean WDDS for the sample was 3.54±0.99. About 37 % of women were in the low dietary diversity class and only 4 % of the respondents in the high class (≥ 6food groups) (Table 2.2). Overall, mean WDDS for the towns was generally low, being 3.81± 0.29 in Richards Bay, 3.37± 0.3 in Dundee and 3.52± 0.27 in Harrismith. There was a significant difference in WDDS along the agro-ecological gradient ($F_{2, 549} = 9.072$, $p<0.0001$) with Richards Bay being higher than the other two, which were not different from one another.

Table 2.2: Individual dietary diversity scores (WDDS) of women for three sites and three locations per site. (Unlike superscripts indicate significant differences).

Town	WDDS (mean± sd)	Location	WDDS (mean±sd)	Percentage of women		
				≤3 food groups	4-5 food groups	≥ 6 food groups
Richards Bay (n= 183)	3.81± 0.29[a]	Urban (n=44)	3.98±1.02[a]	20	41	39
		Peri-Urban (n=76)	3.82±0.97[a]	28	39	33
		Rural (n=63)	3.63±0.75[a]	32	48	21
Dundee (n=173)	3.37± 0.30[b]	Urban (n=38)	3.67±1.24[a]	26	39	34
		Peri-Urban (n=75)	3.17±1.03[b]	47	44	9
		Rural (n=60)	3.28±0.82[a/b]	45	47	8
Harrismith (n=198)	3.52± 0.27[b]	Urban (n=55)	3.88±0.74[a]	15	56	29
		Peri-Urban (n=85)	3.48±0.99[b]	48	46	6
		Rural (n=58)	3.19±1.06[b]	57	26	17
All towns (n=554)	3.54±0.99	Urban (n=137)	3.84±0.33[a]			
		Peri-urban (n=236)	3.49±0.25[b]	37	59	4
		Rural (n=181)	3.37±0.28[b]			

Within sites, mean WDDS ranged from 3.19 to 3.63 in the rural location, 3.17 to 3.82 in the peri-urban location and 3.67 to 3.98 in the urban location (Table 2.2). There was a significant

difference in WDDS along the rural-urban continuum ($F_{2, 549} = 9.974$, $p<0.0001$), being higher in the urban than the other two which were not significantly different. In all sites, highest WDDS were observed in the urban location and the lowest WDDS were observed in the rural locations in Richards Bay and Harrismith but in peri-urban for Dundee. The WDDS were mostly medium or high for women in Richards Bays urban and peri-urban zones whilst it was mostly low and medium for women in peri-urban and rural locations in Dundee and Harrismith.

2.3.4. Association of WDDS with socio-economic indicators

Significant positive correlations were found between the WDDS and food expenditure and wealth indices in all the towns. The strongest correlations were found for Harrismith (Table 2.3). In Richards Bay, a significant positive correlation was also found between WDDS and access to land (Table 2.3), reflecting the greater engagement in own production in this town. In all three towns, there were no significant correlations between WDDS and household size.

Table 2.3: Spearman correlations between WDDS and selected socioeconomic indicators in the three towns. (Correlations are significant at $p< 0.05$ ([a]) and $p<0.005$ ([b]))

Town	Household size	Food expenditure per week	Wealth index	Access to land
Richards Bay	-0.017	0.294[a]	0.333[a]	0.155[b]
Dundee	-0.063	0.286[a]	0.267[a]	0.117
Harrismith	-0.101	0.533[a]	0.341[a]	0.031

Within sites, the strongest significant positive correlations were found between the WDDS and food expenditure and wealth indices in peri-urban locations of Richards Bay and Harrismith and also in Harrismith's rural location (Table 2.4). Significant correlations were also found between WDDS and food expenditure in urban areas of Richards Bay and Dundee as well as between WDDS and wealth in rural Dundee. There were no significant correlations between WDDS and food expenditure and wealth in Richards Bay rural, Dundee peri-urban and Harrismith urban.

Table 2.4: Spearman correlations between WDDS and both wealth index and food expenditure within towns. Correlations are significant at $p<0.05$ ([a]), $p<0.001$ ([b]) and $p<0.0001$([c])).

Town	Location	Food expenditure per week	Wealth index
Richards Bay	Urban	0.350[a]	0.251
	Peri-urban	0.467[b]	0.429[b]
	Rural	-0.009	0.236
Dundee	Urban	0.427[b]	0.156
	Peri-urban	0.127	0.132
	Rural	0.243	0.338[b]
Harrismith	Urban	0.099	-0.011
	Peri-urban	0.549[c]	0.295[b]
	Rural	0.468[c]	0.422[b]

2.4. Discussion

2.4.1. Women's diet and dietary diversity

The results revealed that the diets of most women living in the study sites were dominated by starchy staples, predominantly maize meal. These findings are consistent with those reported by Steyn et al. (2006), Oldewage-Theron and Kruger (2008), Arimond et al. (2010), Schönfeldt et al. (2010), Faber et al. (2011) and Acham et al. (2012) who reported that cereals and starchy foods, especially maize based foods, are the most consumed foods by South Africans. Other fruits and vegetables and meat and fish were also highly reported by the participants in all towns. However, other fruits and vegetables consisted predominantly of cabbage and onion, with no or very limited intake of fruit. Fruit were mostly consumed with women in the high dietary diversity group and mostly in urban locations. This is consistent with Arimond and Ruel (2004), Arimond et al. (2010), Schönfeldt et al. (2010) and Faber et al. (2011), who found that most poor communities are at high risk of inadequate micronutrient intake due to low intake of

fruits and vegetables. The study found that fish and chicken dominated the meat and fish group and these were the main sources of protein in all three sites in keeping with Acham et al (2012) who reported similar dietary patterns in Gauteng where meat and fish were also mostly consumed. Organ meat, an important source of iron, and dark green leafy vegetables as well as Vitamin A rich fruits and vegetables were the least consumed groups.

When using a mean DDS of three or less to define a poor dietary intake, results reveal that at least 37 % of women had a poor dietary diversity and only 4 % enjoyed a good quality diet. Consuming a more diverse diet with a diverse range of foods is beyond the reach of most people in South Africa because of high poverty levels due to a high unemployment rate, increasing food prices and abandonment of agriculture which leads to over-dependence on purchasing food from markets. It has been reported that the increase in food prices, especially cereals, has an impact on food consumption among vulnerable households. In this case most switch to cheaper and less nutritious foods that satisfy hunger, but compromises the quality of the food consumed (Brinkman et al., 2010).

Due to increasing food prices and limited income, households may reduce dietary diversity in response as the consumption of more expensive food items is reduced which is followed by a reduction of the dietary diversity, portions and frequency of meals (Oldewage-Theron et al., 2006; Brinkman et al., 2010). This was confirmed in the present study by strong positive correlations between wealth, food expenditure and WDDS. In South Africa, the majority of households are struggling to sustain a decent income (Labadarios et al., 2011) and low-income households cannot afford a diverse diet, especially vegetables (Lindhiem and Potgieter, 2005; Modi et al., 2006). Women of reproductive age are at great risk of low dietary diversity in these vulnerable households (Arimond et al., 2010), since women may find it difficult to purchase enough food to feed the entire household (Labadarios et al., 2011) and may prioritise their children's food consumption over their own (De Pee et al., 2000).

This study provides empirical evidence that low dietary diversity scores are associated with households with low wealth status and who rely mostly on purchasing food. There is compelling evidence that these poor households would mostly cope with poverty and rising

food prices by adopting monotonous diets based on starch staples and also collecting food from open spaces as shown by the consumption of dark green leafy vegetables by the rural and peri-urban women. This is consistent with studies by Kaschula (2008), Arnold et al. (2011) and Legwaila et al. (2011) who reported that wild foods, especially indigenous fruits and leafy vegetables, provide an important source of food that are high in micronutrients and supplement diets, especially for people with either low or middle income. Thus, wild foods can act as a 'safety net' or 'fall back' and assist some households during food shortages (Fentahun and Hager, 2009; Arnold et al., 2011). Also, the withdrawal from subsistence farming and reliance mostly on accessing food commercially through markets has been reported to have increased the prevalence of food insecurity, for example, in the Eastern Cape (Musemwa et al., 2015). This could also be the case with women in the present study as most are purchasing food rather than growing. This could have lowered the WDDS in the three towns as the women would compromise the quality of diet for cheap and less nutritious diets as a coping strategy.

2.4.2. WDDS and agro-ecological context

Women in Richards Bay had the highest mean WDDS followed by those residing in Harrismith and women in Dundee had the lowest. Higher WDDS in Richards Bay could be attributed to wetter and warmer climatic conditions and a longer growing season which favour agriculture, compared to Dundee and Harrismith where drier and cool conditions make agricultural production less viable. There is lower dependence on food purchasing in Richards Bay compared to Dundee and Harrismith where the majority of households is buying food. Farming or gardening has the potential to improve the food security of poor households in both rural and urban areas by increasing food supply as food prices increase (Baiphethi and Jacobs, 2009; Crush et al., 2011). Subsistence agriculture in rural Richards Bay produces high quality food and additional income from selling of surplus produce, thus enabling some households to acquire other essential products from the supermarkets. Dietary diversity was strongly correlated with access to use of land in Richards Bay, which suggests that own production improves the quality of women's diets at this site. For example, farming has been shown to increase food security for low-income households and farm produce has been marked as an alternative to imported foodstuffs which is cost effective for poor households (Mkwambisi et al., 2010; Zezza and Tasciotti, 2010; Lerner et al., 2011).

Although there were positive correlations between WDDS and the wealth index and food expenditure in all the towns, the strongest correlations were among women living in Harrismith and to a lesser extent in Dundee. Most women in Dundee and Harrismith are food insecure because they are not producing their own food and are net buyers of food. This has a negative impact on a large proportion of households already vulnerable to food insecurity, thereby increasing hunger and malnutrition (Altman et al., 2009). This is consistent with Musemwa et al. (2015) who suggested that the highest food insecurity in Nkonkobe and Tsolwani Local Municipalites in the Eastern Cape was mainly due to abandonment of own production. Also, a decline in smallholder agriculture in South Africa (Hebinck and Lent, 2007; Shackleton et al., 2013) has exacerbated the levels of food insecurity as the majority of the population is accessing food commercially through markets, as has been reported globally (Maxwell et al., 1998; Ruel et al., 1998; FAO, 2008a; Baiphethi and Jacobs, 2009). Due to increased urbanisation, household agriculture is becoming less significant as a primary food source yet food prices are rising faster than inflation hence increasing food insecurity for the poor households (Crush and Frayne, 2011).

Higher WDDS in Richards Bay could also be due to collecting food from open spaces rather than purchasing. Almost two-thirds of households in Richards Bay obtained some of their food, especially vegetables and fish, from the wild, considerably more than in Dundee and Harrismith. Wild foods can support households that are or have experienced a shock (Paumgarten, 2006) and are important contributors to food security (King et al., 2013), poverty alleviation and also save households time and money as they are cost efficient to collect (Delang, 2006). For example, Mojeremane and Tshwenyane (2004) noted that wild fruit were consumed as a form of reducing the risks of food insecurity in Botswana and Jumbe et al. (2008) also noted that wild foods such as wild fruit, wild leafy vegetables, wild mushrooms, tubers, edible insects and honey from the miombo woodlands improved food security for most rural communities in Zambia. Shackleton and Shackleton (2004) showed that a significant proportion of rural households in South Africa consume wild foods.

Food donations could also have contributed in increasing the dietary diversity scores in Richards Bay since more households were receiving food parcels from the government than in

Dundee and Harrismith. The reasons behind this are not clear but more families in Dundee and Harrismith were receiving social grants instead of food stamps.

2.4.3. Levels of food insecurity along the rural-urban continuum

In all towns, levels of food insecurity were lower in urban areas than in rural and peri-urban areas. On average, the women in urban localities consumed 3.84±0.326 food groups in the last 48 hrs; in peri-urban 3.49±0.246 and in rural they consumed 3.37±0.280 food groups, indicating that households in all three localities are vulnerable to food insecurity. This is within the ranges reported in other South African studies where very low dietary diversity scores were observed in children (Steyn et al., 2006; Labadarios et al., 2011); elderly persons in Sharpville informal settlement (Oldewage-Theron and Kruger, 2008) and HIV/AIDS afflicted households (Kaschula, 2008) although there are no reports on women of reproductive age. Although reports have shown that food insecurity affects the urban poor more severely than the rural (Frayne and Pendleton, 2009; Crush and Frayne, 2011), results from this study indicate that the urban women are better off than their peri-urban and rural counterparts. In most urban areas food is usually readily available and the only limitation is physical and financial access whereas rural populations have limited access to affordable food and they face higher prices for food compared to their urban counterparts (Huddleston-Casas et al., 2009) as they have to travel to markets to buy food as there are few markets in rural areas (Ballantine et al., 2008). Although households in the rural areas may grow some of their food, most rely on purchasing.

Since household income and wealth status influence household food security (Frongillo and Nanama, 2006; Jacobs, 2009; Kaschula and Shackleton, 2012), the peri-urban populations were more food insecure than the urban because of high levels of poverty. This is shown by a larger percentage of households in peri-urban locations at all sites who are living in extreme poverty, that is, below the FPL. Households living below the FPL are said to consume poor quality diets and alter their consumption routines to fit with their poverty (Stats SA, 2014) which is also evident in this study as shown by the lowest WDDS in peri-urban locations and the strong positive correlations between wealth, food expenditure and WDDS in the peri-urban locations of Richards Bay and Harrismith. It has also been noted by Jacobs (2009) and Rudolph et al. (2012) that low-income households are more likely to suffer from food shortages than wealthier

households since food expenditure make up a large share of their spending thereby causing them to be more vulnerable to the impacts of rising food prices. Naicker et al. (2015) also noted that factors such as low income, low asset ownership and unemployment increased the risk of food insecurity in households in informal settlements in Johannesburg. Therefore, poor socio-economic status has been confirmed to have an impact on household food insecurity to a larger extent in peri-urban locations as was found by Oldewage-Theron et al. (2006) and Labadarios et al. (2011) in South Africa and Bhattacharya et al. (2004) in United States of America.

However, this is also true for rural locations as is shown in this study by the strong significant correlations between WDDS, food expenditure and wealth in rural Dundee and Harrismith thus increasing the number of households living in extreme poverty, especially in Harrismith. Also peri-urban households have limited access/ entitlements to land which can also make them more vulnerable to food security than both their urban and rural counterparts who have. Access to land has been shown to be positively associated with WDDS in this study. Peri-urban dwellers are therefore more sensitive to changes in incomes and food prices than the rural and urban populations because they have limited safety nets to absorb income or price shocks as they purchase more, rather than growing their own food. Therefore, the peri-urban households are more food insecure than rural and urban households although the substantial increases in the dependence on market purchases is affecting both urban and rural households (Baiphethi and Jacobs, 2009).

2.5. Conclusion

In South Africa, food insecurity is perceived to mostly affect rural populations as deep levels are commonly noted in rural areas (Ballantine et al., 2008; Jacobs, 2009; D'Haese et al., 2013; De Cock et al., 2013; Musemwa et al., 2015). However, other studies have argued that the urban population is more vulnerable than their rural counterparts and suggest that food security development interventions need to focus on urban areas (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012). In this study I argue that food insecurity is a problem for both peri-urban and rural households as both are net buyers of food. Increased dependence on purchasing food, decreased own production, lack of suitable land, climate change, limited access due to lack of income and high food prices could be the main causes of

food insecurity in women living in mid-sized towns in South Africa. Rising food prices in South Africa pose serious problems for the peri-urban and rural poor as most are net buyers of food. As food prices are continuing to increase gradually and worsening household food insecurity, ways to increase own production of food at household level needs to be implemented. Findings from this study emphasise the need to improve diets and dietary diversity for women of reproductive age. Increasing own food production could have the potential to improve the food security of poor households in both rural and urban areas by increasing food supply and lower dependence on market purchase. Focus should be on encouraging women to practise own production through home gardens or engage in community gardening. Community gardening projects provide families with fresh vegetables, can reduce food insecurity, improve dietary intake and strengthen social relationships as community members provide advice and support to help overcome challenges and all receive the benefits the gardening project offers (Carney et al., 2012). Furthermore, home gardens have direct contributions to household food security through increasing availability, accessibility and utilisation of food; which are the three pillars of food security.

Chapter Three

Household food insecurity and nutritional status of children along an agro-ecological gradient

3.1. Introduction

According to the Food and Agriculture Organisation (FAO), food security exists "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996; 2009). Sufficient food availability, access to adequate and preferred foods and poverty reduction are some of the essential conditions for the achievement of food security for all (FAO, 1996). Availability, access and utilisation are the three major determinants of food security and these three are hierarchical in nature. That is, food may be available but it does not ensure that all have access to sufficient, safe and nutritious food; and one may be able to access food but it may not be sufficient for effective utilisation (Webb et al., 2006; Pinstrup-Andersen, 2009). Food insecurity is mostly experienced when there is limited availability of nutritionally adequate and safe foods or if the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain (Anderson, 1990; FAO, 1996). Thus, food insecurity is "hunger caused by problems with food availability, access, use or vulnerability or any combination of these" (WFP, 2007). Challenges to access to sufficient, nutritious food are experienced mostly in developing countries due to factors such as rising food prices, changing diets and food consumption patterns, environmental and climate change, population growth and urbanisation which in turn may affect people's livelihoods (Brown, 2009; Misselhorn et al., 2012). Food insecurity is also closely linked to poverty, income and unemployment (UNDP, 2006) because food access may be reduced primarily due to loss of employment, cash income and remittances which drives food insecurity in most households (Brown, 2009).

Increased food production has been suggested as a way to alleviate global food insecurity but almost one billion people suffer from hunger and a further billion lack adequate nutrition (Misselhorn et al., 2012). Also, millions of households in developing countries live in poverty

and cannot afford to buy nutritious food (Pinstrup-Andersen, 2007). Moreover, due to high levels of poverty, some populations, especially rural, which depend on rain-fed farming, are barely subsisting even in years without shocks (Maunder and Wiggins, 2006). Increases in food prices (Cohen and Garrett, 2010), high HIV/AIDS prevalence (Clover, 2003; Drimie and Casale, 2009; Masuku and Sithole, 2009; Drimie and Gillespie, 2010), climate change and variability (Drimie and Gillespie, 2010) have worsened food insecurity in Africa, particularly for the poor and have increased the vulnerability of most households in rural (Masuku and Sithole, 2009; Drimie and Gillespie, 2010) and urban (Cohen and Garrett, 2010) areas. Urbanisation is also one of the factors that has worsened food insecurity in developing regions (Ericksen, 2008; Brown, 2009; Frayne et al., 2010). The prevalence of food insecurity is increasing in urban areas (Garrett and Ruel, 1999; Ericksen, 2008; Frayne et al., 2009; 2010; Crush and Frayne, 2011) as increased urbanisation is changing the relationship between food demand and supply. Many people living in urban areas face under-nutrition mainly due to their lack of income rather than to a lack of capacity to produce food (Satterthwaite et al., 2010).

Food insecurity directly affects the quality of both diets and nutritional status of children (Bhattacharya et al., 2004) and also at the household level (Misselhorn, 2005). Although previous reports suggested an improved global nutrition situation, the nutritional status of children in several countries, especially in developing countries, is worsening as about 26 % of children under the age of five suffered from malnutrition in 2006 (UN, 2008). Also, hunger remains an everyday challenge for almost 795 million people worldwide, including 780 million in the developing regions (FAO, 2015). Furthermore, with almost 14.3 million South Africans defined as vulnerable to hunger and 43 % of the households vulnerable to poverty (De Klerk et al., 2004; Drimie and Ruysenaar, 2010), the reduction of food insecurity and hunger eradication should remain a major priority for intervention programmes at all levels. Household food insecurity is one of the determinants of nutritional status of children in developing countries (Smith et al., 2000; Casey et al., 2006; Hackett et al., 2009) although research on the relationship has shown mixed results (Casey et al., 2006; Rose and Bodor, 2006; Hackett et al., 2009; Osei et al., 2010).

3.1.1. Global causes of food insecurity

Food insecurity can be either transitory (short-term/ seasonal food insecurity due to factors such as instability of food prices or crop failure) or chronic (permanent food insecurity due to long-term inadequate access to sufficient diet caused by a continual inability of individuals or households to meet their daily food requirements) (Brown, 1994; IFRC, 2006; WFP, 2007; Pinstrup-Andersen, 2009). The factors that determine food insecurity are mostly experienced at household and individual levels (Misselhorn, 2005; IFRC, 2006). At household level, access to food may be inadequate due to a number of factors which include high market prices of important food products, high medical fees or funeral costs which can reduce household budgets for food, lack of education and skills reduces job opportunities and therefore reduces family income, poor infrastructure (e.g. a broken bridge or poor roads can hamper access to food or trade markets or increase prices) and lack of land to practise farming can also reduce households' access to food (IFRC, 2006). Furthermore, intra-household allocations of food may limit adequate access of food to some household members whilst favouring others as is mostly shown by the existence of both undernourished and obese members in a household (Pinstrup-Andersen, 2009).

At individual level, food insecurity is mostly due to inadequate utilisation although food may be available and having access to it. In this case, the individual's nutritional status and food utilisation depends on other non-food factors such as sanitary conditions, water quality, infectious diseases and access to primary health care (Pinstrup-Andersen, 2009). For example, inadequate food utilisation can be due to factors such as chronic diseases (HIV/AIDS and tuberculosis) which may cause increased nutritional needs, unsafe drinking water can cause chronic diarrhoea and results in decreased absorption of nutrients, some strong cultural beliefs prevent people from eating certain healthy food products and also a lack of nutritional knowledge may cause people to have an inadequate diet or cause extensive vitamin loss during food preparation (IFRC, 2006). Pongou et al. (2006) reported that maternal education and maternal health seeking behavior were associated with better child nutrition and improved household (water, sanitation and cooking fuel) and community environment had positive effects on child nutrition.

The most extreme form of food insecurity is widespread malnutrition which is mainly analysed at household and individual levels and is manifest in one of three ways, namely energy deficiency, nutrient deficiencies or excessive net energy intake (Pinstrup-Andersen, 2007). Globally, many communities are changing diets (nutrition transition) from basic grains and tubers to meat, dairy products and processed foods high in sugar and fat (Ruel and Garrett, 2004; Faber et al., 2011). This may lead to different types of malnutrition as households may experience dual nutritional problems of deficiencies and hunger whilst some may suffer from obesity and related diseases (Pinstrup-Andersen, 2007). This is mostly experienced in developing countries as many are not able to make food choices that allow them to live active and healthy lives (Pinstrup-Andersen, 2007). Child undernutrition is a major public health problem in developing countries (Saaka and Osman, 2013) as millions of households in developing countries live in poverty and cannot afford to buy nutritious food or the farming inputs to grow their own food (Pinstrup-Andersen, 2007). Poverty is a state where physiological human needs are not adequately met as the amount of available money is not enough to purchase a nutritionally balanced diet (Schönfeldt et al., 2010). Since early 2000, many people in southern Africa are now living ''close to the edge'' and are increasingly unable to absorb food shocks or stresses (Maunder and Wiggins, 2006; Drimie and Casale, 2009). Due to high levels of poverty, some populations, especially rural, which depend on rain-fed farming, are barely subsisting even in years without shocks (Maunder and Wiggins, 2006). In South Africa, households that are living below the food poverty line of R321 per month are said to consume poor quality diets and they alter their consumption routines to fit with their poverty (Stats SA, 2014). However, when households experience food insecurity, some studies have shown that mothers are likely to reduce their own intakes to secure those of infants and small children (Kuku et al., 2011; Saaka and Osman, 2013).

3.1.2. Household food access, dietary diversity and food insecurity

Consuming a variety of foods is essential for both a balanced and healthy diet because not all essential nutrients are found in monotonous diets. An individual requires energy for metabolism and vital body functions as well as nutrients for growth and protection from disease (Onyango, 2003). This can only be achieved through the consumption of a varied diet from different food groups. Dietary diversity, which is a key element of high quality diets (Ruel, 2002) is defined as the number of unique foods consumed over a given period of time, and

provides information on household food security through the use of household dietary diversity scores (HDDS) (FAO, 2008b). Dietary diversity has been shown to be a useful measure to capture food access, especially in developing countries, where diets are often composed mostly of starchy staples, with few or no animal products, and may be high in fats and sugars (Carletto et al., 2013). The HDDS tool shows both household food availability and food access on the premise that households consume a variety of foods when they have the means to do so (FAO, 2008b). The tool covers different food groups from the foods that contribute to the quality of the diet in terms of essential nutrients (e.g. staples, fruit and vegetables, fats and oils, vegetable and animal source of protein) to those that do not contribute to a nutritious diet but require resources to acquire (e.g. sugar, sweets, beverages and condiments). Therefore, dietary diversity scores have been used to measure household or individual level of access to food and these have been reported to be useful indicators of household food security (Hoddinott and Yohannes, 2002) as healthy diets are said to be those that are most varied (Nti, 2014). Some households face nutritional problems due to lack of dietary quality rather than a lack of calories (Ruel, 2003), therefore the use of dietary diversity as an indicator of dietary quality has been widely used in food security studies both at the individual and household level (Ruel, 2012). There is typically a positive association of dietary diversity scores with household socio-economic status (Hatløy et al., 2000; Hoddinott and Yohannes, 2002; Savy et al., 2007) and nutritional status of children (Arimond and Ruel, 2002; Aboussaleh et al., 2004; Benefice et al., 2006; Sawadogo et al., 2006; Savy et al., 2007).

The choice and consumption of diverse foods may be limited to higher income households (Rabbani, 2014) as it is determined by the market price (Monsivais and Drewnowski, 2007; Hussain et al., 2014) and education level (De Irala-Estévez et al., 2000; Steyn et al., 2005). For example, in South Africa, high levels of food insecurity are common because most households are accessing food commercially through markets since they have abandoned subsistence farming (Musemwa et al., 2015). Due to increasing food prices and limited or no income, households may reduce dietary diversity as the consumption of more expensive food items is reduced (Brinkman et al., 2010; Stats SA, 2014) especially in low-income households who cannot afford a diverse diet (Modi et al., 2006; Ballantine et al., 2008). Poor households from developing countries are frequently affected by food price increases especially the prices of staple cereals (Gebre, 2012; Tyner, 2013). For example, Torlesse et al. (2003) reported in

Bangladesh on the association between rice prices, rice expenditures and child undernutrition. The prevalence of underweight children decreased with a decline in rice prices as households were able to spend more money on other foods such as meat, fish, fruit, oil and vegetables which are sources of essential nutrients for growth and health (Torlesse et al., 2003). In most developing countries, poor people tend to adopt unvaried diets mainly of starch staples such as maize meal, with little vegetable and fruit intake, to cope with poverty (Steyn et al., 2006; Oldewage-Theron and Kruger, 2008; 2011; Arimond et al., 2010; Schönfeldt et al., 2010; Faber et al., 2011; Acham et al., 2012). In South Africa, stunting and overweight in children have also been implicated to the educational level of the caregiver, and maternal education level (Steyn et al., 2005).

Food security measurements that are based on households' experience of food insecurity are widely based on the Household Food Insecurity Access Scale (HFIAS). The HFIAS captures information on food shortage, food quantity and quality of diet to determine the status of a given household's access to food using a set of nine questions to distinguish the food secure from the food insecure at the household level (Coates et al., 2007). Globally, the tool has been noted to be a useful in conducting food security studies (Melgar-Quinonez et al., 2006; Knueppel et al., 2010) although the interpretation of the results must be context specific to region or country (Swindale and Bilinsky, 2006). A number of studies have shown that food security as measured by the HFIAS tool is also associated with household wealth (Knueppel et al., 2010), household income, dietary adequacy, household assets (Faber et al, 2009), dietary diversity (Faber et al., 2009) and nutritional status (Kadiyala and Rawat, 2013).

3.1.3. Household food insecurity and nutritional status of children

Household food insecurity is a key factor influencing child undernutrition (UNICEF, 1998; de Pee et al., 2000; Kuku et al., 2011; Saaka and Osman, 2013) as the quantity and quality of dietary intake are compromised (Ali et al., 2013). In many developing countries, poor quality diets which are mostly low in calories and most essential nutrients are the major reasons attributed to childhood malnutrition (Nti, 2014). It is estimated that 178 million children aged younger than five years are stunted and 55 million children are wasted and most live in sub-Saharan Africa and south-central Asia (Bhutta et al., 2008). Individuals from households that

are food insecure have lower nutrient intake and the intake of fruit and vegetable decreases as the severity of food insecurity increases (Mello et al., 2010). In South Africa, about 20 % of the population are living in extreme poverty and cannot afford to purchase sufficient food to provide them with an adequate diet, therefore they consume low quality food and also change the quantities (Stats SA, 2014) which affects their nutritional status as is the situation in developing countries (Torlesse et al., 2003). In Columbia, the highest proportion of stunted and underweight children were from food-insecure households (Hackett et al., 2009) and in Pakistan, food-insecure households had greater chances of having a stunted child (Baig-Ansari et al., 2006). In South Africa, stunted growth and underweight are the major nutritional disorders affecting the nation (Drimie and Ruysenaar, 2010) although it is reported that school food programmes and child support grants have lowered the percentages of stunting and underweight in the country (Labadarios et al., 2011; FAO et al., 2012). In contrast, in some developed countries food insecurity is related to the prevalence of overweight, especially among women (Kaiser et al., 2004; Wilde and Peterman, 2006; Lyons, 2008) mainly because foods that are high in calories and fat are less expensive than fruit, vegetables, lean meats, and foods high in fibre (Drewnowski, 2004; Dinour et al., 2007; Mello et al., 2010). In South Africa, both undernutrition and obesity, as two food intake problems that are on the extremes of the scale, are widespread (Faber et al., 2011; Labadarios et al., 2011).

Nutrients are essential for child growth and development and these can be obtained from a diversified diet. Child growth is internationally recognised as an important indicator of nutritional status and health in populations (WHO, 2010). Measuring growth can be achieved through anthropometry (WHO, 2010) using indicators such as weight-for-age (WA), weight-for-height (WH), height-for-age (HA) or Mid-upper arm circumference (MUAC). The results from anthropometry reflects dietary outcomes of an individual over a long period of time (months or years). These indicators are used to measure nutritional imbalance causing undernutrition and overweight. For example, if a child's nutrient intake requirements are not met or exceeds the limit, it can be noticed through retarded or excessive growth, respectively (Onyango, 2003). That is, a child may be too short for his or her age (stunted), have low weight for his or her height or small MUAC (wasted), or can have low weight for his or her age (underweight) (UNICEF, 2009). About one-third of all deaths in children are due to undernutrition which is caused by poor feeding, care and also aggravated by illness (Mandal et

al., 2014) although the basic cause is poverty mostly in developing countries (Torlesse et al., 2003).

In South Africa, no study has explored the links between household food insecurity, household dietary diversity and the nutrition status of children in mid-sized towns. To date, no study has compared the nature and relative magnitude of household food insecurity along the rural, peri-urban and urban continuum of small- and medium-sized towns yet these are characterised by higher poverty levels which is the major factor influencing food insecurity by limiting households' food access (UNDP, 2006; Brown, 2009). Household food access is defined as the ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives. Food access can be measured by using the household food insecurity access scale (HFIAS) based on a 30-day recall period and the household dietary diversity score (HDDS) based on 24 hr, 48 hr or 7-day reference period (FAO, 2008b; 2011). Although household food insecurity is greatly experienced in South Africa, there is limited information on its contribution to child malnutrition and this has prompted the present research.

3.1.4. Aims of study

The aims of the study were to measure household food insecurity using the indicators HFIAS and HDDS and child nutritional status using height-for-age and MUAC. The measurements were to be compared between the three towns and along the rural-urban (R-U) gradient in each town. Globally, many households with limited access to food are hard to identify (Webb et al., 2006) and this study will help differentiate households at varying degrees of food insecurity and identify the most vulnerable household for food security intervention programmes. Since household food security, household dietary diversity and nutrition status of household members, especially children, are closely linked, this study sought to explore the links and determine if there are any associations between household food insecurity, household dietary diversity and child nutritional status in mid-sized towns of South Africa. I hypothesised that:

1. Households in Richards Bay would be more food secure than Dundee and Harrismith because of lower dependence on food purchasing due to involvement in own production in the town mostly because of the better climatic conditions.
2. The peri-urban populations would report higher levels of food insecurity than those in more rural and urbanised areas because of high levels of poverty, unemployment and lack of access/entitlements to land which makes them more sensitive to changes in incomes and food prices.
3. Poor households would cope with poverty and rising food prices by reducing the quality, quantity and number of meals consumed per day. Some household members would compromise their meals for small children.
4. The HDDS would have a negative significant association with HFIAS.
5. Children from food insecure households are more likely to be stunted and or wasted than their counterparts from food secure households. Therefore, HDDS and HFIAS will be correlated with child anthropometry measurements.

3.2. Methods

Refer to Chapter One and Chapter Two for information on study area and sampling.

3.2.1. Household Dietary Diversity Scores (HDDS)

The respondents were asked to recall all foods consumed by the household members in the previous 48 hours. The HDDS tool shows both household food availability and food access on the premise that households consume a variety of foods when they have the means to acquire them (FAO, 2008b; 2011). The tool inquires about 17 food groups which are aggregated to 12 for analysis (FAO, 2011). The 12 food groups are: (1) Cereals; (2) White tubers and roots; (3) Vegetables; (4) Fruits; (5) Meat; (6) Eggs; (7) Fish and seafood; (8) Legumes, nuts and seeds; (9) Milk and milk products; (10) Oils and fats; (11) Sweets and (12) Spices, condiments and beverages. The score is the sum of food groups consumed by household members from the total of twelve (Coates et al., 2007; FAO, 2011). Households were then classified into three categories: 1) lowest dietary diversity score ($\leq$ 5 food groups); 2) medium dietary diversity score (six to seven food groups); and highest dietary diversity score ($\geq$ 8food groups). A validation study for this indicator was done by FAO (2008b) in Mozambique and several

studies have used this indicator in assessing household food security. For example, the use of dietary diversity as an indicator of dietary quality has been widely used in food security studies both at the individual and household level (Ruel, 2012). There is typically a positive association of dietary diversity scores with household socio-economic status (Hatløy et al., 2000; Hoddinott and Yohannes, 2002; Savy et al., 2007) and nutritional status of children (Arimond and Ruel, 2002; Aboussaleh et al., 2004; Benefice et al., 2006; Sawadogo et al., 2006; Savy et al., 2007) and also nutritional status of women (Savy et al., 2005; 2006).

3.2.2. Household Food Insecurity Access Scale (HFIAS)

The HFIAS score is a continuous measure of the degree of food insecurity mostly related to access in the household in the past four weeks (30 days). The HFIAS was developed for use in developing country settings and is the tool that is internationally recognized when measuring food access. The tool has been widely used in food security studies including in Tanzania (Knueppel et al., 2009) and Mozambique (FAO, 2008b). The HFIAS tool is composed of nine questions that ask about any possible modifications households made in their diet or food consumption patterns due to limited resources to acquire food (FAO, 2008b). The nine questions are subdivided into three themes of food insecurity which are: 1) experiencing anxiety and uncertainty about the household food supply; 2) insufficient quality of diet which includes variety and preferences of the type of food and 3) insufficient food intake or reducing quantity of food consumed (Coates et al., 2007). The questions address the situation of all household members and do not distinguish adults from children or men from women or adolescents.

The nine questions represent a generally increasing level of severity of food insecurity and nine "frequency-of-occurrence" questions were asked as a follow-up to each occurrence question to determine how often the condition occurred. A household was asked to describe how often a condition had occurred in the past 30 days if the response to the condition described in the corresponding occurrence question was yes. For each frequency-of-occurrence question, a score was assigned to each household: 1 if the response was rarely (condition having happened once or twice in the past 30 days); 2 if it occurred sometimes (three to ten times in the past 30 days) or 3 if the answer was often (occurred for more than ten times in the past 30 days).

Households were assigned a score that ranged from 0 to 27 at the end of the nine questions which was based on their response to the nine questions (yes or no) and frequency-of-occurrence (rarely, sometimes and often). A household was assigned a score of zero if the household responded "no" to all occurrence questions. The maximum score of 27 was given to a household if the response to all nine frequency-of-occurrence questions was "often", and scores were added together. A high HFIAS score indicates household's poor access to food and significant household food insecurity. Households were classified into four categories based on the overall distribution of the HFIAS for the three towns from: 1) food secure (HFIAS = 0-1), 2) mildly food insecure (HFIAS = 2-7), 3) moderately food insecure (HFIAS = 8-11) and 4) severely food insecure (HFIAS >11) categorisation scheme recommended by the HFIAS Indicator Guide (Coates et al., 2007).

3.2.3. Child Anthropometry

Anthropometry is the most used method to assess the nutritional status of individuals or population groups and the use of nutritional status of children under the age of five is generally considered as a good proxy indicator of a household's nutrition status and health (WHO, 2013). The method is precise and accurate when using standardised techniques and the procedure is simple, safe and non-invasive. Measuring of standing height and mid-upper arm circumference (MUAC) was used for households with children between the age of two and five and where parents provided consent. The age in full months and sex of the children were noted prior to taking all the measurements. The sample consisted of 216 children with 69 children from Richards Bay, 83 children from Dundee and 64 children from Harrismith. Of the 216 children, 21 were from urban locations, 104 from peri-urban locations and 91 children were from the rural areas. Standing height and MUAC were measured in triplicate using a calibrated rod and measuring tape respectively. The children were asked to stand against the wall on a level floor without shoes, with legs and heels placed together when stature was being measured. For MUAC, the measurement was taken on the left upper arm, midway between the shoulder and elbow. Both height and MUAC were measured to the nearest millimeter.

Standing height was used to calculate height-for-age Z-Scores (HAZ) (standard deviation scores below or above a reference mean or median value). The World Health Organisation

(WHO) clear cut-off points were used to classify the children into four classes which are severe stunting (HAZ = < -3), moderate stunting (HAZ= -3 to < -2), mild stunting (HAZ = -2 to < -1) and normal (HAZ = ≥ -1). These classes have different implications for food and nutrition situation of the household. For example, if a child has a low height-for-age (below -2 SD of the NCHS/WHO reference), it means the child is stunted and is gaining insufficient height relative to its age therefore implying long term/chronic malnutrition and poor health (WHO, 1995; FANTA, 2010). Children were also classified into classes of wasting using the MUAC measurements according to WHO growth standards and guidelines (WHO and UNICEF, 2009; WHO, 2013). The four classes were 1) severe wasting if the child's MUAC measurement was <115 mm; 2) moderate malnutrition if measurement was from 115 mm to 125 mm; 3) possibly mildly malnourished if measurement was from 125 mm to 135 mm and 4) a child was regarded as nutritionally normal if his/her MUAC was >135 mm. If a child's MUAC was <125 mm, it means the child is wasted therefore implying acute malnutrition (FANTA, 2010).

3.2.4. Statistical analysis

Data were entered and cleaned using Microsoft Excel and all statistical analyses were performed using Statistica version 12 (StatSoft Inc.). Descriptive data are presented as means and standard deviations (SDs) (mean ± SD) and percentages. Data on HDDS and HFIAS for each town were tested for normality using a Kolmogorov-Smirnov test (Massey Jr, 1951) and did not meet the assumptions for normality therefore non-parametric tests were used for analysis. The differences in both HDDS and HFIAS between towns and locations were tested using 2-way ANOVA and a post-hoc analysis was performed to provide specific information on which means were significantly different from each other. As the data were not normally distributed, associations of the scores with food expenditure, household size, wealth variables and access to use of land were examined through Spearman correlation tests and HDDS and HFIAS were used as response variables analysed as a function of wealth, household size, food expenditure and access to use of land. The association between HDDS and HFIAS was also tested using Spearman correlation. Statistical significance was set at $p < 0.05$ for all tests.

3.3. Results

Refer to Chapter Two for information on household characteristics.

3.3.1. Household food diversity and differences within and between towns

Diets were similar across the three sites (Figure 3.1). The food groups consumed by greater than 50 % of households were mostly Cereals, Vegetables (mostly cabbage and onion), Spices, beverages and condiments (mostly salt and curry powder), Oils and fats; Sweets (mostly sugar and sweetened juice), Meat, and to a lesser extent Milk and milk products (Figure 3.1). Legumes, nuts and seeds (to a greater extent) and fruits were also consumed by more than 50 % of households only in Richards Bay although fruits were frequently consumed in the other towns but legumes were not commonly eaten in Dundee. White roots and tubers and eggs were little consumed in all the towns. Although white roots and tubers were infrequently consumed, households in Dundee consumed more tubers and fewer eggs than households in Harrismith and Richards Bay. Fish and sea food were rarely consumed in all towns, although Richards Bay had a greater percentage of households consuming food from this group, followed by Dundee and lastly Harrismith (Figure 3.1). In general, Richards Bay households have better diet, being highest in oils, legumes, fish, eggs, meat, fruits and vegetables.

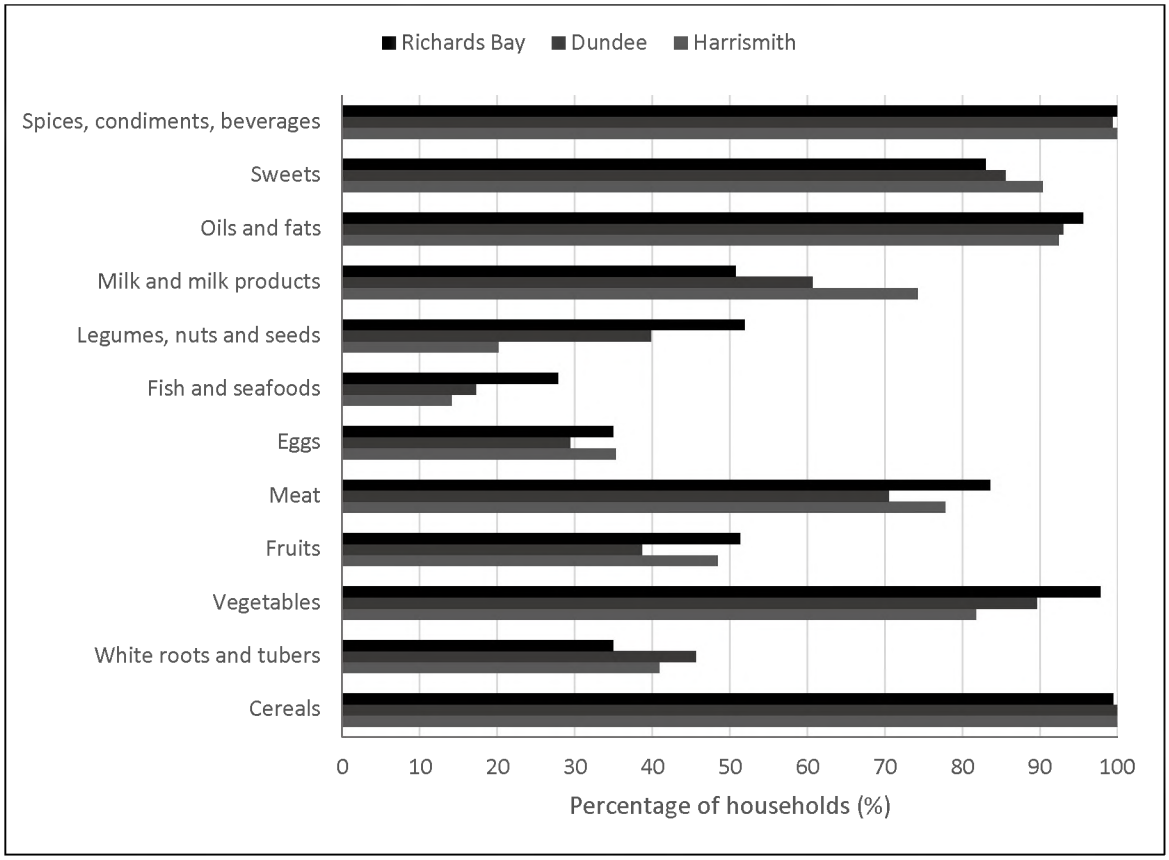

Figure 3.1. Percentage of households consuming different food groups in three towns of South Africa.

The HDDS was generally low in all towns with a mean of 7.96±1.60 for the sample (Table 3.1). Richards Bay had the highest mean HDDS of 8.44± 1.72 food groups consumed and Dundee had the lowest HDDS (7.69 ±1.63). Households in Harrismith had a HDDS falling between those in Richards Bay and Dundee (Table 3.1). There was a significant difference in HDDS along the agro-ecological gradient ($F_{2, 545} = 10.09$, $p<0.001$) with Richards Bay being higher than the other two, which were not different from one another (Table 3.1). Within sites, mean HDDS ranged from 7.53±1.55 to 8.62±1.33 in the rural location, 7.40±1.64 to 8.26±1.61 in the peri-urban location and 8.18 ±1.86 to 8.47±1.26 in the urban location (Table 3.1). There was a significant difference along the rural-urban continuum ($F_{2, 545} = 6.90$, $p<0.001$) being higher in the urban than the other two, which were not significantly different. Significant differences were observed along the rural-urban continuum in Harrismith (Table 3.1).

Table 3.1: HDDS and the percentage of households with low, medium and high HDDS in study sites. (Unlike superscripts indicate significant differences).

Town	HDDS (mean ± sd)	Location	HDDS (mean ± sd)	Percentage of households		
				Low	Medium	High
Richards Bay	8.44± 1.72[a]	Urban	8.43±1.45[a]	2	23	75
		Peri-Urban	8.26±1.61[a]	5	46	49
		Rural	8.62±1.33[a]	2	21	78
Dundee	7.76±1.63[b]	Urban	8.18±1.86[a]	8	16	76
		Peri-Urban	7.57±1.64[a]	9	35	56
		Rural	7.53±1.55[a]	7	45	48
Harrismith	7.83±1.59[b]	Urban	8.47±1.26[a]	4	18	78
		Peri-Urban	7.40±1.64[b]	9	42	48
		Rural	7.60±1.61[b]	10	55	34
All	7.96±1.60	Urban	8.38±1.50[a]	6	31	63
		Peri-urban	7.73±1.67[b]			
		Rural	7.93±1.53[b]			

Generally, in Richards Bay and Harrismith, low HDDS were observed in the peri-urban locations and high HDDS were observed in the urban location in Harrismith and rural in Richards Bay. This was different to Dundee where the low HDDS were observed in rural locations but high HDDS were observed in the urban. Most households in all towns and in all locations were classified in the high HDDS group except for rural Harrismith where the majority (55 %) had medium HDDS (Table 3.1).

3.3.2. Household food access along the agro-ecological gradient and rural-urban continuum

Household Food Insecurity Access Scale was generally low in all towns with a mean of 7.07±7.06 for the sample (Table 3.2). About 36 % of the households were food secure, 24 % were mildly food insecure, 28 % were moderately food insecure and 12 % of the households were severely food insecure (Table 3.2). The level of household food access was high in Richards Bay with the lowest HFIAS score of 5.57±6.98 and households in Dundee had the highest HFIAS of 9.39±7.13, showing household low access to food, whilst Harrismith had an intermediate score of 6.43±6.59 (Table 3.2). There was a significant difference in HFIAS along the agro-ecological gradient ($F_{2, 545} = 12.13$, $p<0.001$) with Dundee being more food insecure than the other two, which were not significantly different.

Within sites, mean HFIAS ranged from 6.74±6.21 to 9.45±6.67 in the rural location, 5.49±6.89 to 11.37±7.19 in the peri-urban location and 3.02±6.29 to 5.37±6.49 in the urban location (Table 3.2). The lowest mean HFIAS was recorded in Richards Bay urban and the highest mean HFIAS was recorded in the peri-urban area of Dundee (Table 3.2). There was a significant difference in HFIAS along the rural-urban continuum ($F_{2, 545} = 21.80$, $p<0.001$) with urban having lower scores than the other two which not significantly different (Table 3.2). This was true for all sites.

The prevalence of household food insecurity was higher in Dundee and Harrismith peri-urban areas than their urban and rural counterparts. This was different in Richards Bay where more households which were food insecure were from the rural areas (Table 3.2). In Richards Bay,

the percentage of households which were food insecure ranged from 34 % in the urban to 68 % in the rural areas; in Dundee it was from 47 % to 87 % and in Harrismith it was from 27 % to 79 %. The urban population in all three towns were more food secure than the rural and peri-urban with the peri-urban being mostly affected in Dundee and Harrismith whilst the rural was more food insecure in Richards Bay. Dundee had the greatest prevalence of severe food insecurity in the peri-urban which was 27 % and lowest in urban which was only 3 % (Table 3.2).

Table 3.2: Percentage of households who are food insecure and food secure classified using HFIAS. (Unlike superscripts indicate significant differences).

Town	HFIAS (mean ± sd)	Location	HFIAS (mean ± sd)	Percentage of households			
				Severely food insecure	Moderately food insecure	Mildly food insecure	Food secure
Richards Bay	5.57±6.98[b]	Urban	3.02±6.29[a]	9	2	23	66
		Peri-Urban	5.49±6.89[a/b]	8	22	20	50
		Rural	7.44±7.07[b]	14	19	35	32
Dundee	9.39±7.13[a]	Urban	5.37±6.45[a]	3	32	13	53
		Peri-Urban	11.37±7.19[b]	27	41	19	13
		Rural	9.45±6.67[b]	15	42	30	13
Harrismith	6.43±6.59[b]	Urban	3.18±6.02[a]	4	16	7	73
		Peri-Urban	8.32±6.46[b]	13	36	29	21
		Rural	6.74±6.21[b]	7	31	31	31
Mean	7.07±7.06	Urban	3.74±6.27[a]	12	28	24	36
		Peri-urban	8.38±7.21[b]				
		Rural	7.88±6.67[b]				

3.3.3. Association between food access indicators and socio-economic indicators

There were clear significant associations between HDDS and HFIAS, HDDS and wealth and access to land, as well as HFIAS and wealth (Table 3.3). For all the towns, there was a significant negative association between HDDS and HFIAS with households with low HDDS tending to have high HFIAS. Thus, the fewer food groups a household consumes, the higher the level of food insecurity. Both HFIAS (negative) and HDDS (positive) were associated with wealth index and food expenditure in Dundee. Also, there was a significant association between HFIAS and household size in Dundee (Table 3.3). In Harrismith, the only significant associations were between HDDS and food expenditure as well as between HFIAS and wealth and food expenditure. There were no significant relationships in Richards Bay between HDDS / HFIAS and the socio-economic status characteristics.

Table 3.3: Spearman correlations between HDDS and HFIAS and selected socio-economic indicators in the three towns studied. (Correlations are significant at $p<0.001$ ([a]), $p<0.01$ ([b]) and $p<0.05$ ([c])).

Town	HDDS vs HFIAS		Household size	Food expenditure	Wealth index	Access to land
Richards Bay	-0.286[c]	HDDS	0.054	0.101	0.132	-0.038
		HFIAS	0.068	-0.058	-0.096	0.141
Dundee	-0.342[b]	HDDS	-0.077	0.337[c]	0.278[c]	0.079
		HFIAS	0.195[c]	-0.354[b]	-0.337[b]	-0.057
Harrismith	-0.474[a]	HDDS	-0.023	0.185[b]	0.081	0.043
		HFIAS	-0.052	-0.255[a]	-0.145[a]	-0.079
All	-0.464[b]	HDDS	-0.058	0.066	0.109[b]	0.132[a]
		HFIAS	0.050	-0.073	-0.105[c]	-0.038

3.3.4. Nutritional status

The mean age of children was 39.0±11.2 months and 53 % were females. The mean HAZ for the sample was -0.93±4.94 and mean MUAC was 152.1±24.9 mm. Richards Bay had the greatest percentage of children who were stunted (45 %) and the least who were wasted (10 %)

(Table 3.4). Harrismith had the greatest percentage of children who were severely stunted (25 %) and who were severely wasted (13 %) (Table 3.4 and 3.5). There were no significant differences in stunting along the agro-ecological gradient, along the rural-urban continuum and between sex of child. However, significant differences were observed in child wasting along the agro-ecological gradient ($F_{2, 210} = 6.65$, $p=0.002$) with Harrismith having more wasted children than the other two, which were not significantly different from each other. Significant differences were also observed between MUAC and sex of child ($F_{1, 210} = 4.06$, $p<0.05$) where male children had higher MUAC than female. There were no significant differences in MUAC along the rural-urban continuum.

In general, the prevalence of wasting followed the agro-ecological gradient with the lowest percentage in Richards Bay and the highest in Harrismith. This was different from stunting were the lowest was observed in Dundee and the highest in Richards Bay. Stunting was significantly associated with wasting in Richards Bay, which shows that children who are suffering from severe stunting are likely to suffer also from severe wasting. Wasting in Harrismith was significantly negatively associated with HDDS, with children from households with low HDDS tending to have large MUAC. There were no significant correlations between HFIAS and children nutritional status measurements in all towns. Generally, the results show that the prevalence of wasting and stunting followed the rural-urban continuum with the lowest percentage of both indicators in the rural areas and the highest in the urban areas. When the urban sample is removed from the analysis due to low sample size (21 children), the prevalence of both stunting and wasting is higher in the peri-urban locations than the rural.

Table 3.4: Anthropometric measurements of children 2 to 5 years old and percentages of stunted and wasted children using HAZ and MUAC respectively. (Unlike superscripts indicate significant differences).

	Town/location	Mean ± sd	Severe stunting/wasting	Moderate stunting/wasting	Mild stunting/wasting	Normal
HAZ	Richards Bay	-1.65 ± 1.88 [a]	23	22	19	36
	Dundee	-0.63 ± 1.83 [a]	10	13	16	61
	Harrismith	-1.54 ± 2.18 [a]	25	14	13	48
	Urban	-1.89 ± 1.32 [a]	24	19	10	48
	Peri-urban	-0.82 ± 1.22 [a]	16	18	20	45
	rural	-0.68 ± 1.28 [a]	20	13	13	54
	All	-0.93±4.94	19	16	16	48
MUAC	Richards Bay	159.4 ± 22.5[a]	1	9	16	74
	Dundee	151.6 ± 24.8[a]	7	11	16	66
	Harrismith	145.0 ±25.5[b]	13	13	20	55
	Urban	149.8 ± 25.9[a]	10	10	19	62
	Peri-urban	154.2 ± 26.1[a]	5	15	13	66
	Rural	150.3 ± 23.2[a]	9	5	21	65
	All	152.1±24.9	7	11	17	65

3.4. Discussion

3.4.1. Household food insecurity as measured by HDDS and HFIAS

Results from this study indicate that households in all three towns had a poor dietary diversity as about 37 % of the households had HDDS in the low to medium classes. That is, one in three households in the study sites were consuming diets that were lacking good quality and diverse foods rich in all essential nutrients. Low dietary diversity has been reported in many South African studies (Oldewage-Theron et al., 2006; Labadarios et al., 2011). About 64 % of the households in the study sites were food insecure, with 12 % being severely food insecure, 28 % being moderately food insecure and 24% were mildly food insecure. The most food insecure were from the peri-urban and rural locations. The percentage of the food secure households (36 %) in this study is lower than that reported by Shisana et al. (2013) who found that only 46 % of the South African population were food secure. This is also lower than that reported by Rose and Charlton (2002) who found that only 43 % of the South African population were food insecure. The differences in the percentages of food secure households between these different studies could be attributed to the differences in sampling tools employed and sample size. As was hypothesised, the results on the prevalence of food insecurity show that it is higher in peri-urban and rural locations as was also reported by Shisana et al. (2013) although Rose and Charlton (2002) found the greatest percentages of food insecure households in rural areas.

Results from this study on HDDS suggest that a large percentage of households in all three towns restrict their food consumption to a number of food groups which is insensitive to geographical location and poverty status of the household. More than 50 % of households across all towns and locations consumed similar food groups which are cereals (mostly maize meal), oil/ fat, vegetables (mostly cabbage and onion), meat, sweets and spices. This is consistent with the study by Rabbani (2014) who found a similar trend in Bangladesh. However, the consumption of other food groups was limited to town and location and this can be explained by the significant differences in HDDS evident between Richards Bay and the other towns as well as the significant differences between urban households and those in the other locations. Households in Richards Bay showed high levels

of food access indicated by the highest mean HDDS and lowest mean HFIAS. This could be attributed to wetter and warmer climatic conditions and longer growing season which favour agriculture and less dependence on food purchasing (Chapter Two), which is likely to improve food security (Baiphethi and Jacobs, 2009; Mkwambisi et al., 2010; Zezza and Tasciotti, 2010; Lerner et al., 2011). This is also shown by a greater percentage of households who were consuming legumes, fruits and vegetables. Most households in Dundee and Harrismith are net buyers of food and they are not producing their own, therefore they have limited access to food which increases the degree of food insecurity. Decline in agriculture and reliance on purchased food has been reported to have a negative impact on households vulnerable to food insecurity (Altman et al., 2009; Crush and Frayne, 2011; Shackleton et al., 2013; Musemwa et al., 2015).

The lower levels of food insecurity in Richards Bay could also be due to collecting food from open spaces rather than purchasing as some households obtained some of their food, especially vegetables and fish, from the wild more so than in Dundee and Harrismith. Food donations could have played an important role in increasing the dietary diversity scores and lowering the HFIAS in Richards Bay since more households were receiving food parcels from the government, although these are pretty basic that they are unlikely to have increased HDDS. Unlike in Richards Bay, the HFIAS was higher in Dundee and Harrismith where more families were receiving social grants instead of food parcels. Significant positive correlations were found between HDDS and food expenditure in both Dundee and Harrismith and between HDDS and wealth index in Dundee. This association of dietary diversity and household socio-economic status was also noted by Hatløy et al. (2000) in Mali and by Hoddinott and Yohannes (2002) and Savy et al. (2007) in Burkina Faso. Rabbani (2014) also noted that some food groups were only limited to higher income households in Bangladesh. Such association was not found in Richards Bay because access to food was more varied as a greater percentage of households were not limited to a variety of foods especially legumes, fruits and fish which were less consumed in the other towns.

Significant negative correlations were also found between these socio-economic indicators and HFIAS in Dundee and Harrismith although food insecurity levels were much higher in Dundee than Harrismith. This was shown by the significant differences in HFIAS between Dundee and the other towns. The significant differences could be attributed to differences in household size between the towns, as households in Dundee were larger than the other towns. In the present study, household size has been shown to be significantly positively associated with HFIAS in Dundee as the level of food access decreased with an increase in household size. Therefore, the present study has shown that levels of households' food security may vary between and within towns and locations due to other stressors hindering the ability of a household to access food and in this case household size. That is, households in the same geographic location may face different levels of food insecurity. For example, Altman et al. (2009), FAO et al. (2012) and Naicker et al. (2015) noted that factors such as the economic crisis and other stressors such as illness or unexpected expenses may increase household food insecurity in some households and some in the same community may not be the affected.

In general, both food insecurity indicators (HDDS and HFIAS) have shown that levels of food insecurity were lower in urban areas compared to rural and peri-urban areas in all towns with the peri-urban households being the most food insecure. For example, about 41 % of households were moderately food insecure and 27 % were severely food insecure in Dundee peri-urban zone. This was shown by the significant differences in HDDS and HFIAS observed between urban and the other locations. On average, households in urban localities consumed 8.38±1.50 food groups; in peri-urban 7.73±1.67 and in rural they consumed 7.93±1.53 food groups. The HFIAS was 3.74±6.27 for urban households, 8.38±7.21 for peri-urban households and 7.88±6.67 for rural households. These results indicate that populations in the peri-urban are the most vulnerable to food insecurity as was hypothesised in this study. This is consistent with studies by Frayne and Pendleton (2009), Crush and Frayne (2011) and Naicker et al. (2015) who have shown that food insecurity affects the urban poor (mostly informal settlements) more severely than their rural counterparts. In urban areas food is readily available but most poor households have limited access (Huddleston-Casas et al., 2009), especially those residing in peri-urban locations where there are

high levels of poverty and unemployment but limited access to land. In these areas, household income and wealth status determine the level of household food security (Frongillo and Nanama, 2006; Jacobs, 2009; Kaschula, 2008; Kaschula and Shackleton, 2012) as illustrated in the present study by strong correlations between wealth, food expenditure and HDDS as well as HFIAS. Low-income households may experience food shortages more than wealthier households as food expenditure makes up a large share of their cash spending therefore they are more vulnerable to the impacts of rising food prices (Jacobs, 2009; Rudolph et al., 2012; Naicker et al., 2015). This study supports reports by Oldewage-Theron et al. (2006) and Labadarios et al. (2011) in South Africa and Bhattacharya et al. (2004) in the United States of America that poor socio-economic status has an impact on household food insecurity in peri-urban locations. Peri-urban households face much higher levels of food insecurity due to very low income, low asset ownership, lack of full-time employment of the head of the household and may also have a number of major problems with the dwelling (Oldewage-Theron et al., 2006; Bhattacharya et al., 2004; Naicker et al., 2015). Therefore, poor households cope with poverty and rising food prices by reducing the quality, quantity and number of meals consumed per day.

3.4.2. Association of household food insecurity indicators (HDDS and HFIAS)

The results show that HDDS was significantly negatively associated with HFIAS indicating that households who have a greater access to food consume more food groups in their diet and those with low HDDS have high HFIAS as households may cope with food shortages by either going to bed hungry or spending the whole day without food. The results support those of FAO (2008b) where household food access as measured by the HFIAS was low among households with low dietary diversity and high in those with greater dietary diversity. Deitchler et al. (2010), Headey and Ecker (2012), Sahyoun et al. (2014) and Desiere et al. (2015) also argued that HFIAS is correlated with food intake-based measures of food security. The HDDS reflects the economic ability of a household to access a variety of foods (FAO, 2011) and Hatløy et al. (2000) and Hoddinot and Yohannes (2002) have shown that an increase in dietary diversity is associated with higher socio-economic status and household food security. Therefore, food insecurity is closely

linked to poverty. Households in Richards Bay and Harrismith had higher access to food although dietary diversity was low in Harrismith. Households in Dundee had limited access to food as well as low dietary diversity. This is explained by the significant differences in HDDS between Richards Bay and the other two towns and also the significant differences in HFIAS between Dundee and the other two towns.

3.4.3. Household food insecurity and child malnutrition

Stunted growth was the dominant form of malnutrition among children in the study sites with, 45 % of the children in Richards Bay, 23 % in Dundee and 39 % in Harrismith suffering from chronic malnutrition although there were no significant differences between towns. Mamabolo et al. (2005) also reported high levels of stunting (48 %) in children in Limpopo Province of South Africa. About 21-48 % of young children in South Africa are stunted and approximately 42 % of children in sub-Saharan Africa who are under the age of five are stunted (de Onis et al., 2000; Faber et al., 2001; Mamabolo et al., 2004; Steyn et al., 2005). Shisana et al. (2013) reported that 27 % of South African children under the age of three are stunted and this value is lower than 35 % which was observed for all three sites when aggregated. The percentage of children who are wasted in the three towns was 18 % which was far greater than 4.5 % that was reported for South Africa in 2005 (Labadarios, 2007) and 6.8 % (4.8 % wasted and 2 % severely wasted) in 2008 (Berry et al., 2013). The percentages of children who were suffering from wasting was alarming, with Harrismith having the highest percentage of 26 %. This is consistent with Faber and Wenhold (2007) who reported that chronic malnutrition is a bigger problem than acute malnutrition in South Africa and Saaka and Osman (2013) also reported a high prevalence of chronic malnutrition in Ghana. In this study, fruits and vegetables (Vitamin A rich and dark green leafy) were infrequently consumed by the respondents in all towns. This is consistent with the study by Labadarios et al. (2000) who reported that South African children consume few fruits and vegetables due to poor access and availability. Kaiser et al. (2002) also noted that greater food insecurity in Latino households (California) was associated with a lower variety of most foods, especially fruits and vegetables. Steyn et al. (2006) reported that low dietary diversity which is an indicator of the micronutrient

adequacy of the diet was associated with poor growth in South African children. In a study across 11 countries, Arimond and Ruel (2004) confirmed that household dietary diversity is associated with child nutritional status. Results from this study further indicate that stunting and wasting are significantly positively correlated as was observed in Richards Bay showing that children who are stunted are likely to be wasted although it has been reported that stunted children have a higher risk of being overweight (Faber and Wenhold, 2007).

Food insecurity has been reported to be related to an inadequate dietary intake and increased levels of stunting and underweight (Labadarios et al., 2000). Results from this study show that household food security, as measured by HDDS, is associated with wasting. The significant negative correlation between HDDS and MUAC in Harrismith shows that children from households with low HDDS had large MUAC which could be attributed to high consumption of poor quality diets rich in more energy foods, more processed foods and foods high in saturated fat, sugar and salt which causes overweight (Faber et al., 2011; UNICEF et al., 2012; Black et al., 2013). Changes in diet has been reported to be one of the main drivers to child overweight (UNICEF et al., 2012; Black et al., 2013). In this study, since HDDS are closely correlated with household food expenditure and wealth index, therefore households with few assets are more likely to suffer from poor dietary diversity and also are more likely to have wasted and/or stunted children as well as obese children. Due to rapid urbanisation in South Africa, the majority of South Africans are in the process of transition from rural to urban lifestyles which is accompanied by nutritional transition whereby undernutrition and overnutrition coexist and affect the majority of the population (Chopra et al., 2009). Undernutrition and obesity are the two food intake problems often reported in South Africa that are on the extremes of the scale (Faber et al., 2011; Labadarios et al., 2011).

Most households in Harrismith obtain their food through purchasing and the choice and consumption of diverse foods among households is determined by market availability and price (Monsivais and Drewnowski 2007; Hussain et al., 2014) therefore majority of households in this

town could be consuming more energy and more processed foods, including refined grains, and foods high in saturated fat, sugar and salt which causes overweight as was reported in other South African studies (Ruel and Garrett, 2004; Faber et al., 2011). Also, large MUAC of children in Harrismith could be due to high intake of dietary fat and low consumption of fruits and vegetables as was the case of Hispanic children in the United State (Matheson, 2008). Labadarios et al. (2011) also indicated that poor South African children consumed inadequate diets which did not meet nutritional requirements indicated by the limited variety of foods consumed by the children. Gender of a child has also been implicated to be associated with nutrition status of children. For example, Baig-Ansari et al. (2006) found that female children were nearly three times more likely to be stunted than male children. In Harrismith, there was a significant difference in wasting between female and male children with female children having a lower MUAC than male children. Further studies need to be done to explore the causes of this observation although gender discrimination was reported in other studies in Asia (Hakim et al., 1998; Hussain et al., 2000).

Early childhood malnutrition can usually be attributed to poverty and lack of economic resources (Begin et al., 1999; Black et al., 2013). This study concludes that the children's nutritional status in general is related to household food security and socioeconomic status therefore any limitations in households' incomes and access to food can result in different forms of nutrition status in small children. As was noted by Oldewage-Theron et al. (2006) and Battersby and McLachlan (2013), coping strategies such as decreasing the variety of foods eaten, limiting portion sizes and eating cheap fast foods implemented by households during periods of food shortages negatively affect nutritional status. The significant negative associations between HDDS and wasting in Harrismith indicates that poverty could be the major determining factor of the nutritional status of children in this town as poor households may find it difficult to serve adequate meals, therefore they resort to cheap and poor quality diets to cope with poverty and rise in food prices.

Although the levels of food insecurity were high in Dundee and Harrismith, there were no significant correlations between HDDS and MUAC in Dundee. The difference could be attributed

to factors other than dietary diversity, such as sanitary conditions, water quality, infectious diseases and access to primary health care because food security may not ensure nutritional security (Pinstrup-Andersen, 2009). Also, intra-household allocation of food could have caused the differences as Dundee had the highest HFIAS which was significantly different to that in Harrismith. Therefore, the nutritional status of young children in Dundee could have been less sensitive to changes in food availability and access as households may reallocate resources when food is scarce to buffer the youngest children from declines in food intakes (Saake and Osman, 2013). For example, poor households would cope with poverty, rising food prices and food shortages by reducing the quality, quantity and number of meals consumed per day but not for small children. That is, households can cope with declines in food availability without sacrificing nutrient adequacy for vulnerable members (Saake and Osman, 2013). For example, some mothers may prioritise their children's food consumption over their own (de Pee et al., 2000) and this could be the case for Dundee. Moreover, in South Africa, the Child Support Grant has been noted to have lowered the prevalence of stunting and underweight (Labadarios et al., 2011; FAO et al., 2012) and a number of households in Dundee are receiving this grant from the government as is happening in other towns. However, a greater percentage of households in Dundee are also obtaining food from other sources (own production, collect from the wild and donations) than those in Harrismith who are mostly relying on purchasing (Chapter One). Therefore, households in Dundee could be using the grant cash to purchase fewer food items which they cannot obtain from the other sources and can use the remainder of the cash to improve their living conditions such as access to health care or treatment of infectious diseases which can affect nutritional status. This could be different from Harrismith where they obtain almost all of their food from purchasing using the grant which might not be enough to buy all food stuffs and other living expenses. However, this needs further investigation to really understand the differences in wasting in these two towns.

Households who are engaging in farming and are producing a major share of the food they are consuming are less likely to suffer from food insecurity than households which depend almost entirely on purchased food (Chapter Two). Farming has the potential to improve the food security

of poor households in both rural and urban areas by increasing food supply as food prices increase (Baiphethi and Jacobs, 2009). Households in Richards Bay had the highest mean HDDS and this may be due to wetter and warmer climatic conditions and the longer growing season which favour agriculture. Hence, there is less dependence on food purchasing in Richards Bay. In Dundee and Harrismith, drier conditions, low rainfall and winter frost make agricultural production less viable, hence the majority of the population is accessing food commercially through markets. Children from households who are farming are less likely to be malnourished as is shown in this study by the prevalence of wasting which corresponded to the agro-ecological gradient with Richards Bay having the lowest percentage of wasted children and Harrismith having the highest percentage. Also, more households in Richards Bay receive food from donations (food parcels from the government and some children get food from school), more than those in Dundee and Harrismith (Chapter Two). School food programmes have been noted to have lowered the prevalence of stunting and underweight in South Africa (Labadarios et al., 2011; FAO et al., 2012). This can be shown by the highest mean MUAC in Richards Bay which is significantly different from that in Harrismith although it was not significantly different from that in Dundee. In this case other factors such as recurrent infections, inadequate sanitation and hygiene, maternal education, and less than optimal infant and young child feeding practices (UNICEF, 1990; Bhutta et al., 2008), consuming low nutrient density foods (Faber, 2005) as well as maternal and antenatal factors (Bhutta et al., 2008) could have contributed to stunting in Richards Bay.

The HFIAS is a valid measure of food insecurity in different regions (FAO, 2007) but in this study it was not associated with both acute and chronic malnutrition as was also found by Kaiser et al. (2002), Bhatachayra et al. (2004), Cook et al. (2004), Osei et al. (2010) and Saaka and Osman (2013). The lack of association between food insecurity indicators and anthropometric indices could be attributed to the fact that in some households, mothers may skip meals or eat less or wait to eat until their children have eaten so as to make sure their children are not hungry and are getting enough nutrients (McIntyre et al., 2003; Martin and Lippert, 2012). Kuku et al. (2011) and Saaka and Osman (2013) also reported that when households experience food insecurity, some mothers

are likely to reduce their own intakes to secure those of infants and small children. In this case, even if the household is reported as being food insecure, the actual individuals suffering from food inadequacy and the severity of the food inadequacy cannot be identified as the tools alone are not good predictors for this (FAO, 2011).

However, some studies have shown that food insecurity was significantly related with stunting because in these studies, stunted children with lower HAZ were from food insecure households (Hackett et al., 2009; Gooding et al., 2012). However, the study revealed that the prevalence of food insecurity using both HDDS and HFIAS was higher in peri-urban locations which is also consistent with the highest prevalence of stunting and wasting. In 2008, wasting rates in children under the age of five were higher in peri-urban areas (eight percent) followed by the rural areas where four percent of the children were wasted (Berry et al., 2013).

3.5. Conclusion

This chapter analysed the differences in food insecurity along an agro-ecological gradient as well as along the rural-urban continuum. The HDDS and HFIAS tools have been used as indicators of access to food and these were able to distinguish households with different levels of vulnerability to food insecurity through identifying groups with poor access to food in mid-sized towns in South Africa. Diets were similar across the three towns and HDDS and HFIAS were generally low in all towns. In general, the prevalence of food insecurity and wasting followed the agro-ecological gradient, with households in Richards Bay least affected. However, the prevalence of food insecurity did not follow the rural-urban continuum as a greater percentage of households who were food insecure was found in the peri-urban locations although this was not significantly different from the rural percentages. The prevalence of wasting and stunting was also higher in the peri-urban locations. Although the study provides an estimate of the percentages of households that are at risk of food insecurity in the study sites, the actual individuals suffering from food inadequacy and the severity of the food inadequacy were not identified as the tools alone are not good predictors for this (FAO, 2011).

Chapter Four

Communities' perceptions of a healthy diet, access to food and barriers to food security along an agro-ecological gradient

4.1. Introduction

4.1.1. Household food security in South African context

South Africa is one of the countries with the highest rate of income inequality in the world and extremely high levels of absolute poverty (Altman et al., 2009; Jacobs, 2009, Stats SA, 2014). The Gini coefficient in South Africa is estimated at 0.69 as calculated from the 2011 Census data (Stats SA, 2014). About 46 % of South Africa's population live in poverty (De Klerk et al., 2004; Drimie and Ruysenaar, 2010; Stats SA, 2014) and almost 20 % in extreme poverty, below the food poverty

line (Stats SA, 2014). Although South Africa may be food secure at a national level, large numbers of households within the country are food insecure (HSRC, 2004; Hendriks, 2005; van der Berg, 2006; Aliber, 2009; Stats SA, 2014). About 20% of South African households are estimated to have inadequate or severely inadequate access to food (Stats SA, 2009; 2014). The 2005 survey indicated that almost 52 % of South African households were food insecure, 33 % people were at risk of hunger and only 20% were food secure (Chopra et al., 2009; Labadarios et al., 2009). In the 2007 General Household Survey, at national level, approximately 10.6 % of adults and 12.2 % of children were estimated to be sometimes or always hungry (Jacobs, 2009). De Cock et al. (2013) reported that approximately 52 % of the rural households in Limpopo Province were considered severely food insecure.

Food security as defined by the South African government is "physical, social and economic access to sufficient, safe and nutritious food by all South Africans at all times to meet their dietary and food preferences for an active and healthy life" (NDA, 2002). The 2011 census indicated a decline in the percentage of food insecure people and reduced poverty levels in the country since 2006 (Stats SA, 2014). The decline is mostly attributed to the introduction of social safety nets by the government, income growth, above inflation wage increases, decelerating inflationary pressure and an expansion of credit (Stats SA, 2014). For example, social grants are reported to have played an important role in improving household food security in South Africa since 2001 (Aliber, 2009; Labadarios et al., 2011). Also, the Integrated Food Security and Nutrition Programme (IFSNP), which explicitly aims to eradicate hunger and nutrition deficits among low-income households helped to alleviate food insecurity levels in the country (Jacobs, 2009; Drimie and Ruysenaar, 2010).

Access to sufficient, safe and nutritious food is dependent largely on household and individual income levels and capabilities and rights to acquire food (Wheeler and von Braun, 2013). Access to food exists when a household is able to secure food by purchasing, own production or from other sources such as transfers or grants (Drimie and Ruysenaar, 2010). Household food security

in South Africa is determined by household income to a large extent rather than to household food production (Hendriks et al., 2006; Shisanya and Hendriks, 2011; Hendriks, 2014) because the majority of the population do not have resources for producing their own food so they access food commercially through markets (FAO, 2008b). Own production has been noted to improve food security of poor households in many communities by reducing the dependence on purchased food (Baiphethi and Jacobs, 2009; Crush et al., 2011). However, many South African households have abandoned farming because they regard it as a 'fall back' activity which they only practice when it is convenient to them and necessary (Aliber and Hart, 2009). They also regard obtaining food through farming as a sign of extreme poverty (Aliber and Hart, 2009) although some lack resources. In other South African communities, the collection of wild foods has been noted as an important strategy for households to access food (Shackleton and Shackleton, 2004; Shackleton et al., 2008; Davenport et al., 2011; 2012). Some urban households grow indigenous or domesticated vegetables to alleviate food insecurity as well as selling any surplus (Shackleton et al., 2010).

4.1.2. Causes of food insecurity and coping strategies in South Africa

The prime causes of household food insecurity are reported to be widespread chronic poverty, high unemployment and high HIV and AIDS (FAO, 2008a). Chopra et al. (2009) also reported that household food insecurity is closely linked with the households' socio-economic status such as income, employment status and food expenditure. Also, Battersby (2011) noted that the majority of households in Cape Town's informal settlements were moderately or severely food insecure due to lack of access to food which was directly related to income. Therefore, total household income is important in achieving food security in South Africa (Hendriks et al., 2006; Shisanya and Hendriks, 2011; Hendriks, 2014) as it is difficult for most South African households to purchase enough food to feed the entire household. The majority struggle to sustain a decent income as the estimated average income of the poor was less than R524 per month per person in 2012 (National Planning Commission, 2012). In many cases, purchased food constitutes up to 90 % of households' diets accounting for 60 to 80 percent of total household expenditure (Baiphethi and Jacobs, 2009).

Rising food prices, particularly of maize and wheat, which are the staple items for poor South Africans, also pose serious problems for the urban and rural poor as the majority are net buyers of food (Altman et al., 2009; Drimie and Ruysenaar, 2010). For these households, food security is determined by either direct or indirect access to cash so as to purchase food (Chopra et al., 2009). Therefore, 'the poor are facing higher food prices but no greater income, and they begin to starve' (Sen, 2008) through the reduction of purchasing power (Altman et al., 2009). The low-income households tend to purchase more energy rich and more processed foods, including refined grains, and foods higher in saturated fat, sugar and salt which are cheaper and more accessible (Ruel and Garrett, 2004; Faber et al., 2011). It has been noted that healthy foods are more expensive to buy than calorie-dense and nutrient-poor foods (Drewnowski and Specter, 2004), therefore most poor households have adopted monotonous diets mainly of starch staples such as maize meal, with limited vegetable and fruit intake, to cope with poverty (Schönfeldt et al., 2010; Faber et al., 2011).

Affordability has also been suggested as one of the major constraints to the consumption of vegetables and fruits in some South African households (Love et al., 2001; Faber et al., 2013). In some poor rural households, the barriers to a healthier diet are food prices and availability (Temple et al., 2011) as some households "cannot afford to buy vegetables" or the inputs for growing their own vegetables (Modi et al., 2006). In South Africa, HIV/AIDS (Modi et al., 2006), urbanisation (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012) and water scarcity have also been noted to be the major influences of household food insecurity. At household level, factors such as mother's education level, household size and age as well as ethnic group can determine the level of food insecurity (Melgar-Quinonez and Hackett, 2008).

Coping strategies such as reducing the quality and variety of the diet, limiting portion sizes, skipping meals and eating cheaper fast foods are implemented by poor households during periods of food shortages (Oldewage-Theron et al., 2006; Wunderlich and Norwood, 2006; Battersby and McLachlan, 2013). Some households also adopt monotonous diets (Schönfeldt et al., 2010; Faber et al., 2011). It has been documented that some mothers skip meals or eat less or wait to eat until

their children have eaten so as to make sure their children are not hungry and are getting enough nutrients (McIntyre et al., 2003; Martin and Lippert, 2012). This has a negative impact on a large proportion of households already vulnerable to food insecurity, thereby increasing hunger and malnutrition (Altman et al., 2009; Faber et al., 2011).

4.1.3. Measuring food security

Food security is a complex developmental issue. It is costly and complicated to measure food security although a number of approaches have been used (Hendriks, 2006; Melgar-Quinonez and Hackett, 2008). Measuring household food security can be achieved through the use of direct and indirect indicators to determine household food supply, food access and the outcomes of adequate food consumption (FAO, 2004b; Hendriks, 2006). Household food supply mainly reflects on sources of food, for example, whether a household is getting food through own production, from the market, through collecting from open spaces or donations. Food access indicators provide information on food entitlement and socio-economic status of the household. Thus, they assume that households consume a variety of foods when they have the means to acquire it (FAO, 2008b). Food access measurements are regarded as crucial in food security studies because they can be used to assess the nature of food insecurity in certain households, assess the severity and for monitoring interventions that may be implemented (Hoddinott and Yohannes, 2002). Food security outcomes mostly measure food consumption and the different effects of consumption which could be an individual's nutritional status and influencing factors. This can be measured directly through the use of qualitative methods to measure people's perception of food insecurity (e.g. participatory observations along with in-depth interviews and focus group discussions (FGD)) or indirectly through use of quantitative survey methods (e.g. measurements of dietary diversity and nutritional assessments using anthropometric surveys) (Wolfe and Frongillo, 2001). Wolfe and Frongillo (2001) further emphasised the importance of including tools which can measure both access to food and perceptions of food insecurity when measuring household food security in developing countries.

In South Africa, most published work on food security has used household surveys and neglected to seek an understanding of the feelings and perceptions of the people involved and why they do the things they do. In many affected households, the experience of food insecurity involves social and psychological stress which is associated with not having enough food (Hamelin et al., 1999). Psychological stress due to lack of access to food may constrain households from practising their 'normal' day-to-day activities which may cause stress, modification of eating patterns as well as disturbances of households' food acquisition and management practices (Hamelin et al., 1999). Hamelin et al. (2002) and Chan et al. (2006) also pointed out the importance of understanding food insecurity from the households' perspectives in Canada.

The aims of the study were to capture information on the 'hidden' constraints in the measures of physical and economic access and availability of food which may affect the dietary quality of households in the study sites. The study sought to understand food insecurity from the perspective of community members who experienced it as well as understanding the community perceptions about food security, food abundance in their area, farming, self-reported, healthy diets and perceptions and feelings on how and where they access food. The study addressed what the communities perceived as food insecurity and the barriers to household food security as identified by the community members along an agro-ecological gradient. The study examined whether communities had limited access to food and how this influenced their diets and food diversity and their choice of food. The study further explored if there were any strategies that households were using to cope with food shortages and their perceptions on improving their food security status along the gradient. I hypothesised that:

1. Communities in all towns would have knowledge about healthy eating but many households will not be practising such due to a lack of resources to buy diverse foods.
2. Food will be abundant throughout the year in all communities but some will face difficulties in accessing the diverse food due to high food prices and a lack of resources.
3. Communities would perceive diverse and interconnected factors to be causing food insecurity in their communities.

4. Poor households in all communities would cope with food insecurity by resorting to a number of different strategies in a similar way along the agro-ecological gradient.
5. School feeding programmes and social grants would help in improving food security for poor households in all communities.

4.2. Methods

Refer to Chapter One for information on study sites.

4.2.1. Focus group discussions (FGD)

A focus group is a small group discussion of issues relevant to a topic and is frequently used to collect qualitative data (Krueger, 1994). Focus group discussions, like other qualitative research methods, can be used to develop an understanding of the meaning and experiences of peoples' lives from the point of view of those who experience it (Fossey et al., 2002; Vaismoradi et al., 2013). These have been used in food security studies to obtain information regarding food choices and diets within the context of lived experiences (Raibee, 2004, Chan et al., 2006). Thus, one can obtain information on the beliefs or feelings of individuals and why they act in the way they do.

In the study, 11 focus groups were conducted in October to November 2014; four in Richards Bay, four in Dundee and three in Harrismith. The focus groups where mostly rural and peri-urban in all sites and only one focus group was conducted in an urban location of Dundee due to difficulties in getting participants in urban locations. Informed consent was obtained from each participant in the focus groups. Each focus group took between 45 - 60 minutes and in all focus groups there was an interpreter, translator and an assistant. I led all the discussions. For each focus group, both the assistant and I made notes of all the discussions and the responses that appeared most often in the group discussions. All questions which were asked in the FGDs were open-ended and the core questions in each FGD included aspects on:

1. Household diets and why households were eating the mentioned foods.

2. Knowledge about dietary diversity, perceived characteristics of a healthy diet and were households able to provide for a healthy diet.
3. Sources of food and perceived time of the year when they have food in abundance or not.
4. Communities' attitudes towards own production and food purchasing.
5. Perceived factors influencing communities' and households' access to food.
6. What participants perceived as food secure, food insecure and the causes of food insecurity in their areas.
7. The coping strategies that are implemented by households to combat food shortages
8. Communities' suggestions on how to improve food security in their areas.

Male and female individuals from a wide range of age and socio-economic statuses were invited to participate in the FGDs by their community leaders. Groups were differentiated by selected socio-economic attributes because participants with similar characteristics become more comfortable with each other and can participate freely in the discussions. The FGD were held in comfortable, peaceful and convenient settings. At the end of each session, the assistant and I compiled our notes. Compiling the research data soon after the discussions helps in linking accurately the statements to anonymously coded individual identifiers in each group (Chan et al., 2006).

Data from all the FGD were entered into Microsoft Word 13 and was edited. I read the corrected transcripts several times to understand the information I got from the discussions as was suggested by Braun and Clarke (2006). During data analysis, I used Qualitative Content Analysis (QCA) which is a research method used to interpret textual data content by using a systematic classification process that involves coding to identify patterns or themes (Hsieh and Shannon, 2005; Braun and Clarke, 2006). Data were analysed through coding (Braun and Clarke, 2006; Saldaña, 2009) using NVivo software. I identified similarities between the codes and combined those that were connected and at the same time forming the significant themes and categories for the discussions. The transcripts were coded for type of food, sources of food, reasons for

consuming a particular diet, food security, reasons for being food secure, causes of food insecurity, own production, attitudes towards farming, time of food abundance, and food insecurity coping strategies. The coded FGD comments were arranged into categories within relevant themes. The five themes and categories that came out from this study are shown in Table 4.1.

Table 4.1: Themes and categories.

Dietary diversity	**Food abundance**	**Agricultural Practices**	**Food security**	**Coping strategies**
• Type of food • Sources of food • Why a particular diet	• Periods of food abundance and scarcity	• Own production • Barriers to farming	• Food secure or not • Causes of food insecurity • Ways to improve food security	• How to cope with food shortages

4.2.2. Participatory transect walks

A member was selected randomly from the focus group participants. Only women agreed to participate in doing transect walks. My assistant and I jointly walked along transects from the respective homes to places where households often purchase, produce or collect their food. I took notes and photos regarding food acquisition, food diversity and food abundance within the community, observing, asking questions and listening carefully to what the participant was saying. The participants were encouraged to comment on the features and issues along the path, and point out whatever they deemed worth mentioning or important. Five transect walks with women were achieved, two in both Richards Bay and Dundee and one in Harrismith. Such "walking interviews"

help to provide insights into links between food systems, daily household routines and perceptions, and space that would otherwise probably go unnoticed in the research process.

4.3. Results

4.3.1. Focus groups participants

The geographical distributions, sample size, age and gender of all the participants are shown in Table 4.2. A total of 91 people participated in the focus group discussions, with about 6-11 attending per community. The age of the participants ranged from 19 to > 50 years and the focus groups were mostly represented by women and people aged from 31 years and above. Most people who attended the focus groups were from the rural areas with a few representatives from the peri-urban areas of which most had informal employment. Those who were formally employed, mostly males and those residing in urban areas chose not to attend the focus groups.

Table 4.2: Total number, age and gender distributions of focus group participants along the agro-ecological gradient.

Town and Location		Focus group	Gender		Number per age group in years			
			Male	Female	<20	20-30	31-50	>50
Richards Bay	Rural	*Khayalethemba (n = 11)*	4	7	1	2	5	3
	Rural	*KwaMbonambi (n = 9)*	0	9	0	1	8	0
	Rural	*KwaMonica (n = 7)*	2	5	0	2	5	0
	Peri-urban	*Esikhaleni (n = 8)*	0	8	0	0	8	0
Dundee	Rural	*Tayside (n = 10)*	2	8	0	3	5	2
	Rural	*Clones (n = 8)*	2	6	0	1	5	2
	Peri-urban	*Sibongile (n = 7)*	4	3	0	2	4	1
	Urban	*Dundee Urban (n = 6)*	0	6	1	3	2	0
Harrismith	Rural	*Makgolokweng (n = 10)*	5	5	0	0	6	4
	Peri-urban	*Intabazwe (n = 8)*	3	5	1	2	4	1
	Peri-urban	*Tshiame B (n = 7)*	0	7	1	2	3	1
		Total (n = 91)	22	69	4	18	55	14

4.3.2. Dietary diversity

4.3.2.1. Food type

Participants listed all the foods that they consume in their households. A variety of foods were mentioned in all communities but most of the foods mentioned were starch, although meat and vegetables were also mentioned. The vegetables mentioned by almost all the groups were cabbage, onion and spinach. Chicken was the meat most mentioned, although all types of meat were being consumed in the communities. Traditional foods and wild vegetables were also mentioned in most of the groups except the urban one. Fruits were rarely mentioned.

> "*We eat cabbage, spinach, beans, carrots, beetroot, mealies, amadumbe, potatoes, sweet potatoes, rice, pap, samp, dumplings, bread, amahewu, fish, all types of meat, mbaqanga (mixture of beans and mealie meal), isijinga (mash of butternut and mealie meal), eggs, isipaklapakla (wild spinach) and imbuya spitsa/mholika, zaqathi (wild white carrot) and sometimes fruits like bananas, peaches, oranges, apples, figs, grapes.*" Clones

4.3.2.2. Sources of food

In all the focus groups, participants were acquiring their food in different ways. Four main methods were mentioned in most of the groups, namely own production, purchasing from the markets, collecting from open spaces and donations from the Department of Social Development, friends and family. Some participants also mentioned that they have enrolled for "work for food" programmes where they would work and get food parcels. Purchasing was the major means of accessing food for most participants in all towns.

> "*We get all this food from different sources. We produce some of the food in our gardens e.g. vegetables like spinach, cabbage, potatoes, onions, beetroot, beans and maize. The greater part of the food we eat is from purchasing.*" Dundee urban

"*Most of the food eaten here is from the supermarkets. We always buy our food.*" Intabazwe

However, all focus groups in Richards Bay mentioned that they mostly produce their own vegetables and also collect vegetables which they consume. They mentioned that they only buy the food which they are not able to produce and a few get donations from the government.

"*We grow our food in our gardens and open spaces around our areas. We have fields in open spaces and we collect some vegetables like imbuya. We only buy the food that we do not produce and use almost on daily basis like rice, sugar, milk, cooking oil and mealie meal and meat.*" Esikhaleni

"We grow vegetables like cabbage and we collect some vegetables which grow on their own from the wild like imfino isiZulu. We also buy the food we eat from the supermarkets in town, small markets around our neighbourhood and kiosks. Food like bread we can get from the tuckshops. Those people who are lazy and do not want to work are getting food parcels from the Department of Social Development." Khayalethemba

Photographs of the ways some households obtain their food were also taken during transect walks and are shown in Figures 4.1- 4.4.

Figure 4.1. Own production by community members in KwaMonica, Richards Bay (left) and Clones, Dundee (right).

Figure 4.2. Obtaining food from markets in Esikhaleni, Richards Bay.

Figure 4.3. Obtaining food from donations in Khayalethemba, Richards Bay (left) and work for food programmes for Sibongile residents in Dundee (right).

Figure 4.4. Wild vegetables obtained from open spaces at Tayside in Dundee (left) and Mbonambi in Richards Bay (right).

4.3.2.3. Why a particular diet

When asked if they knew about a balanced diet, participants in all focus groups perceived that many people knew about healthy eating and getting enough nutrients for the body, although there were many factors which could force them into adopting a particular diet in their households.

"*We eat different types of food for health reasons. To get different types of nutrients from different type of food. We also eat different types of food so as to enjoy the meal and avoid being tired of the same type of meal always.*" Dundee urban

They diversify their diets to avoid getting tired of eating the same meal although they would sometimes consume different foods in the same food groups. Also they consider the food which they produce as fresher, healthier and tastier than purchased food.

"*We eat different types of food for health reasons for example that is why we eat vegetables. Our food is healthier, fresh and tastes nice unlike shops food which is unhealthy. At times we are forced by circumstances to eat the same type of food always. For example, we eat more of rice, pap and bread to fill our stomachs but we know it is not heathy since we will be missing some nutrients. You cannot just eat one thing over and over again because you get tired of it and your body will lack some nutrients. We eat beans because they are healthy and cheaper at the same time but we do not enjoy eating them (beans). Some of us do not have husbands in our homes so we just eat whatever we get at that moment because we do not have money.*" KwaMonica

The participants also mentioned that, the love for a particular food, preference, fulfilment of hunger, household income and just consuming the food present at the moment also influences their diet.

"*We normally eat so as to satisfy our stomachs and we do not consider food diversity. We only diversify due to preference and what is present. We do not consider a balanced diet, we just eat what is available. We like meat but if there is no money to buy it, we just eat pap and cabbage.*" Intabazwe

4.3.3. Food Abundance

4.3.3.1. Periods of food abundance and scarcity

Time of food abundance was slightly different between towns as perceived by the focus group participants. Participants in different communities in the same town had mixed feelings about the time of the year they have more food, especially in Dundee. Some perceived that food is abundant in summer, others in winter and some said food was abundant all year-round in their communities.

> "*We have more food in winter after we have harvested but also in summer when it rains we can get some food from the wild especially fruits and vegetables. Those with taps at their homes can produce vegetables throughout the year.*" Clones

> "*In winter there is serious shortage of food but in summer it is better because of the rains so we can collect from the wild and there is food for the animals.*" Tayside

In Harrismith, focus group participants in all communities perceived that food was abundant in summer mainly due to low food prices. Some also perceived that food abundance can only be achieved when people have received their salaries or grants.

> "*In summer there is more food as people produce more. Food prices are low in summer because of increased supply from September to December. In winter production is low because of low rainfall therefore the food is imported from other places and food is very expensive. In summer, food prices are low so we are able to buy more food.*" Tshiame B

> "*There is enough food in summer after harvesting and because food prices are less than in winter. We also eat better after we receive grants but these grants are very little.*" Makgolokweng

In Richards Bay, all focus group participants agreed that they have enough food in abundance throughout the year but winter was better than summer mostly due to more rains and pests in summer.

> "*We have two seasons in this area, winter and summer. We get food in all seasons because it rains throughout the year therefore we produce food all year-round. However, we prefer winter because we harvest more during that season because there are less insects that affect plants in our gardens. In summer there is too much rain and insects which affect plant growth and produce. We harvest our plants all year-round but the big harvest is in winter.*" Khayalethemba

4.3.4. Agricultural practices

4.3.4.1. Own production

In mostly Richards Bay and Dundee, the focus group participants were practising own production either in the form of keeping livestock or gardening. Only in Harrismith communities was this rare. The animals which they were keeping were mostly cattle, goats and chickens. Cattle were mainly kept for meat, milk and for ceremonies like paying lobola (bride-wealth) and performing some cultural rituals. Goats were kept for meat and also for performing some cultural rituals. Chickens were kept for meat and selling, and rarely they would produce eggs. Communities also produced vegetables for food and selling. However, a number of communities were not happy with their level of production as they perceived they would do more if they had enough knowledge, resources, water supplies, land, enough pastures for the animals and also getting some help from the government.

> "*We grow vegetables like spinach, cabbage and onions in our gardens for both our consumption and for selling. We keep chickens (both the traditional type and broilers), cattle, goats and sheep. We keep these animals mainly for food (meat and milk), to use in the fields and during some ceremonies like cattle to pay lobola and goats for our cultural rituals. We mostly keep broilers for selling but we do not sell our cattle. Meat production*

is affected by less pastures due to low rainfall. Also there is an invasive plant (shanello yasendle) that is growing in the pasture areas and is affecting the growth of grass. This has affected the production of meat as there is not enough food for the domestic animals. We have very limited numbers of livestock because we do not have enough pastures to feed many. Therefore, we are discouraged from keeping a large herd of livestock. Also, there are some wild animals which come and eat our livestock." Clones

"*We produce enough vegetables to eat and a surplus for sell but some of the food and meat we buy from the markets. We fail to produce enough food because we lack the knowledge on how to go about proper farming. Agricultural officers just focus on distributing seeds to us but do not teach us on when, how and what to produce at a time. There are no practical lessons or follow ups on what they tell us. Our land is fertile, we put cow manure in the fields and we have good climate but we do not have enough knowledge to practice proper farming. Sometimes we grow enough and people from town come and buy. Some promise to come back and buy but they do not come so our products end up rotting. Our produce is wasted if we fail to get market especially cabbage. We need machines to use in preserving or drying our vegetables. We do not know how we can go about it and we are failing to get help from agricultural organisations. If we are given proper knowledge and progressive lessons with agricultural extension officers on how to farm, we believe we can improve our production. We also keep cattle, goats mainly for food (meat and milk). We also keep chickens for meat and we sell to get some money but we do not sell or slaughter our cattle always because they are very few so we normally use for ceremonies. Although we get meat from our livestock, we feel we can produce better quantities and quality if we get proper knowledge since we are not educated.*" Khayalethemba

"*We keep chickens mostly the traditional type for meat, our level of food production is limited by a number of things which are theft, water shortages, land is not enough, and we lack resources and knowledge to practice proper agriculture.*" Makgolokweng

4.3.4.2. Perceived barriers to farming

Focus group participants in almost all communities perceived that there are certain factors that are hindering them from fully engaging in farming and many households had difficulties in practising own production. The perceived barriers to farming in these communities are related to lack of income and resources due to high levels of unemployment, lack of enough land, water shortages, theft, limited knowledge, insufficient government support, laziness and some form of individual lifestyle. However, participants in Richards Bay mentioned lack of knowledge, laziness and theft, as well as failure to get a market, as the major impediments to farming in this town.

> "*We have problems of animal theft in our communities so we do not keep much livestock. We get discouraged sometimes because we fail to get market for our produce and it ends up rotting and wasting away. We do not have the means to preserve our farm produce. We used to produce enough food to eat and a surplus for sell but now our land has been affected by Richards Bay minerals (RBM). RBM has affected our homes, land and water but they are not compensating us. Because of them we no longer have enough even the fruit trees we used to have in the open spaces like guava have dried. RBM have grown trees that are sucking water from the soil and these trees are making the soil to lose its fertility thereby affecting our crops. Before the mine was established, we used to have enough food as we were growing our own food and even getting fruits and imfino from the forests. However, there are community projects which we do where we work together, share ideas on how we can get better production but some community members do not cooperate because they are lazy and they feel that working in the fields is for poor people.*" Mbonambi

> "*Farming in our area is not viable because we have limited land, we do not have farming equipment, seeds and fertilisers. We do not have money to buy these because most of us are unemployed. Water shortage is also a big issue in our area which is causing us not to produce more food. We can't make gardens flourish because the water we are using on daily basis is being supplied to us by trucks and we cannot run gardens through such water.*

The water supply is also not efficient and at times we go beyond a month without supply so our life becomes very difficult. Also some people are lazy and do not want to work in the gardens. They think it is something that is done by the poorest. Because not everyone will be having gardens in the community, some of the food is stolen and this is discouraging most people because it's a waste. It is also difficult to keep so many domestic animals because of thieves in this area. We are willing to work with our hands to produce our own food but we have limited land and farming equipment. We desire to produce chickens (broilers) but there is a lot of criminal activities. It is difficult to produce because there are so many thieves in the area who can come and take the chickens when they are ready for sale." Makgolokweng

"*We have no enough land to make the gardens and fence to protect our gardens from animals although some are just lazy. Water is another big problem that hinders us from doing our own production. There is shortage of water and tap water is not reliable, most of the time we don't have water and this is a dry place with very limited rains. Often, the rains come too late for production of crops like maize. We cannot afford to buy fertilisers for our crops and we also do not have pest control measures for our crops and this affects production. Many lack agricultural knowledge but we feel we can produce better if we have the knowledge, enough land, water and income. Those are the main issues that are causing us not to do farming. Also, if we are helped with fencing our gardens so that no animals can eat our vegetables.*" Tayside

4.3.5. Food security

4.3.5.1. Food secure or not

Focus group participants in most communities perceived that they were food insecure although some expressed mixed feelings about some households in the communities being food secure and others experiencing food insecurity. Some participants, especially in Richards Bay, mentioned that they were food secure although some, mostly female-headed households were food insecure. In

the other towns, most participants in the focus groups were saying they are not food secure and the government was just ignoring them.

"*Some families are getting all the food they need and they are food secure. Most of us are not employed and we do not have husbands to take care of us and the children, so we are not getting enough food.*" KwaMonica

"*Some households are food secure but food is not enough for the majority of the households. People are hungry and there is no food that they are getting from the government.*" Dundee urban

"*Not at all, we are very hungry people and we are suffering.*" Sibongile

"*No. The food is not enough in many homes, we are hungry.*" Intabazwe

4.3.5.2. Causes of food insecurity

Focus group participants in all communities of Dundee and Harrismith perceived that many households were facing difficulties in obtaining enough food for the whole family every month. They perceived that the causes of food insecurity in their communities were mostly related to unemployment, lack of land, unreliable rains and water shortages, high food prices, lack of income, insufficient support from the government and to a lesser extent laziness. However, the fact that some participants from rural communities mentioned lack of land as one of the causes of food insecurity in their areas was not considered by all participants as some mentioned that rural households have land, which although not large, could at least be suitable for home gardens. The families that are most vulnerable to food insecurity are those that are female-headed with the burden of taking care of children and grandchildren, those with no source of income with the bread-winner being unemployed. However, in Richards Bay focus group participants perceived that

many households who are suffering from food insecurity are lazy, although they also acknowledged that the unemployed, female-headed households and orphans are at great risk.

"*There are community projects which we do where we work together, share ideas on how we can get better production but some community members do not cooperate because they are lazy so they end up resorting to begging and handouts/food parcels from the Department of Social Development. These won't last for the whole month so they end up suffering from hunger and they keep on blaming the government and RBM, instead of working hard to get food. Those who do not want to work with their hands find themselves hungry and start begging for food or steal from our fields. Households with non-employed members struggle to get food and some are below the receiving age for elderly grant. Most are not getting the child support grant and they are carrying the burden of feeding and educating the orphaned children and their grandchildren. There are no food donations to cater for the orphaned children who are hungry. Female-headed households and orphans are suffering.*" Mbonambi

"*We are hungry because we do not have money to buy enough food and we do not have land to produce our own food. We are not employed so we don't have enough money to buy food. We don't have jobs, we don't have money and we do not have food. The other problem is electricity rates are very high and they are taking a huge chunk of our income which is the grant. The grant is not enough for everything like buying food, paying electricity bills and school fees. If we do not get the grant then there is a big problem and we go hungry even more since the money is not enough. There are no NGO's (Non-Governmental Organisations) that are giving us support and Social Development people promised to come and provide food for us but they did not come. We are living in poverty and no one is helping us. We are very poor because most of us are not employed and this is striking hard on us.*" Sibongile

"*Many households are run by widows and single mothers and food shortages are higher in female-headed households. Some do not want to make gardens due to lack of resources but some it is just out of laziness especially the youth, they think it is for us old people. The area is dry and there are communal taps which provide water to everyone and some individuals have managed to draw water to their homes. Some have failed because of financial problems. The land is fertile but it is dry. Also, unemployment is on the rise.*" Clones

"*Food availability is not a problem at all, the problem is money. We are not employed, we don't have jobs and some are not getting grants from the government. Food is very expensive especially in winter because production is low because of low rainfall therefore the food is imported from other places. Food is available at the markets but if you do not have the money to buy you won't get it. Food is very expensive in these shops and the quantities are too little. The quantities in their packaging do not match the price and because we are not employed we have financial constraints and are not able to buy more. There is efficient transport system to take us to town where we can buy food at reasonable prices but these taxis are also very expensive. We do not have money because we are not working, we are struggling to make ends meet. For most households, food is not enough because we have to buy everything from the markets and it is very expensive. It is better if we get directly from the farmers because the prices are low. We therefore buy less and cheaper food which we do not want to avoid hunger. We are hungry because we cannot farm because we do not have the land, we do not have water and there is no food that we are getting from the government. If there are no rains, there is no food. Department of Social Development has promised to give us food parcels for children who do not receive child grants but the food parcels never came. The grant is too little, it won't last us for days because the money is too little to buy food for the month. Unemployment is the main problem, we are struggling to make ends meet.*" Makgolokweng

4.3.5.3. Ways to improve food security

Focus group participants in all communities had very strong feelings that food security in their communities can be improved through working hard, being engaged in community projects and being formally employed. Although the projects can easily be implemented by the community members, some feel that they also need financial support from the government as well as jobs. Participants in Dundee and Harrismith perceived that there is need for support in providing water and fencing their gardens as well as strategies to boost their knowledge on agriculture through community engagement programmes. They believe that engaging in agriculture, receiving food parcels and social grants can improve food security in their communities.

> "*Those who work hard and families with employed bread winners are having enough food to feed their families and also to sell. Though we are not formally employed we grow some of our food and we get money though selling our produce then buy what we do not have. We have never experienced hunger before like what we hear from other places. We have enough food because we work hard. If you work hard you will have enough to put on the table. There are community projects which we do where we work together, share ideas on how we can get better production and the community members who are cooperating are getting food for their families from these project gardens. Also if we are helped with fencing our gardens so that no animals can eat our vegetables.*" Khayalethemba

> "*Some households are producing enough food for their families and these have water and land. Some homes have enough especially those homes with people who are formally employed. Therefore, employment, availability of land and water can improve food security in our communities.*" Clones

> "*The families who work hard are food secure because they get the food to eat. Some families are getting food vouchers from social welfare, food parcels from NGOs and some are getting social grants. This is helping to fight against hunger*". Dundee urban

"*Employment is the key to having enough food in many households. The homes that have enough food are those with people who are formally employed. If we also get jobs, this will improve our situation.*" Tshiame

4.3.6. Coping strategies

4.3.6.1. How households cope with food shortages

Although families in the study sites may experience food shortages at different levels, their coping strategies were almost the same for all communities. In all communities, the participants mentioned many strategies which they use to cope with food shortages and these included:

1. Changing diet from good to poor quality which is not diverse.
2. Reducing the number of meals and portions.
3. Young children get first preference when serving food.
4. Mothers sacrifice their meals for young children and are the last ones to eat always.
5. Most families send younger children to pre/school so that they benefit from school food programmes. In Harrismith, participants perceived that children eat too much when they are at home.
6. Some family members, especially in Dundee, go for "food for work" in some communities where they would work in the fields at some institutions and receive food parcels twice a week.
7. Some households receive social or child support grants as well as food parcels from the government.
8. Some households, especially in Richards Bay, have converted their farms into timber plantations and they are earning income from selling timber and use the money to buy food.
9. Some families, especially in Dundee and Richards Bay, are involved in community projects like community gardens where they get food and sell any surplus to get income which they use to buy what they need.

In all communities, participants have agreed that the above-mentioned strategies have helped them to deal and manage food insecurity in their communities although long term measures that can sustain families should be implemented.

"*We resort to few meals and buy food that is cheaper so that we can all have a share. In these times, we will only be thinking of eating whatever we get and not what we like or prefer. We will be eating the food that we can only afford. Some families have converted their land into timber plantations where they sell timber and get money for food. Some families get food parcels from the Department of Social Development and children are given food at schools. They get rice and beans most of the time at Khayalethemba. We also have a community project in this area which is called Vukuzithathe. The name motivates people to wake up and work. We decided to fight against hunger and poverty by starting this project. We are 20 members and we grow maize, cabbage, spinach and amadumbe. The soils are fertile and we do crop rotation because the crops are seasonal. We enjoy being busy always. We grow food for our consumption and for selling but sometimes we run short of market or transport to take our produce to possible markets and our produce end up rotting. This project has helped us the members to fight against hunger and poverty since we are getting both food and income through hardworking.*" Mbonambi

"*We eat few meals, buy cheap food and we eat pap and cabbage or beans most of the time because meat is very expensive. We buy cheaper things like mealie meal and have black tea because we cannot afford to buy milk daily. We grow amadumbe and sweet potatoes so we can eat that throughout the day. We as mothers, we can only eat when our young children and grandchildren are full. We also cook what is enough for the meal in order to avoid throwing away food. If there are any left overs, we keep them for the next meal or day.*" KwaMonica

"*We work in the gardens at Umalusi Christian Care Centre and we get food parcels twice a week as a payment. The work for food programme is open to anyone who is in need and is willing to work. The food parcels are not enough because they are only for one person which is not enough for the whole family. For example, we only get a small quantity of mealie meal, one loaf of bread and one head of cabbage twice a week but I have a family, we are seven and the food is not enough. I have two sons but they do not want to come and work but they need food and they want me to provide for them. At Umalusi, they only give the quantity for the person who is working in the gardens. Sometimes we get social grants but the money is not enough support a large family so we go for the work for food programme and at least we get something though not enough. We eat the same meal the whole day and reduce the number of meals and only eat at night. The food parcels we get from Amalusi are not helping us out because you work and get the food that do not last you a day. We work from 8 am to 10 am but we are still hungry.*" Sibongile

"*We are only able to buy some food when we receive the grant and it's not enough to buy all the food we need. We eat what we have, pap and amahewu or pap and potatoes. We eat less food and send children to school even if they are young because they get food there at school. Young children are our priority because they cannot go for long without eating. We look for cheaper food which we can afford and eat the same meal most of the time. Social and child grants are helping to buy food although the money is not enough. We have changed the food we used to eat, we are eating pap and cabbage even on Sundays which is not proper. Food is now very expensive, we used to have rice and meat on weekends, especially on Sundays because Sundays are special days. We are struggling.*" Makgolokweng

4.4. Discussion

Although the information on households' diets and dietary diversity as well as sources of food was obtained through surveys (Chapter Two and Three), the information on why households consumed

the food which they did, why they obtained food from different sources, what determines the choice of diet which they consume as well as information on whether food was always available in abundance or not and when, was limited. The present chapter emphasised on drawing information on the experiences of households in the communities, their perceptions of food security and causes of food insecurity, the feelings they encounter when they are in the situation of being food insecure, the measures they take to combat food insecurity in their households and what they feel should be done to improve food security in their communities.

4.4.1. Diets and food diversity

Although participants from all the focus groups seemed to be familiar with the concept of dietary diversity and a balanced diet as was hypothesised in this study, their perceptions about eating healthily were not in line with the terms as most mentioned that they eat different foods because they get tired of eating the same meal. The way they change their diets, for example, rice, pap, potatoes and samp, does not have an impact on improving their dietary diversity as they would be consuming one food group (starch) more than other food groups. Steyn et al. (2006), Oldewage-Theron and Kruger (2008), Arimond et al. (2010), Schönfeldt et al. (2010), Faber et al. (2011) and Acham et al. (2012) also reported that starchy foods, especially maize based foods, dominate the diet of many South Africans. Fruits were rarely mentioned by the focus group participants which is also consistent with other studies in South Africa where low intake of fruits and vegetables was reported in most poor communities (Arimond and Ruel, 2004; Arimond et al., 2010; Schönfeldt et al., 2010; Faber et al., 2011). Most focus group participants also mentioned that they consume meat a lot and meat has also been found to be the main source of protein consumed in other parts of South Africa (Acham et al., 2012).

4.4.2. Sources of food

Although focus group participants mentioned that they obtain their food from different sources which included own production, purchasing from the market, collecting from open spaces and also

food donations, their main source of food was purchasing. However, in Richards Bay, own production was also an important source of food where the majority of the households were practising subsistence farming and were less dependent on food purchases which was the main source of food in the other towns. Participants in Richards Bay also mentioned that farming improved their food security status as they were getting good quality food from their fields as well as getting income from selling surpluses which they could use to buy the food which they could not produce. Baiphethi and Jacobs (2009) and Crush et al. (2011) also pointed on the importance of farming in improving food security in South Africa as farm produce can substitute imported foodstuffs and this is cost effective for poor households (Mkwambisi et al., 2010; Zezza and Tasciotti 2010; Lerner and Eakin, 2011). In Richards Bay most people who were relying on donations and purchasing every food item were regarded in their communities as being lazy. In all communities, some households were not engaging into farming because of their "status" as some perceived people who are involved in subsistence farming as "poor" members of their society and something for the aged but not the youth. This is consistent with Aliber and Hart (2009) who reported that some South African households regard obtaining food through farming as a sign of extreme poverty. Thornton (2008) also noted the rejection of agriculture by the youth in Grahamstown and Peddie as they regarded it as not part of their lifestyle and also not an alternative to unemployment as well as something that belongs to the aged.

Although agriculture has been shown to improve food security in many households (Baiphethi and Jacobs, 2009; Mkwambisi et al., 2010; Zezza and Tasciotti, 2010; Lerner and Eakin, 2011), it is becoming less significant as a primary food source for many poor South African households as many are purchasing food. Focus group participants in Dundee and Harrismith also reported that their main source of food is through purchasing rather than own production. The decline in agriculture and reliance on purchased food has been reported to have a negative impact on households vulnerable to food insecurity as this increases the levels of food insecurity (Altman et al., 2009; Crush and Frayne, 2011; Shackleton et al., 2013; Musemwa et al., 2015). Also, increases in food prices increases food insecurity levels for many households (Crush and Frayne, 2011). Due to the dependence on the social grant as a form of improving household food security in South

Africa since 2001 (Altman et al, 2009), a greater percentage of the population feels that agriculture is not helping significantly in their day-to-day survival as the income they earn from social grants is sufficient to ensure household survival. In a study by Thornton (2008) participants could only save less than R100 per month in food costs when they engaged in gardening therefore the social grants provided the majority of poor households with the means to purchase food. However, this was different from what was perceived in the focus group discussions as many participants found the social grant as insufficient for their survival only and wished that the government would help with providing knowledge on agriculture to communities as well as providing resources for them to fully engage into subsistence farming. For example, Kundhlande et al. (2004) noted that farmers from Thaba Nchu in the Free State could no longer cultivate their communal lands because they could not afford the necessary inputs as a result of removal of government support to farmers. Theft was also mentioned as one of the reasons why some households abandoned own production in many communities in the study sites.

4.4.3. The choice of diet

Participants in the focus group discussions had different perceptions as to why they consume a particular diet as some mentioned preference, others to satisfy hunger whilst others had little choice but to eat whatever is available and cheap food that they can afford to buy. It has been hypothesised in this study that households may not consider consuming a diverse diet due to lack of resources. Feelings of having no choice of the food one consumes has also been reported by Connell et al. (2005) for children in the United States of America. In this case, focus group participants reported on circumstances forcing them to consume pap with potatoes, pap with amahewu or pap with cabbage thus mostly adopting monotonous diets based on starch staples as was reported by Oldewage-Theron and Kruger (2008), Arimond et al. (2010), Schönfeldt et al. (2010) and Faber et al. (2011). The study revealed that it is beyond the reach of many households to consume a more diverse diet as many are compromising the quality of their food for cheaper and less nutritious foods that only satisfy their hunger. This is consistent with what was reported in South Africa by Brinkman et al. (2011) who said most vulnerable households compromise the quality of the food

by switching to cheaper and less nutritious foods that satisfy hunger in response to the increase in food prices. In Canada, Chan et al. (2006) reported that younger people would resort to cheaper foods which are reasonable in terms of cost, quality and ability to satisfy hunger although they might prefer the more expensive healthier foods such as fruits, vegetables or whole-wheat products.

Participants also perceived that they do not consider food diversity when they are preparing their food but they just eat what would be available at the moment and what they could afford to buy although they know they will be missing some important nutrients in their diets. This is in line with Puoane et al. (2005) who reported that household food choices in South Africa are influenced both by what is available in households' immediate environment and food prices on the market. For example, the diet of most South Africans is rich in animal fats and low in complex carbohydrates and it lacks fruits and vegetables because these are expensive. Because of few supermarkets in the rural and peri-urban locations, it is difficult for many households living in these areas to travel to urban areas always to buy food as this involves a considerable transport cost. Also due to increases in transportation costs, food prices are forced to increase (Altman et al., 2009). Therefore, households resort to buying food from the local shops which are expensive and have limited variety of healthy foods, especially in rural areas, or may buy from numerous street vendors with stalls selling cheap fatty meat and fatty snacks such as "vet koek", especially in peri-urban locations (Puoane et al., 2005). Thus, most poor households have access to cheap but unhealthy foods. This was also mentioned in the focus groups, especially in Harrismith, where participants perceived transport costs and high food prices at local shops as some of the influencing factors to not consuming varied diets in their communities as they only resort to buying cheap unhealthy food from their local spaza shops. This has also been hypothesised in this study that higher food prices can limit households' access to diverse foods.

Market price has also been reported in other studies to have an influence on the choice and consumption of diverse foods in many households (Monsivais and Drewnowski 2007; Hussain et

al., 2014). Results from this study are also consistent with other South African studies by Ruel and Garrett (2004) and Faber et al. (2011) who reported that the diet of most South African households comprises of more energy and more processed foods, including refined grains, and foods higher in saturated fat, sugar and salt which are cheaper to buy. The cost of electricity was also mentioned by the focus group participants as a contributing factor to food insecurity in their households as they perceived the rates to be too high taking a huge portion of their income as was reported by Abdu-Raheem and Worth (2011) in South Africa. Therefore, total household income is the major determinant of household food security in South Africa (Shisanya and Hendriks, 2011) as this directly affects the type of food a household consumes.

4.4.4. Food abundance, food insecurity and coping strategies

Food is readily available at the markets throughout the year as was agreed by the focus group participants in all communities but the problem of limited access to the food was emphasised as was hypothesised in this study and was also reported by Huddleston-Casas et al. (2009). Because these focus groups were carried in the rural and peri-urban locations (except one in Dundee), many had limited access to affordable food as they face higher prices for food whilst some had limited financial access (Ballantine et al., 2008; Huddleston-Casas et al., 2009). These areas are characterised by high levels of poverty and unemployment therefore household income and wealth status determine the level of household food security (Frongillo and Nanama, 2006; Jacobs, 2009; Kaschula, 2008; Kaschula and Shackleton, 2012) through the ability of the household to access food. This corresponds closely to what has been documented that South Africa is food secure at national level (National Department of Agriculture, 2002; HSRC, 2004), but large numbers of households within the country are food insecure as about 20% of South African households are estimated to have inadequate or severely inadequate access to food (Stats SA, 2009; 2014).

Due to low incomes, about 30 % to 50 % of the population has insufficient food, or is exposed to an imbalanced diet (Hendriks, 2014). Focus group participants articulated that barriers to food

access are mostly low income, poor climatic conditions, water shortages, poverty, unemployment, no access to land, rising food prices and lack of resources to practise farming. This was also hypothesised in this study and is in line with reports by HSRC (2007) who mentioned that widespread chronic poverty and unemployment are the main causes of food insecurity in South Africa. Chopra et al. (2009) also reported that household food insecurity was consistent with income, employment status and food expenditure in Eastern Cape, Northern Cape and Limpopo Province in South Africa. However, Shackleton et al. (2013) and Musemwa et al. (2015) also noted that the high food insecurity levels in South Africa could be due to a decline in smallholder agriculture. The majority of the South African population is accessing food through purchasing from the markets, as has been reported elsewhere (Ruel et al., 1998; FAO, 2008a; Baiphethi and Jacobs, 2009). Water shortages in many communities have also been implicated as driving forces preventing most households from growing crops on their homesteads (Stimie et al., 2010) thereby increasing food insecurity in some households as access to food would be limited. FAO (2011) also noted that availability and access to land and water resources are of the greatest importance in improving food security as well as reducing poverty globally. Cook et al. (2011) and Kemp-Benedict et al. (2011) reported that food security along the agricultural basins in Limpopo is strongly determined by water availability and use. Availability of water can increase agricultural production which in turn can improve food security and reduce poverty (Magombeyi et al., 2015).

Increases in food prices cause the most vulnerable households to reduce dietary diversity (Brinkman et al., 2010). It becomes very difficult for most households, especially low-income households, to consume a more diverse diet with a diverse range of foods as the majority of South African households are struggling to sustain a decent income (Labadarios et al., 2011) and many cannot afford to purchase even vegetables (Modi et al., 2006). Therefore, households reduce the consumption of more expensive food items as well as dietary diversity, portions and frequency of meals (Oldewage-Theron et al., 2006; Brinkman et al., 2010). As was hypothesised, reducing the quality, quantity and frequency of meals consumed per day was also mentioned in this study by the focus group participants as one of the ways they cope with food shortages. This supports other studies by Oldewage-Theron et al. (2006) and Battersby and McLachlan (2013) who reported that

during periods of food shortages, households decrease the variety of foods eaten, reduce portion sizes and may eat cheaper fast foods. Poor households may resort to cheap and poor quality diets to cope with poverty and rise in food prices.

Some households in these communities prioritise the diets of small children as they buffer the youngest children from declines in food intake (Saake and Osman, 2013) and some mothers prioritise their children's food consumption over their own (de Pee et al., 2000). Households can cope with declines in food availability without sacrificing nutrient adequacy for vulnerable members (Saake and Osman, 2013) which are young children in this case. Many perceived that the food parcels, the Child Support Grant and school feeding programmes are also part of their coping strategies as they get food from the government, use the grant money to buy food as well as sending children to school where they receive food. In South Africa, the Child Support Grant and school food programmes have been attributed to lower levels of malnutrition (Labadarios et al., 2011; FAO et al., 2012).

The most vulnerable members in the communities were identified as mostly female-headed households who are taking care of the children, orphaned children and grandchildren, those families with unemployed members and those with low cash-flow and only survive on social grants as well as those who are lazy. This was also noted by FAO (2009) that the rural and urban poor, the landless and female-headed households are the major groups that are affected by food price increases. Women, especially of reproductive age, were also noted as the most vulnerable group in other studies (De Pee et al., 2000; Arimond et al., 2010; Labadarios et al., 2011). Jacobs (2009) and Rudolph et al. (2012) also noted that low-income households are more likely to suffer from food shortages because food expenditure make up a large share of their spending thereby causing them to be more vulnerable to the impacts of rising food prices. Low income, low asset ownership and unemployment also increased the risk of food insecurity in households in the informal settlements of Johannesburg (Naicker et al., 2015).

4.4.5. Community perceptions on improving food security

Although communities may implement the above-mentioned coping strategies, they also perceived that there is room to improve food security in their communities with the help and support from the government and also working together as community members. For the government, they perceived that the government needed to provide them with inputs and agricultural knowledge and also provide services (such as land and water) which can help them achieve farming as they agreed that farming can improve food security in their communities but limited resources constrain them from practising farming. This is in line with what was reported by Kundhlande et al. (2004) where farmers from Thaba Nchu in the Free State abandoned agriculture due to lack of resources and no government support. Furthermore, gardening skills and access to land were also found to be barriers to food production by residents in Toronto, Canada (Kortright and Wakefield, 2011). In Dundee and Harrismith, where water scarcity was an issue, they wished the government could provide taps so that they can establish home or community gardening projects. Community gardening projects have been noted to provide families with fresh vegetables, can reduce food insecurity, improve dietary intake and strengthen social relationships as community members provide advice and support to overcome challenges and all receive the benefits the gardening project offers (Carney et al., 2012). Also, home gardens directly contribute to household food security as these increase food availability and access as well as promoting a nutritious diet (Kortright and Wakefield, 2011). Finding employment was also perceived by most participants as another way to improve food security as this would improve their income status.

4.5. Conclusion

The focus group participants in the study sites were knowledgeable about eating healthily. Their perceptions about difficulties in access to diverse food and consuming healthy diets reflects what has been reported in other studies that food might be abundant but with limited access to many households. The perceptions provided insights into the pressing issues of food security in small towns as participants touched on the issues of access, coping strategies and their ideas on improving food security in their communities. The majority of households in the study sites are

experiencing food insecurity and some groups, especially the female-headed households, the unemployed and orphaned children, are most vulnerable. Focus group participants from all communities highlighted the complexity of the food system in their communities which relies on own production, collecting from open spaces, donations and to a larger extent market purchasing, in the context of unemployment, low income, water and land shortages as well as theft. Although the focus group participants agreed on the role social grants and school food programmes are playing to alleviate food insecurity, they still feel it is not enough and are facing difficult challenges with food insecurity. They hoped the government would assist with capacity building, employment creation and providing resources for them to practice agriculture which they all agreed that it can be used as a way to improve food security through increased food access and consumption of nutritious food.

Chapter Five

The role of wild foods and social grants in alleviating food insecurity in South Africa

5.1. Introduction

South Africa is one of the countries with the highest rate of income inequality in the world and has extremely high levels of absolute poverty (Altman et al., 2009). While the country is rated as a food secure nation, large numbers of households within the country are food insecure with high prevalence of undernutrition mainly due to high poverty and unemployment (Altman et al., 2009; Labadarios et al., 2011). Achieving food security requires that people have enough food for an active and healthy life at all times (FAO, 1996). Access to enough food of diverse and good quality in a socially acceptable way is the most important of all and when food is not easily accessible and households find it difficult to secure adequate food, then households experiences food insecurity.

Although food may be available on the market, a large proportion of South African households do not have access to enough nutritious food as they lack enough income to meet their daily needs (Labadarios et al., 2011). Reducing poverty and unemployment levels has been suggested as one of the strategies in reducing the food insecurity levels in the country as households would have income to access adequate and nutritious food. The South African government introduced social grants to enhance income of poor households which has been reported to have improved food security for many poor households in the country (Thorntorn, 2008; Altman et al., 2009). However, in other parts of South Africa, poor households are making use of wild foods as part of their diet as well as for income generation to alleviate household food insecurity and poverty (Shackleton, 2003; Shackleton and Shackleton, 2004; Shackleton et al., 2007; Oluoch et al., 2009; Arnold et al., 2011).

5.1.1. Wild foods

Wild are edible, non-domesticated species of both flora and fauna that are gathered or hunted by humans for consumption (Muller and Almedon, 2008; Bharucha and Pretty, 2010). They not farmed or cultivated although some may occur as weeds in farmlands. Wild foods may include fruits, green leafy vegetables, bulbs and tubers, cereals and grains, nuts and kernels, saps and gums (which are eaten or used to make wine), mushrooms, invertebrates such as insects and snails, honey, bird eggs, bush meat from small and large mammals, reptiles, birds, fish and shellfish (Shackleton et al., 2010). Wild foods are important for food security (King et al., 2013), poverty alleviation, and they are often cost efficient to collect whilst also saving households time and money (Delang, 2006). For example, some households could use wild leafy vegetables because they are hardy, require very little care, and are reported to do better than cultivated species (such as spinach (*Spinacea oleracea*) and cabbage (*Brassica olearecea*)) in areas with low or unreliable rainfall, which is common in many parts of southern Africa (Dweba and Mearns 2011), although this has not been empirically proven (Shackleton et al., 2009). Wild foods can be used as a part of an economic strategy to bridge food needs and extend budgets. For example, Poe et al. (2013) revealed that some people in Seattle in western Washington State looked for anything to eat from the forests when they did not have money for food.

In Africa, wild vegetables can be used as a relish and are consumed with the main staple cereal which cannot be eaten in the absence of relish (Mavengahama et al., 2013) as this forms part of the African diet (Smith and Ezyaguirre, 2007). In the Democratic Republic of Congo, communities supplement their diet with wild foods such as wild leafy vegetables, palm oil, bush meat, wild fish, wild mushrooms, caterpillars, ants and honey depending on the season of the year (de Merode et al., 2004; Termote et al., 2010). This is different in the developed world where some households forage in formal urban green spaces and interstitial spaces where plants and fungi grow naturally (McLain et al., 2014). In these areas foraging is not because of hunger and limited finance, but people gather wild foods as a hobby and have knowledge about the health benefits they get from

wild foods (McLain et al., 2014). Some do that as a tradition as well as connecting with nature and the environment (McLain et al., 2014).

Moreover, in Africa, both rural and some urban dwellers depend on wild foods to satisfy part of their food, nutritional, health and livelihood needs (Arnold et al., 2011). Rathore (2009) reported that both urban and rural households in Rajasthan, India, benefited from consuming wild foods. In African urban areas, a variety of wild foods are mostly found in the market either dried or fresh and consumption is driven by culture, tradition and preference although need and poverty may be driving factors in some households (Greyling and Potgieter, 2004; Weinberg and Pichop, 2009; van Vliet et al., 2012). In these urban areas wild foods can be consumed by households who can afford to buy as most people cannot afford to buy adequate food due to the increases in food prices (FAO, 2012). For example, in south-west Nigeria, wild leafy vegetables are sold at higher prices than conventional vegetables especially during the dry season (Adebooye and Opabode, 2005).

In South Africa, wild foods (especially wild vegetables) are consumed by both poor and wealthy urban households, although poorer households consume significantly more than their wealthier counterparts (Jansen Van Rensberg et al., 2007; Cocks et al., 2008). The consumption pattern varies according to the households' poverty status, degree of urbanisation, distance to fresh produce markets and season of the year (Jansen Van Rensberg et al., 2007; Uusiku et al., 2010). In most developing nations, wild vegetables are commonly consumed by rural households (e.g. in South Africa (Shackleton, 2003; Modi et al., 2006; Jansen van Rensburg et al., 2007; Vorster et al., 2008; Mavengahama et al., 2013)) although they are also an important food source for the urban poor (Vorster et al., 2007). Some rural households in South Africa depend more on wild leafy vegetables than conventional vegetables due to higher transport costs to the market where they can buy these vegetables (Vorster et al., 2007). However, in some communities it's the urban households which benefit most from wild foods (Titus et al., 2009) and in some communities, the low income and the rural populations benefit more since these vegetables can be obtained without purchasing (Lewu and Mavengahama, 2010). Thus, wild foods have a number of benefits and

fulfill a range of roles which may include alleviating food insecurity, improving dietary diversity, generating income, and contributing to culture and tradition.

5.1.1.1. The role of wild foods in alleviating food insecurity

Until recently, research on food security mostly focused on cultivated foods (Ericksen et al., 2009), but recent literature has shown that wild foods are a crucial part of the global food basket as a large number of species of wild foods are consumed by different communities (Shackleton, 2003; Bharucha and Pretty, 2010; Godfray et al., 2010) including in the developed world (e.g. McLain et al., 2014). Wild foods contribute to the food basket of many rural households yet are rarely included in national foods baskets and balance sheets (Bharucha and Pretty, 2010; Legwaila et al., 2011). Although wild foods are also collected in developed countries, they are more critical for healthy diets in the developing countries as most of the individuals from the estimated 1.02 billion people that are undernourished globally are from developing countries (FAO 2009). Wild foods can contribute to the alleviation of household food insecurity in many households (Bharucha and Pretty, 2010; Legwaila et al., 2011; Mavengahama et al., 2013). They are especially important to the more vulnerable members in the communities, i.e. those that are at risk of food insecurity rely on these products for food (Shackleton et al., 2007; Vinceti et al., 2008; Oluoch et al., 2009; Völker and Waibel, 2010; Arnold et al., 2011).

For example, indigenous fruits and leafy vegetables provide an important source of food throughout the rural areas of South Africa (Shackleton, 2003; Modi et al., 2006; Jansen van Rensburg et al., 2007; Vorster et al., 2007; Vorster et al., 2008; Mavengahama et al., 2013). Also, during crop failure in Zimbabwe, poor rural households increased the quantities of wild fruits they consumed to reduce food insecurity (Mithöfer and Waibel, 2003; 2004). Mithöfer and Waibel (2004) noted that vulnerability to poverty was mostly determined by the level of consumption and availability of wild fruits during those periods of food insecurity in Zimbabwe. In Botswana, wild fruits were consumed as a form of reducing the risks of food insecurity, especially during droughts

when there was crop failure (Mojeremane and Tshwenyane 2004). Jumbe et al. (2008) also noted that wild foods such as wild fruits, wild leafy vegetables, wild mushrooms, tubers, edible insects and honey from the miombo woodlands improved food security for most rural communities in Zambia through enriching the starch based diets. In other areas, wild fruits and vegetables have been reported to reduce food insecurity through supplementing diets in times of plenty by being a substitute for previously purchased goods (Hunter et al., 2007; Kepe, 2008), especially for people with either low or middle income (Odhav et al., 2007; Kaschula, 2008; Arnold et al., 2011, Legwaila et al., 2011). Wild foods have also been suggested to be a significant dietary replacement for households who usually consume unhealthy diets (Redzic, 2007) hence they have the potential to fight malnutrition (Uusiku et al., 2010; HarvestPlus, 2011) which is one of the determinants of food insecurity.

5.1.1.2. Wild foods enhance household dietary diversity

Wild foods provide diversity and nutrients to local diets in many developing countries. Shackleton and Shackleton (2004) showed that a significant number of rural households in South Africa accessed nutritional and dietary benefits from the consumption of wild foods. For example, from the studied rural villages the authors found that about 96 % of households consumed wild spinaches, 88 % consumed wild fruits, 54 % ate edible insects, 52 % consumed bush meat and 51 % consumed honey. Dweba and Mearns (2011) also noted that more than 100 different plant species were consumed as wild vegetables in South Africa.

Wild foods may improve dietary diversity because they are high in micronutrients. For example, Fentahun and Hager (2009), Pasquini et al. (2009) and Yang and Keding (2009) noted that wild foods, especially vegetables and fruits, are high in micronutrients such as vitamins, carotenoids, iron and other minerals that boost one's immune system to fight against infections. Oluoch et al. (2009), also reported that some wild foods, especially the African indigenous vegetables, have significant quantities of crude protein, dietary energy, fat and oil. When compared with

conventional vegetables, McGarry and Shackleton (2009) reported that a portion of an indigenous green leafy vegetable (*Amaranthus* species) widely consumed in sub-Saharan Africa, has 200 times more vitamin A and ten times more iron than cabbage of the same-sized portion. Fentahun and Hager (2009) also reported that the baobab fruit (*Adansonia digitata*) has 360 mg/100 g of vitamin C, which is six times more than that of an orange (57 mg/100 g). Also, wild mushrooms are rich in protein, for example, *Psathyrella atroumbonata* has a 77 % higher protein content than beef (Barany et al., 2004). Mushrooms are also good sources of vitamins and minerals and these are not affected by cooking (Borah and Rahman, 2011 cited in Ncube 2013), as well as important sources of carbohydrates and fibre (Ayodele and Okhuoya, 2009).

Furthermore, edible insects, such as mopane worms, which are mostly consumed and marketed in parts of Zimbabwe, Botswana and South Africa, are also an excellent source of protein (Greyling and Potgieter, 2004). Greyling and Potgieter further reported that a 100 g of dried mopane worms has approximately 76 % of daily protein requirements of an average human adult which is much higher than that obtained from meat of domestic animals. Bush meat contributes significantly to household meat consumption throughout central and western Africa, including in Equatorial Guinea (Kümpel et al., 2010) and the Congo Basin (Fa et al., 2003). Protein from bush meat is regarded as an important contributor to food security (FAO, 1992; Fa et al., 2003). Bush meat is also consumed in South Africa, but in far lower frequencies and quantities (Kaschula and Shackleton, 2009). Termote et al. (2010) also reported that the Turumbu people in the Democratic Republic of Congo also get fat in their diet from palm oil.

5.1.1.3. Wild foods provide safety nets

Close to one billion people in the world consume wild foods (Aberoumand, 2009) but this varies from place to place as some people use wild foods only in times of famine or droughts, whilst others may use them frequently (Oluoch et al., 2009). Wilds foods have been suggested to provide a 'safety net' or 'fall back' for some households during periods of food scarcity and uncertainty

(Shackleton and Shackleton 2004; Shackleton et al., 2006; Vinceti et al., 2008; Powell et al., 2010; Anorld et al., 2011; Sunderland, 2011). For example, Kaschula (2008) and Ncube (2013) found that although wild leafy vegetables were consumed by many households (both HIV/AIDS afflicted and non-afflicted), the use increased amongst the HIV/AIDS afflicted households in South Africa due to income shortfalls. This was consistent with Challe and Price (2009) in Tanzania. Shackleton (2006) and Hunter et al. (2007) reported that wild foods also acted as a 'safety-net' for many households in Mpumalanga province of South Africa as a result of AIDS mortality. Fentahun and Hager (2009) also noted that in Venezuela, the Yanomani Indians often used wild foods (plants) in their diet but increased their consumption of wild plants in times of food shortage. Thus, wild foods are vital coping strategies during periods of food shortages (Mithöfer and Waibel, 2003; 2004; Mojeremane and Tshwenyane, 2004; Redzic, 2007; Quaye, 2008; Fentahun and Hager, 2009; Arnold et al, 2011).

5.1.1.4. Income generation from wild foods

Wild foods can also be used for generating income in many poor households. For example, during crop failure in Zimbabwe, Mithöfer and Waibel (2003) and Mithöfer and Waibel (2004) reported that poor rural households generated income for household food expenditure from selling wild fruits although they also consumed some. Shackleton (2003) also showed that wild edible herbs were extensively used by rural households in South Africa for income generation, which is consistent with other recent studies (Shackleton et al., 2007; Vinceti et al., 2008; Oluoch et al., 2009; Völker and Waibel, 2010; Arnold et al., 2011). In some communities in Kiliwa in north-eastern Democratic Republic of Congo, wild foods play a small role in household consumption but a major role in household income as over 90% of both bush meat and fish catches are sold (de Merode et al., 2004).

5.1.1.5. The consumption of wild foods

The collection and use of wild foods can be determined by economic status of a household, gender, age and geographic location of an area. For example, wild foods are perceived as food for the poor

and most vulnerable households in some communities (Shava, 2005; Jansen van Rensburg et al., 2007; Hunter et al., 2008). In South Africa, Shackleton and Shackleton (2004) noted that gender played a significant role in the collection and utilisation of wild food as some wild foods were only collected and consumed by men whilst others were only consumed by women. In many communities, the collection of wild vegetables is done by women and girls (Jansen van Rensburg et al., 2007; Yang and Keding, 2009; Lewu and Mavengahama, 2011) and hunting (White, 2004) and fishing (Ngwenya and Mosepele, 2007) are mostly done by men. In some communities, wild fruits are collected by children and it is very rare for adults to go and collect (Shackleton et al., 2007). Proximity of area homestead or village to where wild foods are collected can also determine the rate of collection and use of wild foods. For example, coastal areas in west Africa have easy access to fishing (World Fish Centre 2005) relative to the inland areas, coastal areas in South Africa also have easy access to wild foods relative to the inland areas as these receive more rainfall hence more biodiversity than drier inland areas (Ncube, 2013) and also communities residing close to the miombo woodlands in Zambia access wild mushrooms for consumption and sale (Cunningham and Yang, 2011).

5.1.2. Social grants and food security

5.1.2.1. Types of social grants in South Africa

The South African Social Service Agency (SASSA) issues seven long-term grants to South African citizens, permanent residents or refugees who live in South Africa and are not already being cared for in a state institution. Assessment of income and assets is done to ensure that social grants are only paid to people who earn too little to support themselves and the elderly. The social grants that are issued in South Africa include: (i) Grant for Older Persons which is R1 500 per month for people over 60 years and R1 520 for beneficiaries older than 75 years of age. In order to access the grant, a recipient may not earn more than R64 680 a year or have a combined household income of R129 360 a year; (ii) Disability Grant of R1 500 per month which is issued to people between the age of 18 and 59 years who are unable to work because of disability. The recipients must submit a medical assessment or report no older than three months in order to qualify and may not receive

another social grant; (iii) War Veteran's Grant of R1 520 per month for people who are disabled or older than 60 who served in the Second World War or Korean War; (iv) Foster Child Grant of R890 per month; (v) Care Dependency Grant of R1 500 per month given to the main caregiver of a child with a permanent, severe disability; (vi) Child Support Grant of R350 per month given to the main caregiver of a child 18 or younger and (vii) Grant-in-Aid of R320 per month for people receiving the Grant for Older Persons, Disability or War Veteran's Grant, and who require full-time care because of physical or mental disability. The Social Relief of Distress is a temporary grant which is awarded to people in dire need and this may be paid out in various circumstances, including to people awaiting payment of an approved social grant, or who have been affected by a disaster, such as severe flooding (SASSA, 2016).

5.1.2.2. Social grants and food security

In South Africa, there is evidence of social grants improving household food security (Altman et al., 2009). Social grants have been noted to be the most important contributor in reducing poverty and food insecurity in the poorest households in South Africa (Van der Berg, 2006; Schatz and Ogunmefun, 2007; Altman et al., 2009). In Grahamstown and Peddie, Thornton (2008) found that social grants were providing a more vital service to ensure food security for the majority of poor households than was subsistence agriculture. The social grants provide the majority of the poor households with the means to purchase food. Social support from the government as cash transfers have also been reported to have a significant impact on food security and food diversity in rural Malawi as it is known to improve food security in the country's destitute households (Miller et al., 2010a). This is also consistent with Gertler's (2005) findings in Mexico and Maluccio and Flores (2005) in Nicaragua, as cash transfers prevented the worsening of food insecurity during periods of food crisis

The child support grant, together with school food programmes were reported to have lowered the percentages of stunting and underweight in the country by at least five percent and one percent, respectively, between 1999 and 2005 (Labadarios et al., 2011; FAO et al., 2012). Cash transfers

have also been noted to improve food security and child growth in other studies (Lagarde et al., 2007; Duflo, 2006). In Malawi, Miller et al. (2010b) found that children from families who were receiving cash transfers experienced gains in height and reduced stunting by 12 %, reduced wasting by 2.1 % and reduced underweight by 6.9 % compared to those who were not receiving the cash transfers. Social grants were also found to act as a 'safety net' for HIV/AIDS-affected households in South Africa as affected households were more dependent on income from social grants compared with those who had never been affected by the disease (Booysen, 2004). Goudge et al. (2009) also reported that many households in South Africa who were receiving grants often had an advantage of getting food on credit from the local shops, which was not the case for those without grants.

5.1.3. Study aims

The aim of this study was to determine if two widespread strategies, i.e. consumption of wild foods and receipt of social grants improved household food security in medium-sized towns. The study sought to explore the extent of use of different wild foods among households and addressed whether their use was following the agro-ecological gradient and rural-urban continuum and the same with social grants. The study compared and determined if there were any significant differences in food security indicators (HDDS, HFIAS, household monthly food expenditure and household wealth status) between the households who were consuming wild foods and those who were not and between the households who were receiving social grants and those who were not. I hypothesised that:

1. The use of wild foods would follow the agro-ecological gradient.
2. Poor households would use social grants and wild foods as coping strategies in times of food scarcity, but not wealthy households.
3. Wild foods and social grants alleviate household food insecurity in poor households by increasing dietary diversity and food access, but not wealthy households.
4. Wild foods are a more important safety net than the social grants.

5.2. Methods

Refer to Chapter One and Two for information on study sites and sampling.

5.2.1. Household surveys

Sampling was done between October and November 2014. A questionnaire was used to collect information on the use of wild foods and if the respondents were receiving social grants or not. The respondents who were consuming wild foods were also asked the types of wild foods which they consumed, i.e. wild vegetables, wild fruits, wild meat and fish. Respondents were to elaborate on any other wild foods they consumed which were not on the list and they were to specify the wild food. Information on whether households were receiving a social grant was obtained as the interviewee was giving information on all the sources of household income.

5.2.2. Statistical analysis

Data were entered and cleaned using Microsoft Excel and all statistical analyses were performed using Statistica version 12 (StatSoft Inc.). Descriptive data are presented as percentages and means and standard deviations (SDs) (mean ± SD). An independent-samples t-test was conducted to compare HDDS, HFIAS, wealth index and monthly food expenditure (in Rand) of households that were receiving social grants and those who were not, as well as of households who were consuming wild foods and those who were not.

5.3. Results

Refer to Chapter Two for information on the sample (e.g. sample size and mean age of sample) and household characteristics (e.g. household size, wealth status, monthly food expenditure and household head).

5.3.1. Social grants

Results indicate that social grants are not a major source of cash income in the sampled households as only 25 % the households were receiving the grants (Child support grant) (Table 5.1). The percentage of households who were receiving social grants did not follow the agro-ecological gradient, Richards Bay had the lowest (14 %), Dundee had the highest (39 %) and Harrismith was intermediate with 24 % of households receiving a grant (Table 5.1). There was a significant difference in the percentage of households receiving social grant along the agro-ecological gradient ($F_{2, 549} = 16.2$, $p<0.001$) with Dundee being higher than the other two, which were also significantly different from one another (Table 5.1). Within sites, the percentage of households receiving the grant ranged from 21 % to 55 % in the rural locations, 12 % to 39 % in the peri-urban locations and 7 % to 13 % in the urban locations (Table 5.1). The percentage of households receiving grants increased significantly along the rural-urban continuum ($F_{2, 549} = 22.01$, $p<0.001$), being highest in the rural locations (38 %) than the other two (peri-urban (27 %) and urban (7 %)), which were also significantly different from one another. Significant differences were observed along the rural-urban continuum in Dundee ($F_{2, 170} = 9.4$, $p<0.001$) and Harrismith ($F_{2, 195} = 12.3$, $p<0.005$) and there were no significant differences along the rural-urban continuum in Richards Bay (Table 5.1).

5.3.2. The use of wild foods

Wild foods were consumed by 36 % of the total sample (Table 5.1). There was a significant difference in the percentage of households consuming wild foods along the agro-ecological gradient ($F_{2, 549} = 97.0$, $p<0.001$) with the greatest percentage of households consuming wild foods being from Richards Bay, followed by Dundee and lastly Harrismith, which were also significantly different from one another (Table 5.1). Within sites, the percentage of households consuming wild foods ranged from 17 % to 78 % in the rural locations, 1 % to 64 % in the peri-urban locations and 4 % to 50 % in the urban locations (Table 5.1). There was a significant difference in the use of wild foods along the rural-urban continuum ($F_{2, 549} = 11.9$, $p<0.001$), being higher in the rural locations (49 %) than the other two (peri-urban (34 %) and urban (23 %)), which were also

significantly different to one another. Significant differences were observed along the rural-urban continuum within all three towns, Richards Bay ($F_{2, 180} = 4.6$, $p=0.01$), Dundee ($F_{2, 170} = 3.8$, $p=0.02$) and Harrismith ($F_{2, 195} = 8.3$, $p=0.0003$). The significant differences in Richards Bay and Dundee were between urban and rural whilst peri-urban was not significantly different from both and in Harrismith, there were significant differences in the use of wild foods between rural and both urban and peri-urban households which were not different from one another (Table 5.1).

Table 5.1: The number and percentages of households receiving social grants and those who are consuming wild foods against those who are not.

Town	Location	Households receiving a social grant (%)		Households using wild foods (%)	
		Town	Location	Town	Location
Richards Bay (n=183)	Urban	14 [a]	7[a]	66 [a]	50[a]
	Peri-Urban		12[a]		64[a/b]
	Rural		21[a]		78[b]
Dundee (n=173)	Urban	39 [b]	13[a]	39 [b]	21[a]
	Peri-Urban		39[b]		40[a/b]
	Rural		55[b]		48[b]
Harrismith (n=198)	Urban	24 [c]	2[a]	7 [c]	4[a]
	Peri-Urban		29[b]		1[a]
	Rural		38[b]		17[b]
All (n=554)	Urban	25	7 [a]	36	23 [a]
	Peri-urban		27 [b]		34 [b]
	Rural		38 [c]		49 [c]

Households consumed different wild foods and of the 200 households who consumed wild foods, 64 % consumed wild vegetables, 60 % consumed wild fruits, 31 % consumed wild meat, 33 % consumed fish and only 5 % consumed other wild foods which included edible insects (consumed in Richards Bay), mushrooms (consumed in Dundee) and bush tea (consumed in Harrismith). The contribution of each wild food to the wild foods consumed per town are shown as percentages in Figure 5.1. Other wild foods have been removed from this analysis due to small sample size as there were only less than five households in each town for this group. Wild fruits and fish were the most consumed wild foods in Richards Bay, followed by wild meat then wild vegetables which were also consumed by 50 % of the households who were consuming wild foods in the town (Figure 5.1). In Dundee, the most consumed wild food were wild vegetables (44 %). All the other wild foods contributed infrequently to the overall wild foods that were consumed in Dundee as well as Harrismith where all wild foods were infrequently consumed (Figure 5.1).

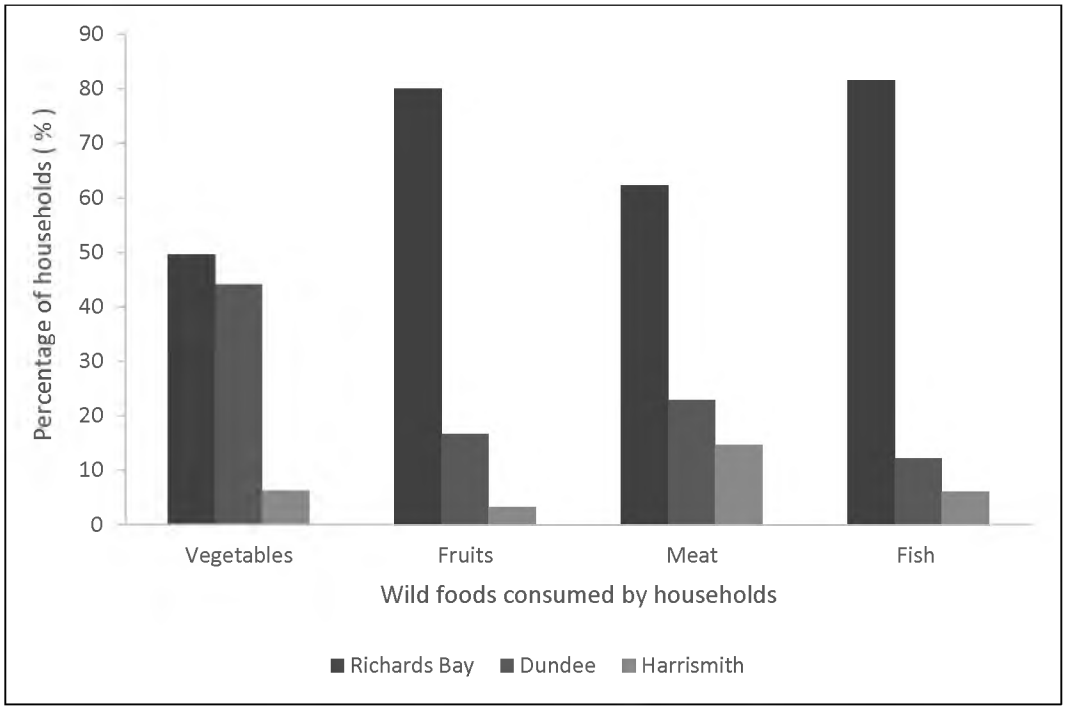

Figure 5.1. Percentage of households consuming each wild food per town along the agro-ecological gradient.

5.3.3. Influence of social grants

No significant differences were found in food security indicators (HFIAS and HDDS) between households who were receiving social grants and those who were not in all towns (Table 5.2). Significant differences were found in mean monthly food expenditure between households who were receiving social grants and those who were not (Table 5.2). In Dundee, households with no social grants had higher mean monthly food expenditure (R372±R292) than those who were receiving a grant (R271±R158) ($t(171) = 2.58$, $p < 0.05$). The same applied in Harrismith with those not receiving a grant having a higher mean (R372 ±R275) than those who were getting the grant (R170±192) ($t(196) = 4.72$, $p < 0.05$). In Harrismith, significant differences were also found in wealth index with households receiving a grant having a lower mean (2.14±0.91) than those without a grant (2.57±0.85) ($t(196) = 2.94$, $p < 0.05$). This was different from what was observed in Richards Bay where households who were receiving social grant had a higher mean wealth index (2.89±0.72) than those who were not (2.24±0.57) ($t(181) = -2.75$, $p<0.05$) (Table 5.2).

5.3.4. Influence of wild foods

Generally, there was little difference between households consuming wild foods and those which did not in the three towns across the four measures of interest (Table 5.2). The only significant differences were observed in Richards Bay and Harrismith. In Richards Bay, households consuming wild foods had a significantly higher HFIAS (6.49±7.15) than those who were not (3.81±6.34) ($t(181) = 2.50$, $p<0.05$). In Harrismith, it was the opposite, with mean HDDS of households consuming wild foods (6.62±1.19) being significantly lower than those who were not (7.84±1.59) ($t(196) = 2.72$, $p<0.05$)(Table 5.2).

Table 5.2: Comparisons of HDDS, HFIAS, food expenditure per week and wealth status of households, grouped by whether households receive a social grant or not and whether households consume wild foods or not. (Bold numbers show significant comparisons).

	Town		No (mean ± sd)	Yes (mean ± sd)	t-value	p-value
Social grant	Richards Bay	HFIAS	5.56±7.03	5.64±6.81	-0.06	p > 0.05
		HDDS	8.46±1.42	8.20±1.83	0.82	p > 0.05
		Food expenditure (R)	195±183	198±159	-0.08	p > 0.05
		Wealth index	**2.24±0.57**	**2.89±0.72**	**-2.75**	**p < 0.05**
	Dundee	HFIAS	8.92±6.46	10.13±8.08	-1.10	p >0 .05
		HDDS	7.79±1.58	7.53±1.70	1.01	p > 0.05
		Food expenditure (R)	**372±292**	**271±158**	**2.58**	**p < 0.05**
		Wealth index	2.40±0.88	2.18±1.05	1.45	p > 0.05
	Harrismith	HFIAS	6.07±1.58	7.56±5.99	-1.37	p > 0.05
		HDDS	7.89±1.58	7.58±1.64	0.87	p > 0.05
		Food expenditure (R)	**372±275**	**170±192**	**4.72**	**p < 0.05**
		Wealth index	**2.57±0.85**	**2.14±0.91**	**2.94**	**p < 0.05**
Wild foods	Richards Bay	HFIAS	**3.81±6.34**	**6.49±7.15**	**2.50**	**p < 0.05**
		HDDS	8.49±1.58	8.39±1.43	-0.43	p > 0.05
		Food expenditure (R)	201±166	193±188	-0.31	p > 0.05
		Wealth index	2.67±0.69	2.55±0.54	-1.33	p > 0.05
	Dundee	HFIAS	10.10±7.32	8.25±6.73	1.67	p > 0.05
		HDDS	7.54±1.76	7.94±1.37	-1.59	p > 0.05
		Food expenditure(R)	314±247	363±262	-1.24	p > 0.05
		Wealth index	2.41±0.90	2.16±1.01	1.70	p > 0.05
	Harrismith	HFIAS	6.38±6.59	7.15±6.82	-0.41	p > 0.05
		HDDS	**7.84±1.59**	**6.62±1.19**	**2.27**	**p < 0.05**
		Food expenditure (R)	325±267	287±334	0.49	p > 0.05
		Wealth index	2.47±0.86	2.32±1.16	0.57	p > 0.05

5.4. Discussion

5.4.1. Social grants and local setting

The proportion of households receiving a social grant was significantly different along the agro-ecological gradient. The percentage of households receiving social grants was higher in Dundee than in Harrismith and Richards Bay. This coincides with the fact that Dundee had the lowest wealth index, highest food expenditure and highest food insecurity levels than the other two towns

(Chapter Two and Three). In South Africa, a social grant is given to qualifying poor households as an important contributor in reducing poverty and food insecurity (Schatz and Ogunmefun, 2007; Altman et al., 2009) which is consistent with the present study. Poor households spent much of their income on food. For example, Richards Bay had the least proportion of households receiving social grants because it had the highest wealth index, least food expenditure and had the lowest levels of food insecurity which makes the town to be regarded as having fewer poor households who could qualify to receive a social grant. This could be due to good climatic conditions which are wetter and warmer with a longer growing season which favour agriculture, therefore, providing food and additional income from selling of surplus produce, thus improving some households' wealth status as well as food security in the town. Farming has the potential to improve the food security of poor households in both rural and urban areas by increasing food supply as food prices increase (Baiphethi and Jacobs, 2009; Crush et al., 2011) which is not the case for Dundee and Harrismith where drier and cool conditions make agricultural production less viable. Hence, poor households have to rely on social grants as a source of cash income.

Over and above differences within towns, there were also significant differences within town locations and receipt of social grants. Socials grants were most common in the rural locations and least amongst urban dwellers. However, within the towns, no significant differences were found between locations in Richards Bay whilst in Dundee and Harrismith, significant differences were found between urban and both peri-urban and rural locations which were not different from each other. This could be because the highest levels of poverty are evident in the rural and peri-urban locations due to high levels of unemployment and high food prices (Baiphethi and Jacobs, 2009; Crush et al., 2011).

5.4.2. Role of social grants in food security

Social grants were not the main source of income in the study sites as overall only 25 % of the sampled households were receiving a grant and within the towns, only 14 % of households in

Richards Bay, 39 % in Dundee and 24 % in Harrismith were receiving social grants. The percentages in the study towns are lower than those reported by Crush and Frayne (2011) for Msunduzi (65 %) and Cape Town (43 %) although low percentages were also found in Johannesburg (25 %). The study also revealed that the dietary diversity (HDDS) and household food access (HFIAS) were similar between households who received social grants and those who did not. There were no significant differences in food security indicators between these two groups showing that the social grants had no influence in reducing household food insecurity. This could be because households who were receiving a grant did not use it for food but other things as evident in Harrismith and Dundee where food expenditure was significantly less amongst households receiving grant. These results are not in line with the original hypothesis that social grants alleviate food insecurity in poor households by increasing access to food through purchase and are also not consistent with many studies. For example, Thornton (2008) reported that social grants provided the platform for the poor households in Grahamstown and Peddie to purchase food. Van der Berg (2006), Schatz and Ogunmefun (2007) and Altman et al. (2009) also noted the importance of social grants in improving food security in poor households in South Africa and reports from other countries such as Malawi (Miller et al., 2010a), Mexico (Gertler, 2005) and Central America (Maluccio and Flores, 2005) have shown that cash transfers had a significant impact on improving food security and food diversity in low income households as they provided the majority of the poor households with the means to purchase food and prevented worsening of food insecurity during periods of food crisis.

Although there were no significant differences in HDDS and HFIAS, significant differences were found in monthly food expenditure and wealth index between households receiving grants and those who were not. Households who were receiving a social grant had lower monthly food expenditure than those who were not getting a grant in both Harrismith and Dundee. This could be because households receiving the grant were purchasing less, that is, they could have been using their grant cash to buy basic foods only and use the rest for other necessities such as paying bills since this was their only form of cash income. Twine and Hunter (2011) and Ncube (2013) also found that many households would use their money to buy mostly basic commodities and forgo

some food items which they regard as 'luxury' items thereby reducing households' monthly food expenditure. This could also be the case in the study sites since social grants are only given to the poorest households. Social grants were also found to act as a 'safety net' in other studies as households who were getting grants could get food on credit from the local shops in some parts of South Africa as was reported by Goudge et al. (2009). This can also reduce the monthly food expenditure in these households as they only use little money to purchase what they cannot get on credit. However, further research needs to be done to see if this also apply to the study sites.

Social grants have become much more important as a source of income for the poorest in the communities (Leibbrandt et al., 2012). This is evident in Richards Bay where significant differences in wealth were noted between households receiving a social grant having lower wealth index than those who were not receiving the grant. However, the situation in Richards Bay was different from that in Harrismith where the households receiving the social grant had a higher wealth index than those who were not receiving. This could be explained by the fact that social grants are known to have an impact on reducing the inequality and reducing the prevalence, depth and severity of poverty in many households (Booysen and Berg, 2005). Although a smaller percentage of households in Harrismith were receiving social grants, only 9 % of the households had no other form of cash income, 72 % had either the interviewee or head having some forms of cash income and about 19 % of the households had both the interviewee and the head of the household having some form of cash income (Chapter Two). Therefore, the differences could therefore be due to the fact that those who are receiving the grants might not be the poorest in the communities as shown by a higher wealth index. Also, households who are eligible to receive the social grant might not be getting it as what was noted by Aliber (2009) who mentioned that approximately one third of people in South Africa who are experiencing hunger are not receiving any grants at all although they are eligible to receive the grant. In this case, some households who are not receiving the social grant could be eligible but are not getting the social grant which could have been improving their poverty levels, therefore they had a lower wealth index than those households who were receiving the social grant. However, further research needs to be done for the fact to fully qualify.

5.4.3. Consumption of wild foods

The use of wild foods was prevalent and an important source of food in Richards Bay and Dundee where approximately 66 % and 39 %, respectively, of the households consumed them. This is different from the Harrismith where the use of wild foods was uncommon, as only 7 % of the households were consuming them. The consumption of wild foods followed the agro-ecological gradient as was hypothesised. The differences in the percentage of households consuming wild foods could be due to different climatic conditions as Richards Bay is wetter and coastal site and it receives more rainfall which is favourable for the growth of wild foods than the drier, inland sites. This is consistent with Shackleton et al. (2000) and Ncube (2013) who reported that use of wild foods is higher in moister sites than drier areas.

Vorster et al. (2002), Jansen van Rensberg et al. (2004), Jansen van Rensberg et al. (2007) and Uusiku et al. (2010) have noted that the consumption of wild foods in South Africa, especially wild leafy vegetables, is mostly influenced by factors such as poverty status and degree of urbanisation, and proximity to markets and time of the year. Age has been noted as one of the factors influencing the decline in the consumption of wild vegetables in South Africa as the youth and urbanised associate consumption of wild foods with poverty and being traditional (Vorster et al., 2002; Hart and Vorster, 2006). The mean age for the sample was 32 ± 10 years, which shows that most of the people who participated in the surveys were the youth and would be resisting to consume wild foods. Also, the effects of urbanisation can be highlighted in the study, especially in Harrismith where most households were relying on purchasing food and only 7 % of the sampled households were collecting wild foods. Modi et al. (2006) has also noted the decline in the use of wild foods in South Africa with households usually using cultivated species rather than wild foods, as was noted by Bharucha and Pretty (2010). Jansen van Rensburg et al. (2005) also noted the growing use of exotic vegetables rather than indigenous leafy vegetables in former Transkei in the Eastern Cape province. In this study, approximately 50 % of the wild foods consumed in Richards Bay were wild vegetables and approximately 44 % of the wild foods were consumed in Dundee were wild vegetables. However, households in Harrismith rarely consumed wild vegetables as they

constituted only 6 % of the wild foods which were consumed in the town. Most of the vegetables which were consumed in the towns were from either own production or purchasing which was mostly cabbage (Chapter Two; Three).

In Richards Bay, of the wild foods which were consumed, 82 % was fish, 80 % were wild fruits, 62 % wild meat and 50 % were wild vegetables. The consumption pattern was different from that in Dundee where wild vegetables contributed 44 %, wild meat 23 %, wild fruits 17 % and fish only contributed 12 %, although the percentages in Dundee were very small. The study revealed that wild vegetables were the least consumed wild food in Richards Bay yet the most consumed in Dundee and fish was the most consumed in Richards Bay and least consumed in Dundee. This could be because the percentage of female-headed households in Dundee was higher than in Richards Bay (Chapter Two), therefore gender could be playing a significant role as many women in Dundee could have been focusing more on collecting wild vegetables and because of more male-headed households in Richards Bay, many men may have been practising fishing. This is in keeping with Shackleton and Shackleton (2004), Jansen van Rensburg et al. (2007), Ngwenya and Mosepele (2007), Yang and Keding (2009) and Lewu and Mavengahama (2011) who noted the importance of gender in the collection of wild foods. Also, the climatic conditions in Dundee are less conducive for own production and almost 40 % of the households survive on social grants with no other income. Therefore, the consumption of wild vegetables could act as a 'safety net' in the town since the majority of the households were poor and therefore could not afford to buy vegetables on the market. This is in keeping with Modi et al. (2006) who reported that many South African households cannot afford to buy vegetables since they struggle to sustain a decent income (Labadarios et al., 2011). Vorster et al. (2007) also argued that wild vegetables are an important food source for the poor in most developing nations. However, in Richards Bay, the consumption of wild vegetables could have been less frequent because many households practice subsistence agriculture and could have a preference for the exotic vegetables which they grow rather than the wild vegetables, echoing Bharucha and Pretty (2010).

The high proportion consuming wild foods in Richards Bay could also be due to the location of the town. For example, the town is coastal and many households have easy access to the coast where they practice small-scale fishing which is consistent with what was reported by World Fish Centre (2005) in West Africa. In addition, households in Richards Bay have access to other wild foods mainly because of the conducive climatic conditions for the growth of 'forest' where hunting and gathering can occur all year-round, unlike in Dundee and Harrismith where the access and consumption of wild foods, especially wild vegetables, is mostly limited to the rainy season since the areas are drier and are mostly affected by drought. Ncube (2013) also found the consumption of wild foods was higher in Willowvale which is a coastal area than Lesseyton which is inland.

The consumption of wild foods also followed the rural-urban continuum with the greatest proportion of households consuming wild foods being from the rural areas. Factors such as increased urbanisation, preference and increased reliance on the exotic foods, lack of access to natural resources and markets and also deterioration of indigenous knowledge about wild foods (Flyman and Afolayan, 2006; Vorster et al., 2008; Dweba and Mearns, 2011; Mavengahama et al., 2013) could reduce the urban populations' consumption of wild foods. For the rural and peri-urban households, the high levels of consumption of wild foods are likely due to poverty status and proximity to natural resources (Vorster et al., 2002; Jansen van Rensberg et al., 2004; Jansen van Rensberg et al., 2007; Uusiku et al., 2010; Ncube, 2013).

5.4.4. The role of wild foods in food security

There were no significant differences in wealth and monthly food expenditure between households who were consuming wild foods and those who were not. This could be because wild foods can be consumed by everyone whether of high or low income but are more important in low income households in keeping with Jansen van Rensburg et al. (2007), Vorster et al. (2007), Vorster et al. (2008), FAO (2009) and Mavengahama et al. (2013). Findings from the study revealed that wild foods had no influence in reducing household food insecurity as there were no significant

differences in food security indicators between households who consumed wild foods and those who did not in Dundee. Although significant differences were observed in HFIAS between households who were consuming wild foods and those who were not in Richards Bay, households who consumed wild foods had limited access to food. Moreover, households who consumed wild foods in Harrismith had lower HDDS than those who did not. Therefore, the consumption of wild foods had no influence in reducing household food insecurity for those who consumed them in Richards Bay and Harrismith. This is inconsistent with Bharucha and Pretty (2010), Legwaila et al. (2011) and Mavengahama et al. (2013) who reported that wild foods can reduce food insecurity in poor households through increasing dietary diversity as they provide nutrients to a diet. Hunter et al. (2007) and Kepe (2008) also reported that wild foods can increase household food access as they may allow one to supplement diets since they can be a substitute for purchased goods especially for many poor households who struggle to buy food.

However, findings from this study have shown that wild foods are consumed as a coping strategy by households with challenges of food access (in Richards Bay) and low dietary diversity (in Harrismith) echoing Mojeremane and Tshwenyane (2004), Redzic (2007), Quaye (2008), Fentahun and Hager (2009) and Arnold et al. (2011). Wild foods could be acting as 'safety net' in these households (Cavendish, 2002; Modi et al., 2006; Paumgarten, 2006; Shackleton et al., 2006).

5.5. Conclusion

The study has shown that although a small proportion (25 %) of the sampled households were receiving social grants, the grant had no influence in alleviating food insecurity for the poor households as no significant differences were observed between households who had a grant and those who were not receiving a grant. However, further research needs to be done to fully understand how much of the grant cash is used for the food for the entire household or if it is used to buy food for the children who are recipients of the grant. For example, in a study designed to estimate the impact of child support grants (CSG) on child nutrition as measured by child height-

for-age, it became evident that the availability of grants early in life were shown to significantly boost child height as children who were receiving the CSG were significantly taller than other children (Agüero et al., 2006). Thus, the CSG payments have bolstered early childhood nutrition as signaled by height-for-age. There is statistically significant evidence that receipt of the Child Support Grant (CSG) reduces child hunger, both over time and compared to similarly poor households that do not receive the grant (Devereux, 2010). This could be because the recipients of CSG cash are almost always women, and although the income elasticity of nutrition is generally low, it is higher for women's income than for men's income (Devereux, 2010).

Also, it is evident from the findings that wild vegetables are mostly consumed in Richards Bay and infrequently consumed in Harrismith thus following the agro-ecological gradient. For the households who were consuming wilds foods, findings have shown that their HDDS were lower and their HFIAS scores were higher than those who were not consuming wild foods. Since dietary diversity is associated with households' socio-economic status and HFIAS shows households' food access level, findings have therefore highlighted that wild foods are mostly consumed by the poor and may act as a 'safety net' for these poor households. The study has shown that the consumption of wild foods had no influence in reducing food security in the study sites as was reported in studies by Bharucha and Pretty (2010), Legwaila et al. (2011) and Mavengahama et al. (2013). However, the study did not list and analyse the species which were consumed by households in each wild food group therefore further research needs to be done.

Chapter Six

Quantification and reasons for household food waste in South African towns

6.1. Introduction

The world faces a food security challenge with approximately 868 million people undernourished and about two billion people suffering from the negative health consequences of micronutrient deficiencies (FAO et al., 2012) due to starvation. Yet, it is believed that at least 33 % of food produced for human consumption is lost or wasted along the food chain between farm and fork (Bloom and America, 2007; Lundqvist et al., 2008; Meeusen and Hagelaar, 2008; Ridoutt et al., 2010; Gustavsson et al., 2011; FAO, 2013). According to Gustavsson et al. (2011), this wasted food amounts to approximately US$ 680 billion and US$ 310 billion annually in industrialised and developing countries, respectively. About 40 % of all the food produced in the United States is never eaten, in Europe 100 million tonnes of food are thrown away every year and in South Africa, it is estimated that close to one and a half million tonnes of food are wasted per annum (Nahman et al., 2012). A food waste study by WRAP (2008) showed that consumers in the United Kingdom throw away about one-third of the purchased food and 61 % of this food would still be suitable for human consumption.

Food waste occurs all along the food chain at the stages of production, processing, distribution, acquisition, preparation and consumption (Griffin at al., 2009). The stages at which food is lost or wasted and the quantities differ between regions. In developed countries food is to a significant extent wasted at the consumption stage as it is discarded even if it is still suitable for human consumption and this is mainly due to consumers' behavior (Gustavsson et al., 2011). For example, Griffin et al. (2009) reported that of all the food that was wasted in one United States county, 20 % was production waste, 1 % was lost through processing, distribution comprised 19 % and 60 % of food waste was generated by consumers. This is consistent with what was reported for European

Union countries where household food waste constituted the greatest percentage of food wasted (European Commission, 2010). This is different to low income countries where most food is lost during the early and middle stages of the food supply chain and much less food is wasted at the consumer level (Gustavsson et al., 2011). In developing countries, food waste and losses are mainly due to financial, managerial and technical constraints in harvesting techniques as well as insufficient storage and cooling facilities. Much more food is wasted in the industrialised world than in developing countries with an estimated per capita food waste by consumers in Europe and North-America being 95-115 kg/year whilst only 6-11 kg/year is wasted by consumers in sub-Saharan Africa and South/Southeast Asia (Gustavsson et al., 2011). However, there are increasing global concerns regarding the environmental, economic and social implications of food waste as food waste has been identified as contributing to global warming and climate change through landfill expansion and greenhouse gas emissions (Gustavsson et al., 2011). Economically, food waste is regarded as money wasted in the context of rising food prices and global food shortages (European Commission, 2010), not to mention the biodiversity and ecosystem services losses attributed to food production which is never consumed.

Globally, the food which is wasted is four times the amount needed to solve world hunger (Gustavsson et al., 2011). Thus, the vast amount of food which is wasted could potentially feed the almost one billion people worldwide (13% of the global population) who are classified as undernourished (Gustavsson et al., 2011). Large quantities of food which are going to waste are aggravating problems of hunger and food insecurity, especially in poorer countries (Gustavsson et al., 2011). Globally, fruits and vegetables as well as roots and tubers have the highest wastage rates of approximately 40-50 %, cereals contribute to about 30 % of the quantitative food losses and waste per year and oil seeds, meat and dairy contributes 20 % whilst fish contributes roughly 35 % (Gustavsson et al., 2011; FAO, 2013). Therefore, reducing the amount of food that is being wasted after production could play an important role in meeting the challenge of feeding the global hungry (Lundqvist et al., 2008) and decreasing food insecurity (Gustavsson et al., 2011).

6.1.1. Definition and classification of food waste

Food waste refers to wholesome, edible material intended for human consumption, arising at any point in the food supply chain that is instead discarded, lost, degraded or consumed by pests (FAO, 1981). Food loss is defined as the decrease in food quantity or quality which makes it unfit for human consumption (Grolleaud, 2002). Food losses take place at production, postharvest and processing stages in the food supply chain and the food losses that occur at the end of the food chain (retail and final consumption) are called "food waste" (Parfitt et al., 2010). Food waste mainly relates to retailers' and consumers' behaviour (Parfitt et al., 2010; Gustavsson et al., 2011). According to European Commission (2010), food waste is composed of raw or cooked food materials such as vegetable peelings, meat trimmings and spoiled or excess ingredients or prepared food as well as bones, carcasses and organs. However, food waste can be measured only for edible products that are directed to human consumption (Gustavsson et al., 2011). Thus, it includes food loss before, during or after meal preparation in the household, as well as food discarded in the process of manufacturing, distribution, retail and food service activities.

Consumer food waste mainly occurs during food acquisition, preparation and consumption. Improper or prolonged storage are also a key cause of consumer food waste (Griffin et al., 2009). About 60 % of food waste is avoidable food waste and these include leftovers (food which is cooked, prepared or served too much), whole unused food or food not used in time and part consumed food (WRAP, 2009; Partiff et al., 2010; Lebersorger and Schneider, 2011). About 20 % of food waste is potentially avoidable food waste (e.g. things like bread crusts and potato skins (WRAP, 2009; Partiff et al., 2010)) and this is often related to habits. Only about 20 % of food waste is unavoidable (e.g. preparation residues (WRAP, 2009; Lebersorger and Schneider, 2011)).

6.1.2. Reasons for household food waste

Although food waste occurs along the food chain from food production, processing, distribution and consumption, studies have shown that most food waste is generated by consumers (Griffin et

al., 2009; European Commission, 2010). There are different ways in which consumers may waste food and these include:

- Plate scrapings as consumers put more food on their plates than they could eat and frequently end up scraping the food off their plate into the garbage.
- Poor storage/stock management in homes therefore food is discarded before serving.
- Poor food preparation techniques whereby edible food is discarded with inedible food (Griffin et al., 2009) or cooked food but inedible (e.g. did not taste good or made a mistake while preparing (Williams et al., 2012)).
- Discarding leftover foods whilst food is still good for human consumption because household members would not want to eat leftovers (Williams et al., 2012) or feeding pets (WRAP, 2009).
- Food is also discarded in packaging due to confusion over 'best before' and 'use by' dates because some people do not understand the labels (Cox and Downing, 2007; Fredriksen et al., 2010 cited in Williams et al., 2012; Partiff et al., 2010).
- The availability of cheap food, particularly in industrialised nations, encourages overbuying and hoarding behaviours that result in waste (Griffin et al., 2009).
- Children are regarded as one of the reasons why households discard a lot of food waste as was reported by approximately two-thirds of the families with children in UK (say that is due to the children (WRAP, 2007)).

The quantities of food waste depend on different factors such as household size and composition, household income, household demographics and household culture (Parfitt et al., 2010). Some studies from developed countries have shown that household size and composition may significantly influence food wastage (Van Garde and Woodburn, 1987; WRAP, 2009; Partitff et al., 2010). Studies suggested that larger households waste less food per person than smaller households. Also, single-person households tend to generate more food waste, and households with children tend to waste more than households without children. Some studies have suggested that young people waste more food than older people, with pensioner households wasting the least

as such households normally contain comparatively fewer people (Hamilton et al., 2005; Lyndhurst, 2007).

Lyndhurst (2007) suggested that there is lower food loss in low-income households than in high-income households, although some studies found little or no correlation between income and food wastage (Parfitt et al., 2010). Household culture has also been noted to have influence on food waste. Partiff et al. (2010) suggested that culture may contribute to food wastage as some cultures have lower rates of food waste than others. For example, Hispanic households in the USA have approximately 25% lower food waste rates of than non-Hispanics although this might be related to wealth. Also, Rathje and Murphy (2001) found that Mexican households waste significantly less food than the average Anglo-American household in the USA because Mexicans have a variety of dishes but only use a few ingredients that are combined differently and used regularly to the extent of even incorporating leftovers into new meals. Another factor might be cultural differences between nations. In South Korea, for example, if invited for a meal, the hosts are expected to supply large meals which could be too much to eat and it is regarded as being polite to leave some food on the plate (Hogg et al., 2007).

6.1.3. Research gaps

In Africa, particularly in southern Africa and South Africa, there is very little information on household food waste (Pereira, 2014). Studies have focused on food waste along the household waste stream (Nahman et al., 2012), along the entire food chain (Nahman and De Lange, 2013) and along the food value chain (Oelofse and Nahman, 2013). Oelofse (2013) also presented information on food waste with an emphasis on waste incurred during production including imports. Due to inadequate information on household food waste in South Africa, Nahman et al. (2012) quantified household food waste in the country using secondary data that was based on the waste stream analyses characterising the relative contribution of food waste to the overall household waste stream. However, the estimates were based on a number of assumptions and these need to be used with caution.

Although, some studies in South Africa have shown that consumer food waste contributes significantly to the waste stream (Gibb Engineering and Science, 2008; Silbernagl, 2011), no national data on food waste is available for the country (Nahman et al., 2012). Very little is known about the quantities of food waste that are generated by households in South Africa. There are no known national studies available on household food waste and the tonnages that are disposed of each year.

These few above-mentioned studies were done in urban areas therefore there are no comparative analyses along the rural-urban gradient and how it might reflect trends as southern African societies urbanise. Parfitt et al. (2010) has identified urbanisation as one of the drivers that are influencing food waste together with dietary transition and contraction of agricultural markets, especially in developing countries. Lundqvist et al. (2008) reported that dietary transition has led to increased consumption of food that has a short shelf-life, such as fruit and vegetables, which may result in greater food waste. Also, none of the studies has considered the agro-ecological context in which food may be grown or collected, which could potentially decrease waste as food is procured fresh when actually needed. Food waste research is neglected yet it is an important aspect of the food system (Pereira, 2014) as it negatively affects food security (Oelofse, 2014) The link between food security and food waste has prompted this research to quantify food waste at household level.

6.1.4. Aims of study

As food waste has a negative effect on food security, the present study sought to analyse household food waste both along the agro-ecological gradient and rural-urban continuum. The aims of the study were to quantify the food households throw away after purchase, before, during and after meal preparation as well as after consumption and identify the causes and correlates of household food waste in the three study sites. The study sought to determine if there were any significant differences in the amount of food waste between and within towns and also compared if the amount

of food wasted by households was associated with household wealth, household size, food expenditure and household food access using HFIAS. I hypothesised that:

1. The quantities of household food waste follow the agro-ecological gradient with households in Richards Bay throwing away less food.
2. Households in rural areas would waste more food than those in the urbanised settings.
3. Wealthy households would throw away more food than poor households.
4. Most of food waste would be from unprepared or raw food.
5. Households with limited access to food would waste less food than those with good access to food.
6. Smaller households would throw away more food per capita than larger households.

6.2. Methods

Refer to Chapter One and Two for information on sampling and study sites.

6.2.1. Household surveys

Data were collected between October and November 2014. A woman of reproductive age (15-49 years old) and ideally the person in the household who usually prepared most of the meals was asked to participate in the interview. A questionnaire was used to collect information on households' behaviour regarding the meals they consume at home. That is, information on where household members usually eat their meals, if most household members usually ate the same meal, how often was not all the food eaten and what households did with the left-overs. In the present study, food waste was classified into three main classes which were prepared food waste, unprepared/raw food waste and drinks waste. Participants were then asked to recall the food waste that they had generated over the past 48 hours in their homes, including classifying the type of food waste, naming the type of food, the quantity (weight or volume) and reason for disposal. Participants were asked to measure and record their food waste using estimated standard household measures such as cups, tablespoons or teaspoons. Prepared and unprepared foods were measured in kilograms (kg) and grams (g) whilst drinks were measured in litres (l) and millilitres (ml).

However, it was not possible for households to separate some of the prepared foods and weigh them separately according to food type and therefore these were measured as mixed dishes.

6.2.2. Statistical analysis

Data were entered and cleaned using Microsoft Excel and all statistical analyses were performed using Statistica version 13 (StatSoft Inc.). Descriptive data are presented as means and standard deviations (SDs) (mean ± SD) and percentages. Data on food waste quantities for each town were tested for normality using a Kolmogorov-Smirnov test and did not meet the assumptions for normality therefore non-parametric tests were used for analysis. The differences in amount of food wasted per households per town and locations were tested using 2-way ANOVA and a post-hoc analysis was performed to provide specific information on which means were significantly different from each other. The associations of the food waste quantities with food expenditure, household size, wealth variables and HFIAS were examined through Spearman correlation tests and the amount of food waste was used as a response variable. Statistical significance was set at $p < 0.05$ for all tests.

6.3. Results

Refer to Chapter Two for information on household characteristics.

6.3.1. Household behaviour regarding meals at home

The sample consisted of 541 households with 172 households from Richards Bay, 171 households from Dundee and 198 households from Harrismith. In all three towns, at least 70 % of the household members were always eating their meals at home and were eating the same meal at the same time (Table 6.1).

Table 6.1: Percentage of households whose members usually eat meals at the same time and where household members usually eat their meals.

Town	Meal	Eating meals together (%)	Where households eat meals (%)				
			Always at home	Mainly at home	Partly at home and partly elsewhere	Mainly elsewhere	Always elsewhere
Richards Bay	Breakfast	79	86	6	5	2	2
	Lunch	75	61	14	17	6	2
	Dinner	91	86	3	5	5	1
	Mean	82	78	8	9	4	1
Dundee	Breakfast	92	91	2	4	1	1
	Lunch	87	75	7	12	3	3
	Dinner	97	91	1	6	2	0
	Mean	92	86	4	7	2	1
Harrismith	Breakfast	81	87	7	5	1	1
	Lunch	67	59	15	18	6	2
	Dinner	92	85	6	6	4	0
	Mean	80	77	9	9	4	1
Grand mean	Breakfast	84	88	5	4	1	1
	Lunch	76	65	12	16	5	2
	Dinner	93	87	3	6	3	0
	All	84	80	7	9	3	1

For all meals in all towns, more than 75 % of households rarely left any food after the meal (Table 6.2). About 10 % of the households reported to have left food uneaten fewer than five times.

Table 6.2: Percentage of households showing the frequencies per month when not all the prepared food is consumed.

Town	Meal	Percentage of households				
		Very rarely	< 5 times	5-10 times	11-20 times	> 20 times
Richards Bay	Breakfast	75	11	7	1	6
	Lunch	74	13	8	3	3
	Dinner	73	9	5	3	9
	Mean	74	11	6	3	6
Dundee	Breakfast	89	8	2	0	0
	Lunch	84	13	3	0	1
	Dinner	83	12	4	1	1
	Mean	85	11	3	0	0
Harrismith	Breakfast	83	8	4	0	5
	Lunch	77	11	7	3	2
	Dinner	77	9	5	5	4
	Mean	79	9	5	3	4
Grand mean	Breakfast	83	9	4	0	4
	Lunch	78	12	6	2	2
	Dinner	78	10	4	3	5
	All	80	10	5	2	4

When the food was not consumed, almost 80 % of the households in all towns reported that they rarely throw it away but rather keep the leftovers and consume the food within a day or two (Table 6.3). Very rarely did households give the food to other people, feed to animals or throw it away.

Table 6.3: Different ways in which households usually deal with the leftover food (%).

Town	Meal	Percentage of households			
		Keep and eat in the next day or two	Give away to other people	Feed animals	Throw away
Richards Bay	Breakfast	87	6	3	3
	Lunch	87	8	3	2
	Dinner	87	5	2	5
	Mean	87	6	3	4
Dundee	Breakfast	90	5	5	0
	Lunch	84	7	8	1
	Dinner	83	4	10	3
	Mean	86	5	8	1
Harrismith	Breakfast	80	5	10	6
	Lunch	77	9	9	5
	Dinner	82	5	8	6
	Mean	80	6	9	6
Grand mean	Breakfast	86	5	6	3
	Lunch	83	8	7	3
	Dinner	84	5	7	5
	All	84	6	6	3

6.3.2. Types of food waste along the agro-ecological gradient

Generally, 191 households (35 % of the sample) had wasted food in the past 48 hours with 67 households (12 %) from Richards Bay, 55 households (10 %) from Dundee and 69 households (13 %) from Harrismith. Generally, about 27 % threw away prepared food, 15 % threw away unprepared/raw food whilst 8 % of the households in all towns wasted drinks (Table 6.4). Thus, more households were throwing away prepared food followed by unprepared/raw and the least

percentage of households threw away drinks. Generally, the percentage of households who were throwing away prepared food and drinks followed the agro-ecological gradient with Richards Bay having the highest percentages, followed by Harrismith and Dundee had the lowest although the percentage was almost similar to that of Harrismith. There were significant differences in the percentages of households wasting prepared food and drinks between the towns.

Considering the rural-urban continuum, urban location had the highest percentage of households who were throwing away prepared food and drinks, followed by rural locations and lastly the peri-urban had the lowest proportion of households throwing away both prepared food and drinks. There were no significant differences in the percentages of households throwing away prepared food between the locations. However, significant differences were observed between the percentages of households throwing away drinks in the urban locations and both peri-urban and rural locations ($F_{2, 536}$=4.31, p=0.01), which were not different from one another. Within towns, significant differences were observed along the rural-urban continuum in Harrismith with the percentages of households throwing away prepared food ($F_{2, 195}$=4.2, p=0.16) and drinks ($F_{2, 195}$=12.7, p=0.0001) being higher in the urban locations than both peri-urban and rural locations, which were not different from one another (Table 6.4).

Table 6.4: Percentage of households throwing away different types of food waste in each town in the previous 48 hours and the aggregate. (Unlike superscripts show significant differences).

Town	Location	Percentage of households wasting food					
		Prepared food waste		Unprepared/raw food waste		Drinks	
Richards Bay	Urban	31[a]	33 [a]	12 [a]	12[a]	9[a]	7[a]
	Peri-urban		24 [a]		9[a]		6[a]
	Rural		38[a]		16[a]		13[a]
Dundee	Urban	24[a]	14 [a]	12 [a]	14[a]	6[a]	8[a]
	Peri-urban		15 [a]		15[a]		8[a]
	Rural		10 [a]		10[a]		3[a]
Harrismith	Urban	25[a]	39[a]	20 [a]	31[a]	8[a]	22[a]
	Peri-urban		21[b]		15[b]		2[b]
	Rural		17[b]		14[b]		2[b]
Grand mean	Urban	27	34[a]	15	20[a]	8	13[a]
	Peri-urban		23[a]		13[a]		5[b]
	Rural		27[a]		13[a]		6[b]

With respect to unprepared food, Harrismith had the highest percentage of households who were throwing away unprepared food waste whilst Richards Bay and Dundee had the lowest percentage of households wasting unprepared food (Table 6.4). The percentage of households throwing away unprepared food followed the rural-urban continuum with households in the urban locations throwing away more unprepared food than their peri-urban and rural counterparts, although not significantly so, other than in Harrismith ($(F_{2, 195}=3.7, p=0.03)$. The types of food waste were similar across the three sites. In general, the prepared foods that were most commonly wasted were pap, meat, vegetables and rice. Pap and meat were thrown away by greater than 20 % of the households in all the towns. In Richards Bay, pap and meat were mostly discarded in the rural

areas, in Dundee they were mostly thrown away in the peri-urban and rural areas whilst in Harrismith it was the urban households who threw away these food items. Rice was wasted by more than 20 % of the households in Richards Bay only (more in rural location), whilst vegetables were wasted by more than 20 % of the households in Dundee and Harrismith (more in peri-urban locations). Potatoes were mostly wasted in Harrismith whilst samp was mostly wasted in Richards Bay and Dundee and beans mostly in Dundee. Bread and fish were among the least wasted prepared foods in all the towns (Table 6.5).

Table 6.5: Percentage of households wasting different prepared foods per town and location in the previous 48 hours.

Town	Location	Pap	Rice	Meat	Potatoes	Beans	Vegetables	Bread	Fish	Samp
Richards Bay	Urban	7	7	3	0	0	1	3	0	3
	Peri-urban	7	9	9	0	0	3	0	0	4
	Rural	12	13	9	0	1	1	0	1	3
	All (n=67)	27	30	21	0	1	6	3	1	10
Dundee	Urban	4	2	7	0	0	4	2	0	0
	Peri-urban	15	2	11	0	7	11	0	0	5
	Rural	11	4	11	0	2	7	0	0	2
	All (n=55)	29	7	22	0	11	22	2	0	7
Harrismith	Urban	10	4	9	4	3	9	1	3	0
	Peri-urban	9	4	6	1	1	12	0	1	0
	Rural	6	1	4	0	1	7	0	0	0
	All (n=69)	25	12	22	7	4	26	1	3	0
Grand mean	Urban	7	5	6	1	1	5	2	1	1
	Peri-urban	10	5	9	0	3	8	0	0	3
	Rural	10	6	8	0	2	5	0	0	2
	All (n=191)	27	16	21	2	6	18	2	1	6

The unprepared/raw foods that were wasted by households in all towns were potatoes, fish and to a large extent vegetables (mostly tomatoes and cabbage) which were discarded by greater than 14 % of the households in all towns (Table 6.6). Vegetables were mostly wasted in the rural location in Richards Bay (6 %), whilst in Dundee (13 %) and Harrismith (13 %) it was the peri-urban dwellers who wasted more vegetables. Fish and meat were mostly wasted in Harrismith urban with 10 % of households throwing away these unprepared foods. The other unprepared/raw foods that were wasted were town specific. For example, maize meal and flour were wasted in Richards Bay only (mostly peri- urban and urban locations), whilst fruits were thrown away in Dundee only (more in the urban location). Unprepared/raw waste from beans, bread and meat were recorded in Harrismith and Dundee only whilst that from samp and rice were found in Richards Bay and Dundee only (Table 6.6).

Table 6.6: Percentage of households wasting different unprepared foods per town and location in the previous 48 hours.

Town	Location	Meat	Vegetables	Potatoes	Beans	Fish	Bread	Fruits	Samp	Rice	Maize meal and flour
Richards Bay	Urban	0	4	1	0	1	0	0	0	0	3
	Peri-urban	0	4	1	0	0	0	0	0	0	4
	Rural	0	6	1	0	3	0	0	3	3	1
	All (n=67)	0	15	4	0	4	0	0	3	3	9
Dundee	Urban	0	4	2	0	0	0	4	0	0	0
	Peri-urban	2	13	4	4	4	4	2	0	0	0
	Rural	0	9	0	0	2	0	0	0	2	0
	All (n=55)	2	25	5	4	5	4	5	0	2	0
Harrismith	Urban	10	6	1	0	10	3	0	0	0	0
	Peri-urban	3	13	4	3	1	3	0	0	0	0
	Rural	1	4	3	3	4	1	0	0	0	0
	All (n=69)	14	23	9	6	16	7	0	0	0	0
Grand mean	Urban	3	5	2	0	4	1	1	0	0	1
	Peri-urban	2	10	3	2	2	2	1	0	0	1
	Rural	0	6	1	1	3	0	0	1	2	0
	All (n=191)	5	21	6	3	9	4	2	1	2	3

Drinks were rarely wasted in all the towns. Milk was the mostly wasted drink in Richards Bay rural location and Dundee's peri-urban location whist soft drink and juice were the most wasted drinks in Harrismith urban location (Table 6.7). The percentage of households wasting milk also followed the agro-ecological gradient although the differences in the percentages in Richards Bay and Dundee were minimal.

Table 6.7: Percentage of households wasting drinks per town and location in the previous 48 hours

Town	Location	Milk	Soft drinks	Juice	Beer
Richards Bay	Urban	4	1	0	0
	Peri-urban	2	3	0	1
	Rural	10	0	0	0
	All	17	4	0	1
Dundee	Urban	2	4	0	0
	Peri-urban	11	0	2	0
	Rural	4	0	0	0
	All	16	4	2	0
Harrismith	Urban	4	7	7	0
	Peri-urban	1	1	1	0
	Rural	1	0	0	0
	All	7	9	9	0
Grand mean	Urban	4	4	2	0
	Peri-urban	5	1	1	0
	Rural	5	0	0	0
	All	13	6	4	0

6.3.3. Quantities of food waste along the agro-ecological gradient

In terms of quantities wasted in the last 48 hours it was 111±234 g of prepared food, 265±1399 g of unprepared/raw food and 77±419 ml of drinks per household (Table 6.8). The mean amount of prepared food waste ranged from 94±16 g per household in the previous 48 hours in Dundee to 122±18 g per household in the previous 48 hours in Harrismith (Table 6.8). Within sites, the mean amount of prepared food waste was 144 ±23 g per household per 48 hours in the urban locations, 100±15 g per household per 48 hours in the peri-urban location and 102±17 g per household per

48 hours in the rural locations (Table 6.8). There were no significant differences in the amount of prepared food waste that was produced between towns ($F_{2, 536}$=0.61, p=0.54) and between locations ($F_{2, 536}$=1.6, p=0.2).

Table 6.8: The mean amount of food wasted per household in the past 48 hours. (Unlike superscripts indicate significant differences).

Town	Location	Amount of food waste					
		Prepared food (mean (g) ±sd)		Unprepared/raw food (mean (g) ±sd)		Drinks (mean (ml) ±sd)	
Richards Bay	Urban		113±37		382±349		15±73
	Peri-urban	117±19	90±30	495±179[a]	296±292	71±36	29±59
	Rural		147±31		736±288		153±60
Dundee	Urban		126±35		230±120		74±63
	Peri-urban	94±16	111±25	163±51[b]	188±84	72±29	107±44
	Rural		66±28		138±95		34±50
Harrismith	Urban		181±33		255±71		264±52 [a]
	Peri-urban	122±18	97±26	154±28[b]	139±56	86±28	15±41 [b]
	Rural		88±32		146±68		21±50 [b]
Grand mean	Urban		144±23		212±52		132±42
	Peri-urban	111±234	100±15	265±1 399	184±47	77±418	49±20
	Rural		102±17		406±165		71±36

Considering unprepared food, although the greatest percentage of households throwing away unprepared/raw food was in Harrismith, with Richards Bay having the least, the mean amount of unprepared/raw food waste followed the agro-ecological gradient with Richards Bay having the highest amount of unprepared food waste (495±179 g per household in the previous 48 hours) and Harrismith having the least amount of 154±28 g per household in the previous 48 hours ($F_{2, 536}$ =

3.2, p=0.04) with Richards Bay being higher than the other two, which were not different from one another (Table 6.8). No significant differences were observed in the amount of unprepared food waste between the locations ($F_{2, 536}$ = 1.2, p=0.3), being 212±52 g per household in the previous 48 hours in the urban locations, 184±47 g per household in the peri-urban location and 406±165 g per household in the rural locations (Table 6.8).

The mean amount of drinks wasted per household in the previous 48 hours was relatively similar between towns (70-86 ml per household) ($F_{2, 536}$ = 0.06, p=0.94) (Table 6.8). Within sites, the mean amount of drink waste was 132±42 ml per household in the previous 48 hours in the urban locations, 49±20 ml in the peri-urban location and 71±36 ml in the rural locations ($F_{2, 536}$ = 1.6, p=0.196) (Table 6.8). However, significant differences were observed in Harrismith between the amount of drinks wasted with urban location throwing away more drinks than both the peri-urban and rural locations which were not different from each other ($F_{2, 195}$ = 8.2, p=0.0004).

No correlations were observed between different food waste types and household characteristics, including HFIAS for most situations (Table 6.9). However, there was a negative one between prepared food waste and household size for the sample (r= -0.23, p<0.05), and a positive one between unprepared food waste and HFIAS in Richards Bay only (r= 0.512, p<0.05) (Table 6.9).

Table 6.9: Spearman correlations between HFIAS, household size, food expenditure and wealth status of households with the amount of food wasted by households in the previous 48 hours. (Bold correlations are significant at $p<0.05$).

Food waste type	Town	HFIAS	Household size	Food expenditure	Wealth
Prepared	Richards Bay	0.14	-0.09	0.02	-0.16
	Dundee	0.07	-0.3	0.02	-0.2
	Harrismith	-0.2	-0.2	0.05	0.12
	All	0.04	**-0.23**	0.10	-0.06
Unprepared	Richards Bay	**0.51**	-0.16	-0.07	0.16
	Dundee	0.2	-0.01	-0.12	-0.01
	Harrismith	0.03	0.19	0.21	0.08
	All	0.18	0.09	-0.12	-0.02
Drinks	Richards Bay	-0.08	0.17	-0.09	0.26
	Dundee	0.49	0.21	-0.25	0.30
	Harrismith	-0.4	-0.17	0.03	-0.2
	All	0.10	0.11	-0.01	0.18

6.3.4. Reasons for household food waste

Table 6.10 shows the reasons which were given by the respondents regarding why they throw away the different foods in their households. The most cited reasons were that the food had visibly gone bad or smelt bad (23 %) and that they had prepared too much and it was not possible for them to save leftovers (22 %). In Richards Bay, the highest reasons were because they had prepared too much and it was not possible for them to save leftovers (34 %), because the food had visibly gone bad or smelt bad (19 %), because they had prepared too much and did not want to save leftovers (11 %) and another 11 % reported that they had served too much and could not finish all the food (Table 6.10). In Dundee, the top four reasons for throwing away prepared food were food visibly bad or smelt bad (29 %), prepared too much and it was not possible to save leftovers (26 %), food

was burnt/ruined during cooking/preparation (12 %) and saved leftovers but were not used in time (10 %). In Harrismith, prepared food was mostly wasted because the food was visibly bad or smelt bad (22 %), households had served too much and could not finish all the food (16 %), 14 % of the households had prepared too much and did not want to save leftovers and some households had found the food did not taste nice (14 %) (Table 6.10).

For unprepared/raw food, households in all towns threw away the food mostly because the food had passed its best before date (48 %) (to a larger extent in Richards Bay (50 %) and Harrismith (49%)) or the food was bad (rotten, sour or mouldy) (38 %) (to a larger extent in Dundee (41%)) (Table 6.10). In general, the greatest percentage of households wasted drinks when they had passed the best before date (59 %) or accidentally (27 %). Drinks were mostly wasted in Dundee and Harrismith when they had passed the best before date ($\geq$ 60 % of households) whilst in Richards Bay it was mainly due to accidents (53 %) although a greater percentage of households (33 %) had thrown away the drinks that had passed the best before date (Table 6.10). Also, about 27 % of the households in Dundee had accidentally wasted drinks whilst about 17 % of the households in Harrismith had thrown away the drinks because they had bought the wrong things (Table 6.10).

Table 6.10: Percentage of households throwing away food for different reasons at each study site.

Food wasted	Reason for throwing away food	Percentage of households (%)			
		Richards Bay	Dundee	Harrismith	All
Prepared food	Prepared too much and not possible to save leftovers	34	26	6	22
	Prepared too much and do not want to save leftovers	11	5	14	10
	Served too much and could not finish all	11	7	16	12
	Saved leftovers but were not used in time	8	10	4	7
	Food was burnt/ruined during cooking/preparation	6	12	8	8
	The food did not taste nice	2	5	14	7
	Always want to eat the freshest food	6	0	6	4
	Food visibly bad or smelt bad	19	29	22	23
	Accident	2	2	2	2
	Made a mistake while preparing	0	2	4	2
	Want to keep kitchen clean/organised	2	0	2	1
	Not liking the food	0	2	0	1
Unprepared/raw food	Passed best before date	50	36	49	45
	Bought too much	0	14	3	7
	Buying more perishable food	5	9	5	6
	Food has gone bad (rotten, sour or mouldy)	36	41	36	38
	Bad/broken package	0	0	8	3
	Accident	9	0	0	3
Drinks	Passed best before date	33	83	60	59
	Bought the wrong thing	0	17	7	8
	Accident	53	0	27	27
	Bad/broken package	13	0	7	7

6.4. Discussion

Results from this study suggests that households in all three towns were minimising the amount of food they threw away as more than 70 % of the households in all towns consume their meals at home with all household members, ate the same meal at the same time, rarely left any food uneaten and if it happened that they had not finished the food, they usually kept it and consumed it in the next day or two. This corroborates other studies reporting that minimal food waste occurs when household members eat together at home (Lebersorger, 2004 (cited in Schneider (2008)) rather than eating out. Only 35 % of the sampled households had thrown away any food in the previous 48 hours and the greatest percentage had thrown away prepared food, especially pap, meat and vegetables (mostly cabbage) and, to a lesser extent, drinks. The type of food that was wasted depended on the food types that were being consumed by households as more than 50 % of households across all towns and locations consumed starchy cereals (mostly maize meal), vegetables (mostly cabbage and onion) and meat (Chapter Two). This is slightly different from the types of food that were reported to have been wasted in the developed world where Thönissen (2009) found a high proportion of dairy products being wasted in the Netherlands and Pekcan et al. (2006) reported the highest proportion of food waste in Turkey to have consisted of fresh fruits and vegetables. However, the wasting of meat is consistent with other studies, especially in the developed world as meat has also been reported as one of the products contributing to food waste in the UK (WRAP, 2009), the Netherlands (Thönissen, 2009), Austria (Lechner and Schneider, 2009 (cited in Parfitt et al., 2010)), USA (Jones, 2002) and in Turkey (Pekcan et al., 2006). In South Africa, meat and fish are widely consumed (Acham et al., 2012; Chapter Two), therefore, it was easier for households in the present study to generate food waste from meat as it is readily available in the households. Globally, fruits and vegetables, starchy cereals, fish, meat and dairy contribute more than 20 % of food waste per annum (Gustavsson et al., 2011; FAO, 2013).

The percentage of households who were throwing away food and drinks did not differ along the agro-ecological gradient. However, location along the rural-urban continuum did influence the percentage of households throwing away drinks as was shown by the significantly higher

prevalence of wasting drinks in urban locations relative to both peri-urban and rural locations. Most drinks thrown away in the urban locations were soft drinks and juice, whilst in the peri-urban and rural locations it was more commonly milk. This could be attributed to households in urban areas having good access to cheap and affordable goods which can encourage bulk buying, some of which may end up expiring before being used. Milk was mostly wasted in rural and peri-urban areas because it is a perishable product and requires proper storage and cooling, which can be lacking in poor rural households.

In general, households generated greater quantities of unprepared food waste than prepared food waste and drinks, as was hypothesised in the study. The amount of prepared food waste and drinks waste not restricted to towns and locations as no significant differences were found in the amounts of prepared food waste and drinks waste between and within the towns. However, the amount of unprepared food waste followed the agro-ecological gradient as per the study hypothesis although households in Richards Bay were throwing away greater quantities (495±179 g per household per 48 hours) of unprepared food than the other two towns. Each household in the study sites waste approximately 28-90 kg of unprepared food per year and on per capita basis, they waste 4-13 kg per person per year of unprepared food waste since the average household size of the study site was seven members per household (Chapter Two). Households in the study sites also waste approximately 17-22 kg of prepared food per household per year and 2-3 kg per peson per year of and 13-16 l of drinks per household per year with each household member wasting 2 l of drinks annually.The estimated per capita food waste by consumers in this study, including prepared and drinks waste, is higher than that which is estimated in the developing countries (6-11 kg per person per year in sub-Saharan Africa and South/Southeast Asia) and lower than that in the developed countries (95-115 kg per person per year in Europe and North America) (Gustavsson et al., 2011).

The amount of unprepared food waste was limited to town as is explained by the significant differences in the amount of unprepared food waste produced between Richards Bay and the other towns. This could be because of high levels of food access in Richards Bay (Chapter Two) which

could be attributed to wetter and warmer climatic conditions and longer growing season which favour agriculture. The same weather conditions can also affect the processing and storage of the produce which could end up rotting as this was one of the reasons why about 36 % of the households in Richards Bay threw away unprepared food. Lack of infrastructure and associated technical and managerial skills in food production and post-harvest processing have been reported as the main driver promoting food waste in developing countries, although this might apply on a large scale (WFP, 2009; Parfitt et al., 2010). Also, food waste in developing countries has been linked to poor financial status, storage and cooling facilities (Gustavsson et al., 2011) and most food was wasted in the rural areas in Richards Bay where most households fall in the low wealth status (Chapter Two), have limited market and knowledge on how to preserve their farm produce (Chapter Four) and could have poor storage and cooling facilities.

A significant negative correlation between the amount of prepared food waste and household size was observed, i.e. smaller households were wasting more prepared food than larger households as was hypothesised in the study. This could be because small households prepare large portions of food which they ended up not eating as they lavish their resources which may appear as more than enough. In larger households, resources may appear as insufficient, therefore, members may be sparing their resources through exercising portion measurements and can only prepare what would be enough for the meal. These results are consistent with studies from developed countries which have shown that household size may significantly influence food wastage as larger households waste less food per person than smaller households (Van Garde and Woodburn, 1987; WRAP, 2009; Partitff et al., 2010).

A significant positive correlation in the amount of unprepared food waste and HFIAS was observed in Richards Bay meaning that households with poor food access were discarding greater amounts of unprepared food than those who had good access to food, which was opposite to what had been hypothesised in the study. Households with poor food access could have been doing bulk buying when food was being sold at lower prices when they had the resources to acquire food and

the food ended up passing the expiry date before being used and for perishable food, the quality could have been poor and the food spoilt before being used. The availability of cheap food has also been noted to encourage overbuying and hoarding behaviours that result in waste in developed countries (Griffin et al., 2009). That is, impulse buying as a result of retail promotions, poor storage practices which results in food becoming mouldy or 'off' and poor food management in homes where food is not used before going past 'use by' or 'best before' date has also been reported in the UK (Exodus, 2006). This also applies to prepared food where a large percentage of households in all towns discarded the food because it had gone bad and more drinks were discarded because they had passed the best before date. Households also prepared large portions of food which they ended up not eating and although they could have served leftovers, they could not use them on time. This is consistent with Exodus (2006) who reported poor portion control as households in UK prepared meal portions that were too large resulting in an inability to finish all the food.

There have been reports that low-income households throw away less food than high-income households (Lyndhurst, 2007). However, the present study showed no significant associations between the quantities of food waste (prepared, unprepared and drinks) with household socio-economic status indices (food expenditure and wealth index) as was also reported by Parfitt et al. (2010), which is different from what I hypothesised. However, considering the significant differences along the rural-urban continuum which were observed in Harrismith on the proportion of households wasting food and drinks and also on the amount of drinks wasted in the town, one may conclude that wealth could have a significant influence on household food wastage as it had on the dietary diversity as was observed in Chapter Two. This is because urban households in Harrismith had significantly higher HDDS than their peri-urban and rural counterparts. As HDDS reflects the economic ability of a household to access a variety of foods (FAO, 2011), higher dietary diversity is associated with higher socio-economic status (Hatløy et al., 2000; Hoddinott and Yohannes, 2002). Therefore, urban households in Harrismith wasted food more food than the rural and peri-urban households because they had more access to food. Also, greater quantities of drinks were wasted in urban locations than in the peri-urban and rural locations, which can also point to the issue of affordability, i.e. urban households have a higher socio-economic status

(Chapter Three) and can afford to buy drinks in larger quantities than peri-urban or rural households. However, this was not consistent in the other towns as more food was wasted in the rural locations in Richards Bay and in the peri-urban locations in Dundee.

6.5. Conclusion

Although more households were discarding prepared food than unprepared/raw food and drinks, the amounts were not significant because the quantities of unprepared/raw food discarded were higher than prepared food. Quantities of unprepared/raw food waste followed the agro-ecological gradient with Richards Bay discarding more quantities than the other towns. Households in the study sites waste approximately 28-90 kg of unprepared food per year with each member wasting approximately 4-13 kg per year. The estimated per capita food waste by consumers in this study, including prepared food and drinks waste, is consistent with estimates from other regions in developing countries (6-11 kg per person per year in sub-Saharan Africa and South/Southeast Asia) and lower than that in the developed countries (95-115 kg per person per year in Europe and North America) (Gustavsson et al., 2011). However, this study quantified food waste at using traditional methods which rely on structured interviews, measurement of plate waste and raw food whilst used secondary data to report the quantities of food waste. Household food waste in the study sites was mainly a result of household behavior concerning food preparation and storage as was noted in the developed countries (Gustavsson et al., 2011; Quested et al., 2013). However, increased awareness is required on measuring ingredients when preparing food so that households cook portion sizes which can all be eaten. Education campaigns should also focus on raising awareness on consumer food purchasing skills, meal planning, using leftovers into new meals, interpreting sell-by, use-by and best before dates as well as food management and storage skills so that food can have a longer life even on the shelves (Quested et al., 2013; Aschemann-Witzel et al., 2015). In areas like Richards Bay where households practice agriculture, campaigns should focus on supporting households on how to process their produce, especially drying their vegetables after harvesting, which they can use in the future. Overall, the effects of food waste to the environment also needs to be emphasised such as global warming and climate change (Gustavsson

et al., 2011) and the costs incurred (European Commission, 2010) since one of the biggest gaps in South Africa lies in the awareness and knowledge of food waste in the food system (Pereira, 2014). In the South Africa, costs associated with disposal of household food waste to landfill are estimated at R505 million per annum (Nahman et al., 2012). Considering the rising food prices and global food shortages, reducing food waste significantly increases water and food security in many parts of the world as well as reducing greenhouse gas emissions, conserving energy, protecting soil from degradation and decreasing pressure for land conversion into agriculture (Lundqvist et al., 2008; Kummu et al., 2012).

Chapter Seven

Synthesis and general discussion

7.1. Introduction

As the world continues to face growing challenges of widespread food insecurity and malnutrition (Rosegrant and Cline, 2003; Iram and Butt, 2004; FAO, 2009; 2015; Pinstrup-Andersen, 2009; Godfray et al., 2010), achieving food security for all at all times is obviously increasingly complicated as there are so many interconnecting factors behind. Globally, more than enough food is being produced which can feed everyone (Ingram, 2011; Salami et al., 2011; Gebrehiwot and van der Veen, 2014; Grote, 2014), yet food insecurity remains a pervasive problem (Gebrehiwot and van der Veen, 2014; FAO et al., 2015; WFP, 2016) as almost one billion people face hunger on a regular basis (FAO, 2010; Poppy et al., 2014a; FAO et al., 2015) and more than two billion people suffer from micronutrient deficiencies (Pinstrup-Andersen, 2009; Barrett, 2010; FAO et al., 2015).

When addressing food security issues, one has to consider availability of food, access to food as well as food utilisation (FAO, 1996; Barrett, 2010; Ingram, 2011; Grote, 2014) because these three are closely interlinked. Food may be available but not enough to ensure access to sufficient, safe and nutritious food for all and when a person has access to food, it does not ensure that the food would be utilised effectively (Webb et al., 2006; Pinstrup-Andersen, 2009). The central issue to food security is therefore access to nutritious food and distribution rather than the availability of food. This concept is now widely accepted as the key determinant of food security (Foresight, 2011; Ingram, 2011). However, affordability has been reported as the key determinant to food access for the majority of people which is dependent on food prices and food expenditure, although factors such as household allocation of food to its members and food preferences also affect ability to access food (Ingram, 2011). Inability to access food is the main cause of food insecurity in general, due to increased urbanisation and dependence on purchased food rather than growing one's own food, especially in South Africa (Pereira, 2014). Hunger and nutrient deficiencies are

now common in areas where households mostly rely on purchasing as well as in urban and peri-urban informal settlements across South Africa (Oldewage-Theron and Slabbert, 2008; Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Oldewage-Theron and Kruger, 2011; Battersby, 2012).

As most studies on food security in South Africa have focused on either the rural (Jacobs, 2009; D'Haese et al., 2013; De Cock et al., 2013) or urban areas (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012) as separate entities, the omission of studies which addressed the changes that occurs along the rural-urban gradients in relation to food security where addressed in this thesis as was suggested by Iaquinta and Drescher (2000) so as to fully understand the nature and processes associated with rural-urban transitions. The research in this thesis also focused on unfolding the knowledge gaps regarding the changes in food security and nutrition in medium-sized towns which are positioned along the agro-ecological gradient, which has been often omitted in most studies as well. Small- and medium-sized towns are characterised by persistent population growth as well as high poverty levels (Nel et al., 2011).

The agro-ecological gradient context was empasised in the study to fully understand the importance of agriculture and natural resources in potentially alleviating household food insecurity. The contribution of wild foods to household food security, household food acquisition, coping strategies which households employ during food shortages periods, extent of use of social grants and the quantification of household food waste has also been evaluated in this thesis within a comparative base along both the agro-ecological and rural-urban gradients. The study has identified vulnerable groups and the factors that make them vulnerable to food insecurity. However, the actual individuals suffering from food inadequacy and the severity of the food inadequacy were not identified as the tools alone are not good predictors for this (FAO, 2011). As a detailed discussion of the research results was elaborated in each results chapter, this chapter provides a summary and integration of the overall key findings and it gives recommendations as well as a perspective for future research.

7.2. Key findings

7.2.1. Agro-ecological context and household food security

Overall, households' diets in the study sites were monotonous, dominated by starchy staples, which is consistent with Steyn et al. (2006), Oldewage-Theron and Kruger (2008), Arimond et al. (2010), Schönfeldt et al. (2010), Faber et al. (2011) and Acham et al. (2012) regarding diet of many South Africans. A large percentage of households in all three towns restricted their food consumption to a number of food groups which were insensitive to geographical location and poverty status of the household. More than 50 % of households across all towns and locations consumed similar food groups which were mostly cereals (mostly maize meal). Households were obtaining protein from fish and chicken, and cabbage and onion were the most widely consumed vegetables, with no or very limited intake of fruits. The consumption of other food groups differed by town and location which can be explained by the significant differences in WDDS and HDDS between Richards Bay and the other towns, as well as the significant differences between urban households and those in the other locations. Fruits were mostly consumed by women and households with high dietary diversity scores which is consistent with Arimond and Ruel (2004), Arimond et al. (2010), Schönfeldt et al. (2010) and Faber et al. (2011), who found that most poor communities are at high risk of inadequate micronutrient intake due to low intake of fruits and vegetables. At least 37% of women had a poor dietary diversity (as measured by WDDS) and only 4% enjoyed a good quality diet.

Households in all three towns had a poor dietary diversity (as measured by HDDS) indicated by one in three households were consuming diets that were lacking good quality and diverse foods rich in all essential nutrients. Results from study has revealed that low-income households cannot afford a diverse diet as was shown by strong positive correlations between dietary diversity scores and wealth as well as food expenditure. This study provides empirical evidence that low dietary diversity scores are associated with poor households who have low wealth status and who rely mostly on purchasing food. Therefore, these poor households mostly cope with poverty and rising food prices by adopting monotonous diets based on starch staples. Research from the present study

has shown that dietary diversity is also strongly negatively associated with household food access as measured by HFIAS, is associated with the availability of land and access to food is also strongly positively associated with household size. Thus, large households had less access to food which, in turn, lowered their dietary diversity. However, if households had access to land, then their dietary diversity was higher.

Although the overall dietary diversity scores were low, as measured by both WDDS and HDDS, there were strong significant differences in the scores along the agro-ecological gradient. Households in Richards Bay were more food secure than those in Dundee and Harrismith. Households in Richards Bay showed high levels of food access as indicated by the highest mean HDDS and lowest mean HFIAS. Dundee had limited access to food as was shown by the highest HFIAS scores which were significantly different from those in Richards Bay and Harrismith. Food security in Richards Bay could be attributed to wetter and warmer climatic conditions and longer growing season which favour agriculture and consequently reduced dependence on food purchasing. However, in Dundee and Harrismith, rain-fed agriculture is not viable and most households are not producing their own food and therefore they are net buyers of food, which increases their degree of food insecurity.

Agriculture, including home gardens and community gardens, has been noted to improve food security in many communities by providing families with fresh vegetables thus improving dietary intake and reducing food insecurity (Baiphethi and Jacobs, 2009; Mkwambisi et al., 2010; Zezza and Tasciotti, 2010; Kortright and Wakefield, 2011; Lerner et al., 2011; Carney et al., 2012). Declines in agriculture and reliance on purchased food can have a negative impact on households vulnerable to food insecurity (Altman et al., 2009; Crush and Frayne, 2011; Shackleton et al., 2013; Musemwa et al., 2015). Also, due to the good climatic conditions in Richards Bay, households in the town also had good access to wild foods which could have lowered their risk to food insecurity.

7.2.2. Household food security along the rural-urban continuum

All the food insecurity indicators (WDDS, HDDS and HFIAS) indicated that levels of food insecurity were lower in urban areas compared to rural and peri-urban areas in all towns, with the peri-urban households being the most food insecure. Although there were no significant differences in between rural and peri-urban, results from the present study has indicated that populations in the peri-urban locations were the most vulnerable to food insecurity, for example, about 41 % of households were moderately food insecure and 27 % were severely food insecure in Dundee peri-urban. This could be attributed to rapid urbanisation and over-reliance on food purchasing (Pereira, 2014). Results have revealed that most poor households, especially those residing in peri-urban locations, have limited access to food.

There are high levels of poverty and unemployment in these areas and household income and wealth status significantly influence the level of household food security (Frongillo and Nanama, 2006; Jacobs, 2009; Kaschula, 2008; Kaschula and Shackleton, 2012). This has been illustrated in the present study by strong correlations between wealth, food expenditure and HDDS as well as HFIAS. Low-income households have limited access to food (Huddleston-Casas et al., 2009) and may experience food shortages more than wealthier households as food expenditure makes up a large share of their cash spending. Therefore, in this case, the peri-urban dwellers face much higher levels of food insecurity as they are more vulnerable to the impacts of rising food prices due to low-incomes, low asset ownership, lack of full-time employment of the head of the household and may also have a number of major problems with the dwelling (Oldewage-Theron et al., 2006; Bhattacharya et al., 2004; Naicker et al., 2015). This study supports reports by Oldewage-Theron et al. (2006) and Labadarios et al. (2011) in South Africa and Bhattacharya et al. (2004) in United States of America that poor socio-economic status has an impact on household food insecurity in peri-urban locations. Therefore, poor households, especially those in peri-urban locations cope with poverty and rising food prices by reducing the quality, quantity and number of meals consumed per day.

7.2.3. Household food security and child malnutrition

Results from the study has revealed that stunted growth was the dominant form of malnutrition among children in the study sites, with 45 % of the children in Richards Bay, 23 % in Dundee and 39 % in Harrismith suffering from chronic malnutrition although there were no significant differences between towns and locations. About 21-48 % of young children in South Africa are stunted and approximately 42 % of children in sub-Saharan Africa who are under the age of five are stunted (de Onis et al., 2000; Faber et al., 2001; Mamabolo et al., 2004; Steyn et al., 2005; Shisana et al., 2013). However, the prevalence of wasting followed the agro-ecological gradient with the lowest percentage in Richards Bay and the highest in Harrismith but there were no significant differences along the rural-urban continuum. Overall, the percentage of children who were wasted in the three towns was 18 % which is far greater than 4.5 % that was reported for South Africa in 2005 (Labadarios, 2007) and 6.8 % (4.8 % wasted and 2 % severely wasted) in 2008 (Berry et al., 2013). Results from this study have shown that household food security was associated with wasting. Since HDDS are closely correlated with household food expenditure and wealth index, households with few assets were more likely to suffer from poor dietary diversity and more likely to have wasted and/or stunted children as well as obese children.

The results indicated that gender had a significant influence on wasting, especially in Harrismith, where female children had a significantly lower MUAC than male children. Gender of a child has also been implicated to be associated with nutrition status of children and Baig-Ansari et al. (2006) found that female children were nearly three times more likely to be stunted than male children. In general, this study concludes that the children's nutritional status is related to household food security and socioeconomic status, therefore, any limitations in households' incomes and access to food can result in different forms of nutritional status in small children. The significant negative associations between HDDS and wasting in Harrismith indicates that poverty could be the major determining factor of the nutritional status of children in this town as poor households may find it difficult to serve adequate meals, therefore they resort to cheap and poor quality diets to cope with poverty and rising food prices.

Considering that there were no significant differences in stunting along the agro-ecological gradient, along the rural-urban continuum and between sex of the child, it is a clear indication that responses to address stunting in South Africa need to be prioritized and move beyond relying on food security interventions, including grants, backyard or community gardens and nutritional specific interventions. Indeed, a coherent response that effectively brings nutrition specific (primary and maternal health, water and sanitation, micronutrient supplementation or fortification, exclusive breastfeeding and complementary feeding, dietary supplementation for children, dietary diversification,, nutrition interventions in emergencies), nutrition sensitive programmes and approaches (agriculture and food security especially food access, gender, social safety nets e.g. grants, early child development, women's empowerment , classroom education, water and sanitation) and building an enabling environment (rigorous evaluations of food security and nutrition programmes, advocacy strategies, accountability, incentives regulation, legislation as well as domestic resource mobilization) (Black et al., 2013), together remains a major challenge.

7.2.4. Causes of food insecurity

As Chapter Two and Three revealed that most households in the study sites were food insecure and a significant percentage of children were malnourished, Chapter Four sought to explore the dynamics of the food system in the context of food abundance, food diversity, the causes of food insecurity and households' coping strategies as perceived by the people who experience it. In all three towns, the study concluded that food is available in abundance throughout the year, but it is beyond the reach of many households to consume a more diverse diet. Many had limited access to the food and were compromising on the quality of their food for cheaper and less nutritious foods that only satisfied their hunger, especially in response to the increasing food prices. Puoane et al. (2005), Altman et al. (2009) and Brinkman et al. (2011) also reported that most vulnerable households in South Africa respond to the increase in food prices by compromising the quality of the food by switching to cheaper and less nutritious foods that only satisfy hunger.

Although preference was one of the drivers behind consuming a particular diet, most households did not have a choice but to eat whatever was available and cheap food which they could afford to buy. Although the geographic locations of the study area and North America cannot be comparable, households from both regions were similarly affected by food insecurity and the reasons where the same. Thus, causes of food insecurity cuts across all regions. For example, feelings of having no choice of the food one consumes has been reported by Connell et al. (2005) for children in the United States of America and limited access to food due to low income was also reported by Huddleston-Casas et al. (2009) in the USA. In Canada, Chan et al. (2006) reported that younger people would resort to cheaper foods which are reasonable in terms of cost, quality and ability to satisfy hunger although they might prefer the more expensive healthier foods such as fruits, vegetables or whole wheat products. Therefore, the poorest households in the study sites were being forced by "income circumstances" to adopt monotonous diets just like the majority of poor South Africans (Oldewage-Theron and Kruger, 2008; Arimond et al., 2010; Schönfeldt et al., 2010; Faber et al., 2011). For example, in Harrismith, most poor households had access to cheap but unhealthy foods, which is typical of poor South Africans (Ruel and Garrett, 2004; Faber et al., 2011), as transport costs and high food prices at local shops influenced households not to consume varied diets. The study revealed that higher food prices limited households from accessing diverse foods as was perceived by participants (Chapter Four). Market prices has been implicated to have an influence on the choice and consumption of diverse foods in many households (Monsivais and Drewnowski 2007; Hussain et al., 2014).

However, most households affected by food insecurity were in the rural and peri-urban locations because these have limited access to affordable food and limited financial access (Ballantine et al., 2008; Huddleston-Casas et al., 2009) being characterised by high levels of poverty and unemployment. As per Abdu-Raheem and Worth (2011), the cost of electricity was a contributing factor to household food insecurity in the study sites as high rates diverted cash incomes from purchases such as quality foods. Therefore, total household income and wealth status are the major determinants of household food security in South Africa (Frongillo and Nanama, 2006; Jacobs, 2009; Kaschula, 2008; Shisanya and Hendriks, 2011; Kaschula and Shackleton, 2012) as this

directly affects households' access to food. The scarcity of arable land, water shortages mainly due to poor climatic conditions and lack of resources to practise farming have also been articulated as the barriers to food access, especially for households in Dundee and Harrismith, whilst laziness was often mentioned in Richards Bay. Availability and access to land and water resources can increase agricultural production which in turn can improve food security and reduce poverty (FAO, 2011; Magombeyi et al., 2015).

7.2.5. Vulnerable groups

The research identified the most vulnerable members in the communities to be the low-income households, often female-headed, in the peri-urban and rural locations. Large households, especially in Dundee, and those who are taking care of the children, orphaned children and grandchildren, those families with unemployed members and those with low cash-flow and only survive on social grants as well as those who are unwilling to work on their own were also perceived as being vulnerable to good insecurity. It was also noted by FAO (2009) that the rural and urban poor, the landless and female-headed households are the major groups affected by food price increases, which in turn makes them more vulnerable to food insecurity. Women, especially of reproductive age, as well as children under the age of five were noted to be at high risk of inadequate intake of micronutrients due to household food insecurity from low dietary diversity as noted in other studies (De Pee et al., 2000; Whitaker et al., 2006; FAO, 2009; Arimond et al., 2010; Labadarios et al., 2011; WHO, 2012; Harris-Fly et al., 2015). Children under the age of five could be at greater risk of micronutrient deficiencies due to factors such as recurrent infections, inadequate sanitation and hygiene, maternal education, and less than optimal infant and young child feeding practices (UNICEF, 1990; Bhutta et al., 2008), consuming low nutrient density foods (Faber, 2005) as well as maternal and antenatal factors (Bhutta et al., 2008).

The study has shown that the lack of dietary diversity is severely affecting women of reproductive age from poor households in the towns as was shown by strong positive correlations between

WDDS and wealth as well as food expenditure. Women are more vulnerable because it is often the women's responsibility to make sure the entire household is fed and in many cases there is uneven control of resources in the households which makes the experience of food insecurity to be gender biased (Olson, 2005; Hadley et al., 2008; Sasson, 2012). Studies have also shown that when households experience food insecurity, mothers are more likely reduce to their own intake to secure those of infants and small children to avoid child malnutrition (Kuku et al., 2011; Saaka and Osman, 2013). This was highlighted in the research where women and households in Dundee had the highest food insecurity levels yet the town had the least stunted and wasted children. Household food insecurity status has also been found to be associated with overweight and obesity among women (Townsend et al., 2001; Kaiser et al., 2004; Wilde and Peterman, 2006; Laraia et al., 2010) which could be due to disordered eating patterns (Laraia et al., 2010) or consumption of cheap processed foods that are high in sugar and fat (Ruel and Garrett, 2004; Faber et al., 2011).

Poor socio-economic status has been confirmed in the study to have an impact on household food insecurity to a larger extent in peri-urban locations as was found by Oldewage-Theron et al. (2006) and Labadarios et al. (2011) in South Africa and Bhattacharya et al. (2004) in United States of America. This is also true for rural locations as is shown in this study by the strong significant correlations between WDDS, food expenditure and wealth in rural Dundee and Harrismith, thus increasing the number of households living in extreme poverty, especially in Harrismith. Jacobs (2009) and Rudolph et al. (2012) also noted that low-income households are more likely to suffer from food shortages because food expenditure make up a large share of their spending thereby causing them to be more vulnerable to the impacts of rising food prices. Low-income, low asset ownership and unemployment also increased the risk of food insecurity in households in the informal settlements of Johannesburg (Naicker et al., 2015).

Results from this study has revealed that the peri-urban households have limited access/ entitlements to land which can also make them more vulnerable to food insecurity than both their urban and rural counterparts who had land and or finances. Access to land has been shown to be

positively associated with dietary diversity in this study. Peri-urban dwellers are therefore more sensitive to changes in incomes and food prices than the rural and urban populations because they have limited safety nets to absorb income or price shocks as they purchase more, rather than growing their own food. Therefore, the peri-urban households are more food insecure than rural and urban households although the substantial increases in the dependence on market purchases is affecting both urban and rural households (Baiphethi and Jacobs, 2009).

7.2.6. Coping strategies

When faced with food insecurity shocks, vulnerable households adopted a range of coping strategies to deal with the situation. Due to increases in food prices, most vulnerable households, especially low-income households, would reduce dietary diversity (Brinkman et al., 2010) and households would reduce the consumption of more expensive food items as well as portions and frequency of meals (Oldewage-Theron et al., 2006; Brinkman et al., 2010). Poor households may resort to cheap and poor quality diets to cope with poverty and rises in food prices. Some households in these communities prioritise the diets of small children as they buffer the youngest children from declines in food intake (Saake and Osman, 2013) and some mothers prioritise their children's food consumption over their own (de Pee et al., 2000). Thus households seek to cope with declines in food availability without sacrificing nutrient adequacy for vulnerable members (Saake and Osman, 2013) which are young children in this case.

Many households perceived that the food parcels, the Child Support Grant and school feeding programmes were also part of their coping strategies as they were getting food from the government, use the grant money to buy food as well as sending children to school where they receive food. Social grants and the school feeding programme have been noted to have improved food security for many poor households in the country (Thorntorn, 2008; Altman et al., 2009; Labadarios et al., 2011). However, some poor households resort to the use of wild foods as part of their diet as well as a form of income generation to alleviate household food insecurity and poverty.

Poor households, especially in Richards Bay, where climatic conditions are conducive for the growth of natural resources as well as easy access to fishing, use wild food to reduce food insecurity, which is different from Dundee and Harrismith which are drier and inland towns. Wilds foods have been suggested to provide a 'safety net' or 'fall back' for some households during periods of food scarcity and uncertainty (Shackleton and Shackleton 2004; Shackleton et al., 2006; Vinceti et al., 2008; Powell et al., 2010; Anorld et al., 2011; Sunderland, 2011; McLain et al., 2014) but they are also widely consumed because of cultural and taste preferences (Shackleton, 2003; Shackleton et al., 2010).

7.2.7. The importance of wild foods and social grants in food security

Social grants and the use of wild foods was revealed as a way in which households could cope with food insecurity. In South Africa, there is evidence of social grants improving household food security and reducing poverty (Van der Berg, 2006; Schatz and Ogunmefun, 2007; Thornton, 2008; Altman et al., 2009). The social grants provide the majority of the poor households with improved means to purchase food. In Malawi, social support from the government as cash transfers had a significant impact on food security and food diversity (Miller et al., 2010a; b; 2011). This is also consistent with Gertler's (2005) findings in Mexico and Maluccio and Flores (2005) in Nicaragua, as cash transfers prevented the worsening of food insecurity during periods of food crisis.

Findings from the present study showed significant differences in the proportion of households receiving social grants along the agro-ecological gradient, with more households in Dundee receiving social grants than in Richards Bay and Harrismith, which also differed from each other with Richards Bay having the least percentage of households receiving the grant. The percentage of households receiving social grants also followed the rural-urban continuum with more households in the rural locations receiving grants, followed by those in peri-urban and the least was in the urban locations. Social grants were given to poor households as was shown by the low wealth index and high food expenditure for those receiving grants than those not receiving. Dundee

had the lowest wealth index, followed by Harrismith and Richards Bay with the highest wealth index. The percentage of households receiving grants also followed the same pattern. Social grants were received mostly in the rural and peri-urban areas. Although other studies have shown a significant effect of social grants on household food security, findings from the present study showed no significant influence of social grants to household food security. This could be because recipients of social grants in the study sites had no other form of income or any other means to supplement income from social grant therefore the money would not be enough to cater for all the household needs. This suggests that households were using the money for other things rather than using it to buy food.

The use of wild foods followed the agro-ecological gradient with a greater proportion of households in Richards Bay using wild foods, followed by Dundee and lastly Harrismith. The use of wild foods also followed the rural-urban gradient with the most widespread use in rural areas, followed by peri-urban and lastly urban households. Findings from the study have shown that wild foods are mostly consumed by those households with poor dietary diversity and those who have limited access to food. In Harrismith, households who were using wild foods had lower dietary diversity than those who were not and in Richards Bay, households who were consuming wild foods had more limited access to food than those who were not. The consumption of wild foods, especially wild vegetables, could have been acting as a 'safety net' in the towns since the majority of the households who were consuming wild foods were from low-income households and could not afford to buy all their food on the market, thus relying on these products for food in order to reduce food insecurity. Wild foods can contribute to the alleviation of household food insecurity in many households (Shackleton et al., 2007; Vinceti et al., 2008; Oluoch et al., 2009; Bharucha and Pretty, 2010; Arnold et al., 2011; Legwaila et al., 2011; Mavengahama et al., 2013). However, the study did not show any influence imposed by the use of wild foods on household food security as there were no significant differences in food security indicators between households who were consuming wild foods and those who were not.

7.2.8. Household food waste and reasons for wasting food

Chapter Six sought to explore if households where using the food they had acquired sparingly or if they were also wasting it considering that high levels of food insecurity and child malnutrition had been reported in the previous chapters. Findings show that households in all three towns were minimising the amount of prepared food they threw away as more than 70 % of the households in all towns consume their meals at home with all household members, ate the same meal at the same time, rarely left any food uneaten and if it happened that they had not finished the food, they usually kept it and consumed it in the next day or two. Only 35 % of the sampled households had thrown away any food in the previous 48 hours and the greatest percentage had thrown away prepared food, especially pap, meat and vegetables (mostly cabbage) and to a lesser extent drinks.

There were no significant differences in the proportion of households who were wasting different types of food along the agro-ecological gradient. Along the rural-urban continuum, significant differences were only observed in the percentage of households wasting drinks, with urban households wasting more drinks than the rural and peri-urban households. In Richards Bay, more food was wasted by the rural households whilst in Dundee it was the peri-urban and in Harrismith urban households wasted more food. Households in all towns wasted higher quantities of unprepared food than prepared food and drinks. The amount of unprepared food waste was limited to town and Richards Bay wasted higher quantities than the other towns. This could be because of high levels of food access in Richards Bay which could be attributed to wetter and warmer climatic conditions and longer growing season which favour agriculture and higher socio-economic status. The same weather conditions can also affect the processing and storage of the produce which could end up rotting as this was one of the reasons why about 36 % of the households in Richards Bay threw away unprepared food. Households in the study sites waste more quantities of food per year (4-13 kg per person per year of unprepared food; 2-3 kg per peson per year of prepared food and 2 l per person per year of drinks) compared to 6-11kg per person per year which is estimated for sub-Saharan Africa (Gustavsson et al., 2011).

Household food waste was closely associated with household size and results show that smaller households were wasting more prepared food than larger households on per capita basis. Studies

from developed countries show that household size significantly influences food wastage as larger households waste less food per person than smaller households (Van Garde and Woodburn, 1987; WRAP, 2009; Partitff et al., 2010). In Richards Bay, households with poor access to food were also wasting more unprepared food than those with better access. This could be due to overbuying and hoarding behavior when food is sold at lower prices and the food ends up passing the expiry date before being used. For perishable food, the quality could be poor and the food spoilt before being used due to poor storage and cooling facilities. Households also prepared large portions of food which they ended up not eating and although they could have served leftovers, they could not use them on time. This is consistent with Exodus (2006) who reported poor portion control as households in UK prepared meal portions that were too large, resulting in an inability to finish all the food. The present study showed no significant associations between the quantities of food waste (prepared, unprepared and drinks) with the households' socio-economic status indices (food expenditure and wealth index) as also reported by Parfitt et al. (2010).

Findings from this study revealed that households mostly threw away prepared food when the food had visibly gone bad or smelt bad, when they had prepared too much and it was not possible for them to save leftovers and when they had prepared too much and did not want to save leftovers. Households were also discarding prepared food when they had served too much and could not finish all the food, when the food was burnt/ruined during cooking/preparation, some would save leftovers but were not used in time and some households would find the food not tasting nice. However, unprepared/raw food was mostly thrown away if the food had passed best before date or if the food was bad (rotten, sour or mouldy) and households wasted drinks mostly when they had passed the best before date.

7.3. Conclusion and recommendations

The study analysed the changes in food insecurity along an agro-ecological gradient as well as along the rural-urban continuum. The results of this study form the basis of a deeper understanding of the dynamics of food security and nutrition that occur along agro-ecological gradients and along

the rural-urban gradients in medium-sized South African towns. The approach used in this study has enriched food security research by including the areas and households which were often excluded in scientific studies, as previous research focused on large cities and rural and urban areas as separate entities with no comparative basis along the rural-urban gradient. The WDDS, HDDS and HFIAS tools have been used as indicators of access to food and these were able to distinguish households with different levels of vulnerability to food insecurity through identifying groups with poor access to food in mid-sized towns in South Africa. Although households in all three towns were vulnerable to food insecurity with poor diets and generally low WDDS, HDDS and high HFIAS, results have shown that areas that are coastal, wet with longer growing seasons and where rain fed agriculture is viable, are much better than the inland and drier areas who mostly rely on purchasing food. The nutritional status of children under the age of five was also measured along the agro-ecological gradient and rural urban continuum. In general, the prevalence of food insecurity and wasting followed the agro-ecological gradient, with households in Richards Bay less affected. Considering that there were no significant differences in stunting along the agro-ecological gradient, along the rural-urban continuum and between sex of the child, it is a clear indication that responses to address stunting in South Africa need to be prioritized and move beyond relying on food security interventions, including social grants, backyard or community gardens and nutritional specific interventions. Indeed, a coherent response that effectively brings nutrition specific programmes (e.g. primary and maternal health, water and sanitation, micronutrient supplementation or fortification, exclusive breastfeeding and complementary feeding, dietary supplementation for children, dietary diversification, nutrition interventions in emergencies), nutrition sensitive programmes and approaches (e.g. agriculture and food security especially food access, gender, social safety nets e.g. grants, early child development, women's empowerment, classroom education, water and sanitation) and building an enabling environment (e.g. rigorous evaluations of food security and nutrition programmes, advocacy strategies, accountability, incentives regulation, legislation as well as domestic resource mobilization) (Black et al., 2013), together remains a major challenge which needs to be addressed to support interventions and programmes to enhance growth and development and best child health.

However, the prevalence of food insecurity did not follow the rural-urban continuum as a greater percentage of households who were food insecure was found in the peri-urban locations although this was not significantly different from the rural percentages. The prevalence of wasting and stunting was also higher in the peri-urban locations. In South Africa, food insecurity is perceived to mostly affect rural populations as deep levels are commonly noted in rural areas (Ballantine et al., 2008; Jacobs, 2009; D'Haese et al., 2013; De Cock et al., 2013; Musemwa et al., 2015). However, other studies have argued that the urban populations are more vulnerable than their rural counterparts and suggest that food security development interventions need to focus on urban areas (Frayne et al., 2009; Frayne et al., 2010; Crush and Frayne, 2011; Battersby, 2012). In this study, I argue that food insecurity is a problem for both peri-urban and rural households as both are affected by problems with access to food and therefore food security intervention programmes should focus on developing both the rural and peri-urban communities.

Households in the study sites were knowledgeable about eating healthily but had difficulties in acquiring diverse foods due to limited income as they mostly depend on purchasing food. Decreased own production, lack of suitable land, water scarcity due to drought, limited access to food due to limited income and high food prices were the main causes of household food insecurity in mid-sized towns in South Africa. Women of reproductive age, small children, female-headed households, the unemployed and orphaned children were the most vulnerable groups. The study provided an estimate of the percentages of households that are at risk of food insecurity, yet the actual individuals suffering from food inadequacy and the severity of the food inadequacy were not identified as the tools alone are not good predictors for this (FAO, 2011).

Although the role of social grants, school food programmes and use of wild foods has been emphasised in playing an important role in alleviating food insecurity, it is not enough as the majority of households are facing challenges with food insecurity. In all three towns, food was available in abundance throughout the year but beyond the reach of many households to consume a more diverse diet. The study highlighted the complexity of the food system in the study sites which relies on own production, collecting from open spaces, donations and to a larger extent

market purchasing, in the context of unemployment, low income, water and land shortages as well as theft. As food prices are continuing to increase gradually and worsening household food insecurity, ways to shift 'income circumstances' of these households and also to increase own production of food at household level needs to be advocated. Therefore, focus should be placed on capacity building, employment creation and providing resources (land, inputs and water) for households to fully practice food production which has been noted in this study as the most important way to improve food security of poor households in both rural, peri-urban and urban areas through increased food access and consumption of nutritious food as well as reduced dependence on market purchase.

Households may be encouraged to practise own production through home gardens or engage in community gardening as these may provide families with fresh fruits and vegetables, can reduce food insecurity, improve dietary intake and strengthen social relationships as community members provide advice and support to help overcome challenges and all receive the benefits the gardening project offers (Carney et al., 2012). This is particularly pertinent in the context of high unemployment, which means high labour availability and low cash resources. Furthermore, home gardens have direct contributions to household food security through increasing availability, accessibility and utilisation of food; which are the three pillars of food security. In areas like Dundee and Harrismith which are often affected by droughts, research should focus on climate smart agriculture approaches and as well as use of drought resistant crops.

Results from this study has revealed that households with limited access/ entitlements to land were more vulnerable to food insecurity than those who had land and or finances. Access to land has been shown to be positively associated with dietary diversity in this study. The observed relationship between access to land and dietary diversity (in particular agro-ecological zone), has an important implication for municipalities making available such land, along with relevant support and inputs to affected households. The underlying logic being providing what is required

to enable people to diversify food access particularly through reducing dependence on food purchasing as many will make use of the land to produce their own food.

As the world's communities and households are facing food security and nutrition challenges, households need to be encouraged to minimise the amount of food waste as this may significantly increase water and food security (Lundqvist et al., 2008; Kummu et al., 2012). Future research should focus on education to increase households' knowledge and awareness on measuring food ingredients when preparing food so that they cook portion sizes which can all be eaten. Education campaigns should also focus on raising awareness on consumer food purchasing skills, meal planning, using leftovers into new meals, interpreting sell-by, use-by and best before dates as well as food management and storage skills so that food can have more life-time even on the shelves. In areas like Richards Bay, where households practice agriculture, campaigns should focus on educating households on how to process their produce, especially drying their vegetables after harvesting which they can use in the future. Reducing food waste significantly saves money and reduces greenhouse gas emissions, conserves energy, protects soil from degradation and decreases pressure for land conversion into agriculture (Lundqvist et al., 2008; Kummu et al., 2012).

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Appendices

Appendix 1: Household food and nutrition surveys

Food and Nutrition Questionnaire

IMPORTANT: Interview woman of reproductive age (15 – 49 years) preferably!

Date_____ **Researcher/Enumerator**_____

Sampling ID (e.g. SA_RIC_001 or SA_DUN_001 or SA_HAR_001) _____

Name of suburb or section_____

Alternative household (in case originally sampled household is not available)
◯ 1st house to the left ◯ 2nd house to the left ◯ 3rd house to the left

A Household Background Information

A1 Interviewee

Age of interviewee (in years) _____**Sex of interviewee** ◯ male ◯ female

Highest education grade attained of interviewee_____

Main economic occupation
◯ none ◯ housewife ◯ owner farmer ◯ farm wage labourer
◯ non-farm wage labourer* ◯ salaried job* ◯ own business* ◯ other*

***please specify:** _____

Household head if different from the interviewee

Age of household head (in years)_____**Sex of household head** ◯ male ◯ female

Highest education grade attained of household head_____

Main economic occupation
◯ none ◯ owner farmer ◯ farm wage labourer ◯ non-farm wage labourer*
◯ salaried job* ◯ own business* ◯ Pensioner/ Retired ◯ other*

***please specify:** _____

A2 How many people live together with you in this household? (By "household" we mean those of you that sleep under the same roof and take meals together at least four days a week)

Sex	adults ≥18 years	children (6-17 years)	Small children (≤ 5 years)
Female			
Male			

A3 How many adults in the HH work full-time (self-employed or employed) for cash remuneration? Males_____ Females_____
A4 How many adults in the HH work part-time or casually (for themselves or employed) for cash remuneration? Males_____ Females_____

A5 How many of the following does your household own?

Car/Truck		Tractor		TV		Fridge		Cattle/Goats		House	
Motorbike		Bicycle		Radio		Cell phone		Chicken			

A6 Does the house you live in have electricity? ◯ yes ◯ no

A7 How many rooms does the house have? _____

A8 How long have you lived in this house? Years_____ OR Months_____

A9 How long have you lived in this neighbourhood or village? Years___ OR Months___

A10 If less than 10 years, from where did you move?

◯ Same neighbourhood/village/quarter ◯different neighbourhood/quarter in same town/city ◯ Another place in the same province ◯Another place in a different province

B Aspects of Household Food Acquisition

B1 How often do you normally obtain food from these sources?

	At least once a week	At least once a month	At least once in every six months	Less than once a year	Never
Own production in the town					
Own production in the outskirts of town					
Own production in the rural areas					
Purchase from general food markets					

Purchase from small retail, kiosk or fast food outlets					
Purchase from supermarket(s)					
Purchase from door-to-door salesman					
Collected from open spaces in town					
Collected from open spaces on outskirts of town					
Collected from open spaces in rural areas					
Donated by family/relatives					
Donated by friends					
Donated by government or NGOs					

B2 If your household is doing own food production, how much land do you cultivate?

Number___ **Unit** ◯ ha ◯ acre ◯ m²

B3 Approximately how much does your household normally spend on food purchases per week?

Amount_____ **Currency** ◯ ZAR

B4 Estimate the proportion of your household food needs that are obtained from own-production

Own production	**None**	**Less than half**	**More than half**	**All**
Staple foods				
Vegetables				
Fruits				
Milk (dairy)				
Meat				
Fish				
Eggs				
Others (specify)				

B5 Estimate the proportion of your household food needs that are obtained from wild collected foods

Wild collected foods	**None**	**Less than half**	**More than half**	**All**
Vegetables				
Fruits				

Meat				
Fish				
Edible insects				
Others (specify)				

C Assessment of Household Food Security by using the Household Food Insecurity Access Score (HFIAS) Tool

C1 In the past four weeks, did you worry that your HH would not have enough food? If yes, how often did this happen?

◯ No ◯ Yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C2 In the past four weeks, were you or any HH member not able to eat the kinds of foods you preferred because of lack of resources ("lack of resources" means not having the means to get food, either for growing it, purchasing it or trading for it)? If yes, how often did this happen?

◯ No ◯ Yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C3 In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources? If yes, how often did this happen?

◯ No ◯ Yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C4 In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because a lack of resources to obtain other types of food? If yes, how often did this happen?

◯ No ◯ Yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C5 In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? If yes, how often did this happen?

◯ No ◯ yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C6 In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food? If yes, how often did this happen?

◯ No ◯ yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C7 In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food? If yes, how often did this happen?

◯ No ◯ yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C8 In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food? If yes, how often did this happen?

◯ No ◯ yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

C9 In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food? If yes, how often did this happen?

◯ No ◯ yes, rarely (once or twice in the past four weeks)

◯ Yes, sometimes (three to ten times in the past four weeks)

◯ Yes, often (more than ten times in the past four weeks)

D Individual Dietary Diversity (only for women of between 15 - 49 years)

D1 What is your relationship to the head of household?

wife		sister		niece		mother	
daughter		grand daughter		aunt		Other*	

*specify_____

D2 Did you eat anything (meal or snack) outside of the home during the last 48 hours (i.e. yesterday or the day before yesterday)?
◯ yes ◯ no

D3 Did your food differ during the last 48 hours (yesterday and the day before yesterday) from your usual diet due to a special reason? (e.g. birthday, wedding ceremony, etc.)?
◯ yes ◯ no

D4 Were you sick yesterday?
◯ yes ◯ no

D5 Age of respondent in years_____

D6 Please describe the foods (meals and snacks) and drinks that you consumed during the past two days day and night at home and the food that was not eaten.

D6 (a) Food and drinks consumed yesterday

Meal	**Ingredients**	***Source of ingredients**	***Source of energy**
Before breakfast			
Drinks			
Breakfast			
Drinks			

Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? *(* cup-full *)*			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			
Snacks before lunch			
Drinks			
Lunch			
Drinks			
Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? *(* cup-full *)*			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			
Snacks before dinner			
Drinks			
Dinner			

Drinks			
Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? (* *cup-full* *)			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			
Snacks after dinner			
Drinks			

D6 (b) Food and drinks consumed the day before yesterday

Meal	**Ingredients**	***Source of ingredients**	***Source of energy**
Before breakfast			
Drinks			
Breakfast			

Drinks			
Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? (* *cup-full* *)			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			
Snacks before lunch			
Drinks			
Lunch			
Drinks			
Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? (* *cup-full* *)			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			

Snacks before dinner			
Drinks			
Dinner			
Drinks			
Was all the food prepared for breakfast eaten?		Yes	No
If not, approximately how much was left? (* *cup-full* *)			
If not, why was it not all eaten? *(* codes *)*			
If not, what was done with the remainder? *(* codes *)*			
Snacks after dinner			
Drinks			

D7 Dietary Diversity Score (DDS)

Instructions for determining the DDS: When the respondent's recalls are completed, fill in the food groups based on the information recorded above.

(1) Cereals

Corn/maize, rice, wheat, sorghum, millet or any other grains or food made from these (e.g. bread, noodles, porridge etc.), local foods (ugali, porridge, paste etc.)

◯ yes

◯ no

(2) White roots and tubers

White potatoes, white yam, white cassava or other foods made from roots

◯ yes

◯ no

(3) Vitamin A rich vegetables and tubers

Pumpkin, carrot, squash or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper)

◯ yes

◯ no

(4) Dark green leafy vegetables

Dark green leafy vegetables, including wild forms ones + locally available vitamin A rich leaves such as bra, amaranth, cassava leaves, cowpea leaves, onion leaf, etc.

◯ yes

◯ no

(5) Other vegetables

Other vegetables (e.g. tomato, onion, eggplant, okra) + other locally available vegetables

◯ yes

◯ no

(6) Vitamin A rich fruits

Ripe mango, watermelon, apricot (fresh or dried), ripe papaya, dried peach and 100% fruit juice made from these + other locally available vitamin A rich fruits

◯ yes

◯ no

(7) Other fruits

Other fruits, including wild fruits and 100% fruit juice made from these (e.g. pineapple, apple, ebony fruits, blackberry, cashew fruits)

◯ yes

◯ no

(8) Organ meat

Liver, kidney, heart or other organ meats or blood-based foods

◯ yes

◯ no

(9) Flesh meats

Beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects

◯ yes

◯ no

(10) Eggs

Eggs from chicken, duck, guinea fowl or any other egg

◯ yes

◯ no

(11) Fish and seafoods

Fresh or dried fish or shellfish

◯ yes

◯ no

(12) Legumes, nuts and seeds

Beans, peas, lentils, nuts, seeds, groundnuts, cowpea, soybean, bambara beans, pigeon peas, cashew nut, seasami, pumpkin seeds or foods made from these

◯ yes

◯ no

(13) Milk and milk products

Milk, cheese, yogurt or other milk products

◯ yes

◯ no

(14) Oils and fats

Oil, fats or butter added to food or used for cooking

◯ yes

◯ no

(15) Sweets

Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes

◯ yes

◯ no

(16) Spices, condiments, beverages

Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages

◯ yes

◯ no

(17) Red palm products

Red palm oil, palm nut or palm nut pulp sauce

◯ yes

◯ no

E Care Giving Practices including Breast Feeding

Interview a mother/caregiver of a child of between 6 months to 2 years old. If there is no child of that age group, skip the section. Throughout the following section make sure that you only talk about one particular child.

E1 Name of the child (only if child is between 6 months and 2 years)

_____

E2 What is the age of your child? (in full months only)_____

E3 During your pregnancy with above mentioned child, how many times did you visit a health care facility for a prenatal visit? _____

E4 Did you ever breastfeed the above mentioned child?
◯ yes ◯ no

E5 How many hours after birth did you start breastfeeding the above mentioned child? _____

E6 Did you feed colostrum (the breast milk produced in the first 3 days after birth) to the above mentioned child?

◯ yes ◯ no

E7 During the first 3 days after birth, was the above mentioned child given anything other than breast milk?

◯ yes ◯ no

E8 If yes, what was it? _____

End of survey: Thank you very much for your participation!

Would you be willing to participate in further research related to food security and nutrition?

◯ yes ◯ no

Do you have any questions for us?

Appendix 2: Household food waste survey

FOOD WASTE QUESTIONNAIRE

1. Where do you usually eat your meals

	Breakfast	Lunch	Dinner
Always at home			
Mainly at home			
Partly at home and partly elsewhere			
Mainly elsewhere			
Always elsewhere			

2. FOR MEALS *AT HOME*

	Breakfast	**Lunch**	**Dinner**
1. Who *usually* prepares the meal			
2. Do most household members usually eat the same meal	◯ yes ◯ no	◯ yes ◯ no	◯ yes ◯ no
3. How often is not all the food eaten:			
- Very rarely			
- < 5 times/month			
- 5-10 times/month			
- 11-20 times /month			
- > 20 times/month			
4. What usually happens to the food leftovers:			
- Kept & eaten in the next day or two			
- Given away to other people			
- Fed to animals			
- Thrown away			

3. HOUSEHOLD BEHAVIOUR

a. Are some members of your household more likely to waste food than others?

◯ yes ◯ no

If yes, who and why? _____

b. Have you ever discussed/talked about it with them? ◯ yes ◯ no

If no, why not? _____

4. FOR PREPARED OR COOKED FOOD

a. When did you last throw away any *prepared or cooked* food? _____

b. What type of food was it? _____

c. Approximately how much was thrown away (cup-full) _____

d. Why did you throw it away? (Choose from a list of possible options)

◯ Prepared too much and not possible to save leftovers
◯ Prepared too much and do not want to save leftovers
◯ Served too much and could not finish all
◯ Saved leftovers but were not used in time
◯ Food was burnt/ruined during cooking/preparation
◯ The food did not taste well
◯ Always want to eat the freshest food
◯ Not liking the food prepared
◯ Accident
◯ Made a mistake while preparing
◯ Want to keep kitchen clean/organized
◯ Food visibly gone bad or smells bad
◯ Food not visibly bad but not worth the risk

e. Are there particular times of the week, or month or year that you are likely to throw away more prepared food than normal? ◯ yes ◯ no

If yes, when & why? _____

_____

5. FOR UNPREPARED OR RAW FOOD

a. When did you last throw away any *unprepared or raw* food? _____

b. What type of food was it? _____

c. Approximately how much was thrown away (tins/volume/kg)? _____

d. Why did you throw it away?

◯ Passed best before date ◯ Bought the wrong thing ◯ Bought too much
◯ Too large package ◯ Bad/broken package ◯ Accident
◯ Package difficult to empty completely ◯ Buying more perishable food
◯ Food has gone bad (rotten, sour or mouldy)
◯ Not resealing/repackaging opened products so they stay fresh
◯ Poor storage management – not eating foods that need to be eaten first

e. Are there particular times of the week, or month or year that you are likely to throw away more unprepared/raw food than normal? ◯ yes ◯ no

If yes, when & why? _____

_____

6. FOR DRINKS

a. When did you last throw away any drinks in a bottle/carton? _____

b. What type of drink was it? _____

c. Approximately how much was thrown away (volume)? _____

d. Why did you throw it away?

◯ Too large package ◯ Bad/broken package ◯Accident
◯ Passed best before date ◯ Bought the wrong thing ◯ Bought too much

e. Are there particular times of the week, or month or year that you are likely to throw away more bottled/carton drinks than normal? ◯ Yes ◯ No

If yes, when & why? _____

_____

7. POST HARVEST FOOD WASTE

a. Does your household have a food garden or field? Garden ◯ Yes ◯ No
Field ◯ Yes ◯ No

If yes, in *the last season* have you ever harvested some food items from the garden or field and then thrown it away before using it? ◯ Yes ◯ No

If yes, what was it? _____

Why did you throw it away? _____

_____

8. How do you think your household compares to others in this community in terms of the amount of food thrown away?

a LOT more	a BIT more	more or less the same	a BIT less	a LOT less	Don't know

Why? _____

_____

9. Please indicate your level of agreement or disagreement with the following statements (tick which most applies):

Statement	Strongly disagree	Mildly disagree	Neutral	Mildly agree	Strongly agree	Don't know
Throwing away some food in the home cannot be avoided						
Everyone has to throw food away sometimes						

Throwing away food bothers me a lot because it's a waste of money and resources						
I usually check the sell-by date when purchasing food items that have such information						
The shop where I buy most of my food often has goods that have passed their sell-by date						
The teenagers of today waste more food than when I was a teenager						
The media (radio/television/newspapers/ magazines) I am exposed to discusses food waste reasonably regularly						
Because South Africa as a country produces enough food, food waste is not something to be concerned about						
Every household should have a vegetable garden						
Richer households generally waste more food than poorer ones						
I'd rather throw food away than risk food poisoning						
Food thrown away is not an issue as it is natural and biodegradable						
Discarded food packaging is a greater environmental issue than food thrown away						

End of survey: **Thank you very much for your participation!**

Do you have any questions for us?