CHILDREN'S ANTHROPOMETRIC INDICES AS PROXIES FOR MEASURING HOUSEHOLD FOOD SECURITY

by

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2013

Submitted in fulfilment of the academic requirements for the degree of Master of Agriculture (Food security) in the School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg

ABSTRACT

Food security is a complex concept with no definite measure. Measures of household food security are needed for many different applications in situations where households are chronically vulnerable due to deepening poverty, environmental and climatic shocks, rapid economic change and conflict. Indeed, measurement problems remain a major challenge, not only for research, but particularly for targeting, programme management, monitoring and evaluation.

The objective of the study was to develop a specific analytical approach for measuring food security, by making a comparison of approaches that use children's anthropometric indices (CAI) and Household Food Insecurity Access Scale (HFIAS). The study was specifically aimed at determining the relationship between children's anthropometric indices and household food security. The pros and cons of using children's anthropometric indices as indicators of food security were then assessed.

The study area was Msunduzi Municipality in Pietermaritzburg, KwaZulu-Natal Province, South Africa. A total of 180 children, aged between 0 and 60 months, took part in the study and the sample was geographically broken down equally between two clusters: Edendale and Northdale Hospitals.

The study found that using univariate analysis, "overweight" in "weight-for-height" was statistically significantly associated with HFIAS categories ($p<0.05$). From the bivariate, multiple linear regressions were conducted and the result was that "height-for-age" index was statistically significantly associated with "mild household food insecurity" ($p<0.05$). On the other hand, "weight-for-age" and "weight-for-height" were not statistically significantly associated with categories of HFIAS. The lack of significant association between household food insecurity and these two indices was not expected, because of the substantial evidence that a household's access to food is one of the key determinants of the nutritional status of children.

Alternative indicators were used to make up for the established weak association, so that proxies indicators of poverty, including "households which are continuously using wood fuel for cooking", "households without clean water", "households with access to the child grant" were

statistically significantly associated with children's anthropometric indices. Indeed, It was found that "height-for-age" (≤-2SD) and "weight-for-height" (≤-2SD) indices were statistically significantly associated with "households which are continuously using wood fuel for cooking ($p<0.1$) and ($p<0.1$), respectively. "Weight-for-age", "height-for-age" and "weight-for-height" were statistically significantly associated with "households without clean water" ($p<0.01$, $p<0.1$ and $p<0.01$), respectively, and all these three indices were statistically significantly associated with "households with access to the child grant ($p<0.01$, $p = 0.1$ and $p<0.01$), respectively.

The relationship found between anthropometric indices, especially "overweight" in the "height-for-age" and "weight-for-height" index, proxy indicators of poverty and HFIAS categories suggest that children's anthropometric indices can be good indicators for household food security measurement. However, they have to be used in combination with other indicators.

It is concluded that food security strategies should consider socio-economic characteristics of households in order to achieve more than a marginal reduction in the number of chronically undernourished people. Policy recommendations should focus on addressing overweight children whose anthropometric measures are associated with the physical environment and the accompanying levels of physical activity. Further research may need to assess the relationship between food security and quality of life.

DECLARATION

I, …… declare that:

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As the candidate's supervisor I have approved this thesis/dissertation for submission.

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Dr M. MUDHARA (Supervisor)

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Dr U. KOLANISI (Co-supervisor)

ACKOWLEDGEMENTS

I acknowledge the following persons and institutions which provided me with support and assistance during this study. Without their help this work would have not been possible.

- Doctors Maxwell Mudhara and Unathi Kolanisi, for their great supervision, keen support and motivation. The assistance, knowledge, guidance and ideas presented to me were appreciated;
- I am so grateful to my God for I live, move and have my being in beloved Jesus Christ and I am invincibly God-Protected and Directed;
- My family (my wife Judith, daughters and sons), this dissertation is dedicated to you for your material, psychological and spiritual support and for being there for me when needed you.
- I dedicate this work to the strong team from the “Society of Saint Vincent de Paul”, directed by the master’s hand of Tim McNally, for their untiring support, including accommodation and food;
- I express my acknowledge to the team composed of Mrs Marie Odendaal, Morag Peden, Penny Haswell, Marina Solveig Bang and Anni Tonin, who are working as the heroes in the shade, with a hand of support and encouragement for me and my family;
- Pastor Samson, I thank you for your confidence in me and for holding the vision of success;
- I would like to thank the University of KwaZulu-Natal, especially the College of Agriculture, Engineering and Science for the scholarship awarded to me;
- The KwaZulu-Natal Department of Health, especially the Health Research & Knowledge component, Edendale Hospital, Northdale Hospital and CHC Imbalenhle for their approval letters that allowed me to conduct my research. Also to all the participants (household members) for the valuable information they provided;
- All my colleagues from the African Centre for Food Security, for their collaboration and mutual encouragement during my research

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LIST OF ABREVIATIONS AND ACRONYMS

AMICAALL	Alliance of Mayors' Initiative for Community Action on Aids at Local Level
BMI	Body Mass Index
BRG	Bio-Resources Group
CAI	Children's Anthropometric Indices
CHC	Community Health Centre
DA	Determinant Analysis
DV	Dependent Variables
EC-FAO	European community - Food and Agriculture Organization
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
FBF	Feed the Babies Fund
FIVIMS	Food Insecurity and Vulnerability Information and Mapping Systems
HFA	Height-for-Age
HFI	Household Food Insecurity
HFIAS	Household Food Insecurity Access Scale
HFIASC	Household Food Insecurity Access Scale Categories
HFIASD	Household Food Insecurity Access Scale Domain
HFIASS	Household Food Insecurity Access Scale Scores
HFS	Household Food Security
HH	Household
HIV/AIDS	Human immunodeficiency virus infection/acquired immunodeficiency syndrome
IFAD	International Fund for Agricultural Development
INP	Integrated Nutritional Programmes
IPC	Integrated Food Security Phase Classification
IQ	Intelligence Quotient
L.O. S	Length of Stay
LBW	Low Birth Weight
MDGs	Millennium Development Goals
MUAC	Mid-Upper Arm Circumference
NCHS	National Centre for Health Statistics
NDA	Net Domestic Availability
NGOs	Non-Governmental Organisation

PCAFA	Per-Capita Annual Food Availability
PHC	Primary Health Care
PMB	Pietermaritzburg
RNIS	Refugee Nutrition Information System
SD	Standard Deviation
SNNPR	South Nations, Nationalities and Peoples' Regional State
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFA	Weight-for-Age
WFH	Weight-for-Height
WFP	United Nations World Food Programme
WHO	World Health Organization
ZS	Z-Score

CHAPTER I: INTRODUCTION

Food security is a complex concept with no definite measure. Measures of household food security are needed for many different applications in situations where households are chronically vulnerable due to deepening poverty, environmental and climatic shocks, rapid economic change and conflict. Indeed, measurement problems remain a major challenge, not only for research, but particularly for targeting, programme management, monitoring and evaluation (Maxwell *et al.,* 1999).

The United States Agency for International Development (USAID), cited by Chaparro (2012), emphasised that food security exists when "all people at all times have physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life". Achieving food security relies on fulfilling three elements, namely adequate food availability, adequate access to food by all people and appropriate food utilization and consumption (Chaparro, 2012).

Household food insecurity has been associated with several health and nutrition outcomes, in both developed and developing countries. By negatively affecting food consumption, either through reduced quality or quantity of food, household food insecurity can potentially worsen nutritional status (Chaparro, 2012). Food insecurity may also affect nutritional status through its effects on stress, depression, parenting and infant feeding. However, the relationship between household food insecurity and nutritional status of adults and children, particularly in developing countries, is not well established (Chaparro, 2012). There are few studies from developing countries on the relationship between household food insecurity and nutritional status among adults and children. For example, Hammami *et al.,* (2006) state that living conditions and socio-economic restrictions on Palestinian refugees living in Lebanon do not appear to influence the growth of infants younger than two years of age but may contribute to the growth deficit in older children. One study shows that household food insecurity was associated with obesity among rural women (Chaparro, 2012), while, in another, household food insecurity was associated with underweight among adults. Among children, in one study, where 69% of households were considered food insecure, the household food insecurity level was not significantly associated with stunting, underweight, or anaemia among children under two years of age (Chaparro, 2012).

The different methods used for measuring food security lack clarity and consistency regarding the use of terms and classification of food security**.** There are increasingly strong calls for improved measurement of food security, including food utilisation and perception.

1.1 RESEARCH PROBLEMS

There is a need for a practical and operational approach for measuring food security, because the different methods used to date to measure food security or malnutrition are commonly considered as lacking clarity and consistency regarding the use of terms and classification (FAO, 2008) .The search for viable indicators is driven by the lack of a 'gold standard' measure for food security. Measures of consumption, poverty and malnutrition are all used as proxy measures and indicators of assets and income are used more as determinants of food security. All are related to food security, yet none of them capture the concept accurately or completely. In particular, none of them gets at the crucial issue of vulnerability (Maxwell *et al.*, 1999). Food security is too complex to ever be captured adequately by a single indicator. In brief, measuring household food security in valid and reliable ways is a major challenge, and the search for good, cost-effective alternative indicators continues (Maxwell *et al.*, 1999).

1.2 GENERAL OBJECTIVE

To develop a specific and analytical approach of food security measurements that compare children's anthropometric indices and Household Food Insecurity Access Scales (HFIAS) methods for measuring household food security.

1.2.1 Specific objectives

- To characterise the children's anthropometric indices and household food security in the target population.
- To determine the relationship between children's anthropometric indices and the categories of HFIAS and household socio-economic factors.
- To assess the advantage of using children's anthropometric indices as indicators of food security.

1.2 HYPOTHESES

- There is a relationship between children's anthropometry indices and household food security.
- Children's anthropometric indices are good indicators for measuring household food security.

1.3 IMPORTANCE OF THE STUDY

Assessing the health of children in developing countries is a goal of national and international organisations, because of their vulnerable character. Assessing food security is urgently needed for its practical and operational classifications that take into account the specific problem of children. Monitoring food security can help to identify and understand the basic necessity for the well-being of the population, especially children under five years and to identify population subgroups with malnutrition. It can also help public officials, policy-makers, service-providers, and the public at large to assess the changing needs for assistance and the effectiveness of existing programmes (Bickel, 2000). The health of children is a mirror on the health, social standing and economic resources of their parents (Trapp & Menken, 2005). Anthropometric measurements have the additional advantage of providing information on past nutritional history, which cannot be obtained with equal confidence using other assessment techniques (Gibson, 2005).

1.4 STUDY LIMITS

The study was conducted in the Msunduzi Municipality, Pietermaritzburg in KwaZulu-Natal Province, on a target population composed of children less than five years old, with specific nutritional problems, and their households.

1.5 ASSUMPTIONS

It has been assumed that the caregivers and nurses working in the clinic provide accurate and appropriate information on children's anthropometry measurement.

1.6 ORGANISATIONAL STRUCTURE OF THE DISSERTATION

The dissertation has six chapters. Chapter I is the Introduction, followed by a Review of the Related Literature, Description of the Study Area, Research Methodology, Results and Discussions and ending with the Conclusion and Recommendations.

CHAPTER II: REVIEW OF THE RELATED LITERATURE

2.1 CONCEPT OF FOOD AND NUTRITION SECURITY

2.1.1 Food security

Food security is an ambitious notion to define (Maxwell *et al.*, 1999). The United States Agency for International Development (USAID), cited by Chaparro (2012), declared that food security exists when "all people at all times have physical and economic access to sufficient food to meet their dietary needs for an active and healthy life. Achieving food security relies on fulfilling three elements: adequate food availability, adequate access to food by all people and appropriate food utilization and consumption". This definition was refined by USAID as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2003). This new definition emphasises consumption, the demand side and the issues of access to food by vulnerable people (FAO, 2003). Hence, as the definitions reviewed above imply, vulnerability may occur both as a chronic and transitory phenomenon. A useful working definition of food security must however, take into account the complexities associated with the economic, social, cultural, environmental and political aspects (Khemmarath, 2002). In order to understand the causes of food insecurity, it is important to understand the fundamental notion of food security. Food security depends on four key factors: availability of food; access to sufficient food; stability of food stocks; and utilisation of food, which is related to cultural preference (Khemmarath, 2002).

2.1.1.1 Food availability

Food is available when there are adequate quantities of good quality foodstuffs to provide the nourishing elements and calories necessary. Total availability combines foods available from production and from imports. At the national level, food balance consists of two parts: usage and resources, also called Net Domestic Availability (NDA). At the household level, the 'resource' part of the food balance represents domestic production; this means food produced and/or acquired by means of the physical efforts of household members. This can be from crop production, animal production, fishing, or hunting and gathering of food that is then consumed by household members. Food can be acquired by means of exchange in the form of trade or market exchange. Some food items acquired by household members are in surplus and are

traded for others that are in shortage or not available at all, or exchanged for cash. Cash income can also be generated from economic activities like working as a labourer on a farm, small commerce, service activities (transport), processing and the making of handicrafts. The surplus food produced or acquired may be processed for preservation so that it can be stocked for consumption during periods of shortage. For example, a household can stock dried rice for a year (Khemmarath, 2002). The amount of rice at the beginning of the period, minus the amount of rice at the end equals the *variation of the stock*. This is the amount of rice consumed during that period. In the 'usage' part, the NDA is composed of products for food use (human and animal) and non-food use processing at household level (Khemmarath, 2002). To evaluate food availability, the *per capita* annual food availability (PCAFA) ratio is used: the ratio between the net domestic availability and the total resident population. Food availability can also be expressed in *per capita* daily food availability, by dividing the PCAFA by the number of days in a year (Khemmarath, 2002).

2.1.1.2 Food accessibility

Accessibility is an important element because, even though food is in sufficient quantity, all individuals and families need to have access to food, both physically and economically, that is equitable access to nutritious food. All members of a household, including women and children, need access to the nutrients they require. Children, who depend on their caregivers to make sure they stay nourished, need special consideration. Caregivers should understand how to prepare meals and feed children the right amounts of nutritious foods (Hochstein, 2011).

All stages of the food chain supply system have some influence on physical accessibility, particularly transportation, storage, transformation (processing) and marketing of these food commodities. As for economic accessibility, or purchasing power, household income is considered the most important factor affecting people's accessibility to healthy and nourishing foods (Khemmarath, 2002).

2.1.1.3 Stability of supply

When the food supply is irregular because of drought, flooding, fluctuation of prices, or seasonal unemployment, poor people are the most vulnerable. The stability of provision is dependent on:

- The capacity of storage and saving at the household level.
- The stability of the market, which depends on the balance between supply and demand.
- The role of the state as the regulating instrument of intervention.

- The government's capacity to react in an emergency (Khemmarath, 2002).

The price of rice, for example, goes up during the usual period of rice shortage (from August to the end of October) in many markets. The price drops again right after the harvest.

At some major markets, prices go up by 30% as the period of shortage approaches, coming down again in December (Khemmarath, 2002).

2.1.1.4 Cultural acceptability

The distribution of food in a household is not always related to an individual's food needs. In some ethnic groups, certain foods and food practices are governed by religious beliefs and taboos. For example, in the first week after giving birth, mothers living in many parts of certain countries are only allowed to eat baked rice and salt. For some months thereafter they may only eat selected fish species, chicken, black buffalo meat and some vegetables (Khemmarath, 2002).

Achieving food security relies on fulfilling three elements: adequate food availability, adequate access to food by all people and appropriate food utilisation and consumption (Chaparro, 2012). Food security is a sustainable development issue, linked to health through malnutrition (Chaparro, 2012). Over 10 million children under the age of five years still die every year from preventable and treatable illnesses, such as diarrhoeal dehydration, acute respiratory infection, measles and malaria. In almost one-half of these cases, the illness is complicated by malnutrition. An assessment of child nutritional status not only provides a means of evaluating child health but also reflects various underlying social issues in the community (WHO, 2010).

2.1.2 Food insecurity and poverty

2.1.2.1 Food insecurity

Food security at the household level means access by all members, at all times, to enough food for an active, healthy life. It includes, at a minimum, the ready availability of nutritionally adequate and safe foods; the assured ability to acquire acceptable foods in socially acceptable ways, that is to say, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies. Food insecurity, on the other hand is defined as a limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Andersen, 1990). Food insecurity, as measured

in the United States, refers to the social and economic problem of lack of food due to resource or other constraints, not voluntary fasting or dieting, or because of illness, or for other reasons. This definition, supported by some research conducted by Radimer *et al*., cited by the National Research Council (2006), means that food insecurity is experienced when there is (1) uncertainty about future food availability and access, (2) insufficiency in the amount and kind of food required for a healthy lifestyle, or (3) the need to use socially unacceptable ways to acquire food (National Research Council, 2006). Although lack of economic resources is the most common constraint, food insecurity can also be experienced when food is available and accessible, but cannot be used because of physical or other constraints, such as limited physical functioning by elderly people or those with disabilities (National Research Council, 2006). Worry and anxiety typically result from uncertainty. Feelings of alienation and deprivation, distress and adverse changes in family and social interactions, also occur. Hunger and malnutrition are potential, although not necessary, consequences of food insecurity. Management strategies that people use to prevent or respond to the experience of food insecurity are conceptually different from food insecurity, but are tied to it (National Research Council, 2006). Sometimes the term 'food security' is used in place of 'hunger'. But the FAO defined hunger as *undernourishment*, which refers to the proportion of the population whose dietary energy consumption is less than a pre-determined threshold. This threshold is country-specific and is measured in terms of the number of kilocalories required to conduct sedentary or light activities. Undernourished people are also referred to as suffering from food deprivation (FAO, 2008).

2.1.2.2 Poverty

The declared primary objective in international development policy discourse is, increasingly, the reduction and elimination of poverty. The 1996 WFS exemplified this direction of policy by making the primary objective of international action on food security a halving of the number of hungry or undernourished people by 2015 (FAO, 2003*).* After the World Summit on Social Development in Copenhagen in 1995, 117 countries adopted a declaration and programme of action which included commitments to eradicate "*absolute*" and reduce "*overall***"** poverty (FAO, 2003).

- **Absolute poverty**

Absolute poverty was defined as a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services. Absolute poverty refers to a set standard which is consistent over time and between countries (Gordon, 2005). The World Bank defines extreme poverty as living on less than US$1.25 per person per day and moderate poverty as less than $2 or $5 a day (Wikipedia, 2012). Poverty is "pronounced deprivation in well-being." The conventional view links well-being primarily to command over commodities, so the poor are those who do not have enough income or consumption to put them above some adequate minimum threshold. This view sees poverty largely in monetary terms. Poverty may also be tied to a specific type of consumption; thus someone might be house poor or food poor or health poor. These dimensions of poverty can often be measured directly, for instance by measuring malnutrition (Khandker, 2005).

- **Overall poverty**

Overall poverty takes various forms, including lack of income and productive resources to ensure sustainable livelihoods; hunger and malnutrition; ill-health; limited or lack of access to education and other basic services; increased morbidity and mortality from illness; homelessness and inadequate housing; unsafe environments and social discrimination and exclusion. It is also characterised by lack of participation in decision-making and in civil, social and cultural life. It occurs in all countries: as mass poverty in many developing countries, pockets of poverty among wealth in developed countries, loss of livelihoods as a result of economic recession, sudden poverty as a result of disaster or conflict, the poverty of low-wage workers, and the complete destitution of people who fall outside family support systems, social institutions and safety nets (Gordon, 2005). Fundamentally, poverty is a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to; not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence and it often implies living on marginal or fragile environments, without access to clean water or sanitation (Gordon, 2005). The broadest approach to well-being (and poverty) focuses on the "capability" of the individual to function in society. The poor lack key capabilities and may have inadequate income

or education, or be in poor health, or feel powerless, or lack political freedoms (Khandker, 2005). There are four reasons to measure poverty. First, to keep the poor on the agenda; if poverty were not measured, it would be easy to forget the poor. Second, one needs to be able to identify the poor if one is to be able to target interventions that aim to reduce or alleviate poverty. Third, to monitor and evaluate projects and policy interventions that are geared towards the poor. And finally, to evaluate the effectiveness of institutions whose goal is to help the poor (Khandker, 2005). In order to measure absolute poverty amongst children, it is necessary to define the threshold measures of severe deprivation of basic human need. The proposed operational definitions of deprivation of basic human need for youth can be developed as following:

- Food deprivation– Body Mass Index of 18.5 or below (underweight).
- Water deprivation - access only to unimproved source such as open wells, open springs or surface water or who have to walk for more than 15 minutes to their water source (30 minutes round-trip).
- Deprivation of sanitation facilities – access only to unimproved sanitation facilities, for example pour flush latrines; covered pit latrines; open pit latrines; and buckets or no access to a toilet of any kind.
- Health deprivation – man or women who did not receive treatment for a recent serious illness or women who did not receive the minimum standard of antenatal care from a person trained in midwifery or men and women who do not know that a healthy person can transmit HIV/AIDS or who do not know that using a condom during sex can prevent HIV/AIDS transmission.
- Shelter deprivation – living in dwellings with three or more people per room (overcrowding), or in a house with no flooring (e.g. a mud floor) or inadequate roofing (e.g. natural roofing materials).
- Education deprivation – young people who did not complete primary school or who are illiterate.
- Information deprivation – no access to a radio or television (i.e. broadcast media) at home (Gordon, 2005).

2.1.3 Nutrition situation in Africa.

Malnutrition essentially means “bad nourishment”. It concerns not enough as well as too much food, but the wrong types of food, and the body's response to a wide range of infections that result in mal-absorption of nutrients, or the inability to use nutrients properly to maintain health.

Clinically, malnutrition is characterised by inadequate or excess intake of protein, energy and micronutrients, such as vitamins, and the frequent infections and disorders that result (WHO, 2012). There are two basic types of malnutrition. The first and most important is protein-energy malnutrition. This is a lack of enough protein (from meat and other sources) and food that provides energy (measured in calories) which all of the basic food groups provide. This is the type of malnutrition that is referred to when world hunger or child hunger is discussed (FBF, 2009). Kwashiorkor is a good example of protein-energy malnutrition. The children with kwashiorkor are more likely to develop metabolic complications, heart failure and die than those with simple wasting. A population study from rural Congo attributes 8% of child deaths to kwashiorkor. Kwashiorkor is devastating when it progresses to the point that requires hospital admission, although, if identified early, it can be treated on an outpatient basis with ready-to-use therapeutic food. In sub-Saharan Africa, the number of malnourished children increased by over 75%, or 12.9 million, in the past 30 years. Roughly one in 10 of the world's malnourished children resided in sub Saharan Africa in 1970; today one in five do. The second type of malnutrition, also very important, is micronutrient (vitamin and mineral) deficiency. This is not the type of malnutrition that is referred to when world hunger is discussed, although it is certainly very important. One-third of young children suffer from Vitamin A deficiency, which diminishes the ability to fight infections and diseases, such as diarrhoea and measles (FBF, 2009). Malnutrition is a major health problem, especially in developing countries. Water supply, sanitation and hygiene, given their direct impact on infectious diseases, especially diarrhoea, are important for preventing malnutrition. Both malnutrition and inadequate water supply and sanitation are linked to poverty. The impact of repeated or persistent diarrhoea on nutrition-related poverty and the effect of malnutrition on susceptibility to infectious diarrhoea are reinforcing elements of the same vicious cycle, especially amongst children in developing countries (WHO, 2012). All children need food to grow, develop and learn, but millions go hungry every day. Even those who have food on their tables may often not be getting the correct nutrition they need for optimal growth and development. At least one good meal a day, containing the necessary vitamins and nutrients can help children reach their developmental milestones. *Lack of nutrition damages the most sensitive part of the human body* – the brain. Poor nutrition and high levels of infections can contribute to children failing to achieve their potential, both physically and mentally. Children are the human capital of the future, crucial for families to rise above poverty, and in turn affect the human capital of society and consequently economic development (FBF, 2009). The cascading effects of childhood malnutrition include diminished immune functioning; which leads to greater susceptibility to infection, especially

gastrointestinal and respiratory infections; which leads, in turn, to increased child mortality. Even mild to moderate malnutrition significantly undermines a child's health and chances of survival. A moderately underweight child has a five times higher risk of dying of diarrhoea and a four times higher risk of dying of respiratory infections and malaria, compared to a child with normal weight. Other consequences are decreased growth and development, including cognitive development. Children who were malnourished at younger ages demonstrate lower IQ, poor school achievement and exhibit behavioural problems when they reach school age. Long-term malnutrition results in shorter adult height and reduced economic productivity (Le Roux *et al.,* 2000). The most significant immediate causes of malnutrition are inadequate food intake and illness; and the underlying factors which result in poor food intake and illness include poor household access to food, inadequate maternal and child care, poor access to basic health services and an unhealthy environment, with limited access to clean water and safe waste disposal. Poverty and lack of resources are basic factors that contribute to malnutrition (FBF, 2009).

South Africa, like other developing countries, is in nutrition transition, which includes the coexistence of under- and over-nutrition, and has a malnutrition problem of public health significance. Despite various national nutrition and primary health care programmes being initiated in South Africa over the last decade, recent findings have indicated that child malnutrition rates and hence child health has deteriorated. At the national level, stunting and underweight remain the most common nutritional disorders affecting one out of five children and almost one out of 10 children, respectively. Also, 10% of the children were classified as overweight and 4% as obese. While iodine and folic acid status appear to be adequate, uniformly throughout the country, almost one third of women and children were anaemic, two out of three children and one out of four women had a poor vitamin A status and 45.3% of children had an inadequate zinc status. Poor dietary intake, food insecurity and poor quality of basic services prevail within the context of an HIV/AIDS pandemic (Health Department, 2008).

In South Africa, the national Integrated Nutrition Programme (INP) is a comprehensive nutrition strategy that focuses on children under six years old, at-risk pregnant and lactating women, and those affected by communicable and non-communicable diseases (Health Department, 2008). The challenge for public, private and civic leaders is to scale-up the interventions and technologies that have been proven to work instead, focusing on children under age two years; improved infant and young child feeding; micronutrient control programmes; and focusing

investments on the critical , “window of opportunity” by integrating and prioritising nutrition more effectively into national poverty reduction strategies and development budgets, supporting community-based programmes, strengthening public health systems and building health capacity more generally (Health Department, 2008). All this cannot be achieved unilaterally by the INP and therefore multi-sector partnerships are imperative for South Africa to reduce malnutrition and accelerate efforts to meet the MDGs (Health Department, 2008).

2.2 CHILDREN’S ANTHROPOMETRY INDICES

Anthropometry is the measurement of the human body. Anthropometry measures are used to assess the nutritional status of individuals and population groups and as eligibility criteria for nutrition support programmes. Common anthropometry measures are height, weight, and mid-upper arm circumference (MUAC).

Some measurements are presented as indices, including height-for-age (HFA), weight-for-age (WFA), weight-for-height (WFH), MUAC-for-age and body mass index, BMI-for-age. Each index is recorded as a Z-score that describes how far, and in what direction, an individual’s anthropometric measurement deviates from the median in the 2006 WHO Child Growth Standards for his or her sex. MUAC measurements are compared to recommended cut-offs that apply to all children six to 59 months. An individual’s Z-score or MUAC measurement can be used to classify how malnourished he or she is. A mean Z-score can also be calculated to determine the nutritional status of a population group (Fanta 2, 2011). *Stunting* (HFA)**:** The anthropometry index height-for-age reflects linear growth achieved pre-and postnatal, with its deficits indicating long-term, cumulative effects of inadequate nutrition and/or health. Shortness in height refers to low height-for-age that may reflect either normal variation in growth or a deficit in growth. Stunting refers to shortness that is a deficit in linear growth that has prevent to reach genetic potential as a result of poor diet and disease. Stunting is defined as low height-for-age at < -2 standard deviations (SD) of the median value of the National Centre for Health Statistics/World Health Organization (NCHS/WHO) international growth reference. Severe stunting is defined as < -3SD. *Underweight* (WFA): The anthropometry index weight-for-age represents body mass relative to age. Weight-for-age is influenced by height and weight of the child and is thus a composite of stunting and wasting, making interpretation of this indicator difficult. In the absence of wasting, both weight-for-age and height-for-age reflect the long-term nutrition and health experience of the individual or population. Underweight refers to a deficit and is defined as low weight-for-age, at <-2 SD of the median value of the NCHS/WHO

international reference. *Wasting* (WFH): describes a recent and severe process that has produced a substantial weight loss; usually as a consequence of acute shortage of food and/or severe disease. Chronic dietary deficit or disease can also lead to wasting. The anthropometric index weight-for-height reflects body weight relative to height. Wasting refers to low weight-for-height at <-2 SD of the median value of the NCHS/WHO international reference. Severe wasting is defined as <-3 SD. The statistically expected prevalence of wasting (as with underweight and stunting) is between two and three percent, given the normal distribution of wasting rates. This indicator is used extensively in emergency settings.

To assess nutritional status, an algorithm developed by the WHO and the Center for Disease Control's anthropometrical programme was adopted. Raw anthropometric data were transformed into Z-scores, which evaluated nutritional status using National Center for Health statistics/WHO reference data. The Z-score is calculated as follows: SD score Z= individual value-median value of reference population or SD value of the reference population. Abnormal anthropometry is defined as an anthropometric value below -2 SD or above +2 SD. These cut-offs define the central 95% of the reference distribution as the normal range.

2.3 HOUSEHOLD FOOD SECURITY IN SOUTH AFRICA

In Keeping with the food security definition above, household food security is the application of this concept to the family level, with individuals within households as the focus of concern (FAO, 2003). IFAD (1998) describes household food security as the capacity of households to procure a stable and sustainable basket of adequate food. As the topic of food security has grown, it has become more complex. On conceptual and definitional issues alone, the main cause of increasing complexity is a shift in the level of analysis; from a primary concern in the 1970s with national and international food security, defined in terms of the level and reliability of aggregate food supplies, to a focus in the 1980s on individual and household food security, with the emphasis on access, vulnerability and entitlement (Maxwell & Marisol, 1991). It is now needed to clarify the concepts and definitions at the household level, where interest is now centred and where the literature has grown fastest. This is not to deny the importance of other levels of analysis, but we make connections where appropriate (Maxwell & Marisol, 1991). We view household food security as a concept that integrates environmental, economic and cultural factors in a manner that can provide a useful tool for predicting dietary patterns within the household. The main goal of food security is for individuals to be able to obtain adequate food needed at all times and to be able to utilise the food to meet the body's needs. It was also found

that the majority of the household food insecurity varies according to socio-economic characteristics of the households**.** Resources are disproportionately distributed in favour of higher castes and these groups are more food secure, compared to lower caste people. Compared to food insecure households, food secure households have smaller family sizes, lower dependency ratios, higher percentages of irrigated land and more total land and livestock holdings. Hence, it is concluded that food security strategies should consider socio-economic characteristics of households in order to achieve more than a marginal reduction in the number of chronically undernourished people (Maharjan, 2006). The socio-economic characteristics of households are summarised and cited as following: number of people per household, number of children younger than six years, households with toilet, access to safe drinking water (tap/borehole) and electricity in the home, have regular source of income, mother has schooled for more than five years, mother is married, household reportedly always has enough food to eat**,** ownership of livestock, ownership of home garden and household assets, namely refrigerator, coal stove, electric stove, hotplate, gas stove, paraffin stove, electric kettle, television set, radio, motorcar and cellphone (Lesiapeto *et al.,* 2010). One study revealed that almost one-third of the households depended on grants/welfare and child support/maintenance as source of cash income. These sources of cash income contributed significantly to the 72% of households having some kind of regular source of income (Lesiapeto *et al.,* 2010).

2.4 IMPORTANCE OF MEASURING AND CLASSIFYING HOUSEHOLD FOOD SECURITY

2.4.1 Measures of household food security

While huge strides have been made in the measurement of food security in South Africa, there are a number of issues which concern people working in the field. Some issues are currently being addressed and some remain to be. These include the assessment of food insecurity and hunger, specifically in children, individual food security and hunger (Radimer*,* 2002).

The search for viable indicators is driven by the lack of a ‘gold standard’ measure for food security. Measures of consumption, poverty and malnutrition are all used *as proxy* measures, and indicators of assets and income are used as more distal determining factors. All are related to food security, yet none of them capture the concept accurately or completely. In particular, none of them get at the crucial issue of vulnerability. Food security is probably too complex to ever be adequately captured by a single indicator. In brief, measuring household food security in

valid and reliable ways is a major challenge and the search for good, cost-effective alternative indicators continues (Maxwell *et al.*, 1999).

Measurement is necessary at the outset of any development project to identify the food insecure, to assess the severity of their food shortfall and to characterise the nature of their insecurity (seasonal compared with chronic). Further, it provides the basis for monitoring progress and assessing the impact of these projects on the beneficiaries' food security (Hoddinott, 1999). There are approximately 200 definitions and 450 indicators of food security. Consequently, an important methodological problem for development practitioners is to determine which indicators are appropriate, considering the project being proposed (Hoddinott, 1999). A distinction is made between "process indicators", those that describe food supply and food access, and "outcome indicators", that describe food consumption (Hoddinott, 1999). It is also recognised that the development agencies, and their local collaborators, face significant financial and time constraints. Undertaking very detailed household and individual surveys, on an on-going basis, to characterise, monitor and measure impact, is infeasible; either because the time spent on these activities does not fit into the standard project cycle, the skills, to implement and analyse such data are not available, or because purchasing these skills say by contracting to outside consultants, is prohibitively costly (Hoddinott, 1999). Mindful of this constraint, an objective of this argument is to show how simple measures of food security outcomes can be constructed and compared. These methods have been chosen so as to be accessible to anyone with a very basic grounding in statistics and access to a spreadsheet software programme such as Microsoft Excel (Hoddinott, 1999).

There are few universally valid indicators of food security that are applicable in crisis situations. Nutritional status, if properly measured, is widely accepted as comparable across different contexts. But while nutritional status can be one indicator of food security status, it may equally reflect elements of health status, care practices, water quality and other determinants of nutrition.

In emergencies, weight loss among children aged from birth to 59 months is used as a proxy indicator for the general health and well-being of the entire community. This assumes that children aged 0 to 59 months are as vulnerable as other age groups to external factors (such as food shortages and illness) and the nutrition status of these children is as sensitive to change as that of other age groups. This is usually, but not always, true (The Smart Protocol, 2005).

Until recently, household level measures of food access have relied on *proxy* indicators, such as food consumption (calorie intake), household income, productive assets, food storage and even under-five nutritional status, each of which are presumed to be either determinants or consequences of a particular household's level of food security. Included in this category of indicators is the measure of dietary diversity as an indicator of the quality of food consumption and also as a *proxy* for quantity. In recent studies, dietary diversity and food frequency have proven to be among the most common and valid indicators of nutrient adequacy and/or energy intake. Other useful and cost-effective kinds of measure assess various elements of food insecurity, through a series of questions about self-reported behaviour and attitudes. One such indicator is the Household Food Insecurity Access Scale (HFIAS), developed by the Food and Nutrition Technical Assistance (FANTA) project of USAID, which identifies three key domains of household access to food: (1) perceptions of insufficient quantity of food; (2) perceptions of inadequate quality of food; and (3) anxiety or uncertainty about whether the food budget or supply is adequate to meet basic requirements (Maxwell *et al.,* 2008).

2.4.2 Classification of household food security

The different methods used currently to measure food security lack clarity and consistency regarding the use of terms and classifying food security. There are increasingly strong calls for improved food security analysis, including food utilisation and food perception, which has an impact on children's anthropometry. The ultimate purpose of a classification system is to be useful for decision-making and/or advocacy and, in particular, to be useful to decision-makers who influence the allocation of resources, response strategies, programming and policy formulation. Different classifications of food insecurity serve different purposes, and are used in different ways. Darcy and Hoffman (2003), cited by Young & Jaspars (2009), were concerned with making humanitarian decisions more accountable, which required agreement on indicators of the severity of the crisis. Howe and Devereux (2004), cited by Young & Jaspars (2009), were concerned with developing a clearer classification for the purpose of diagnosing 'famine', as compared with situations of lesser food insecurity. The selective feeding decision-making frameworks apply a classification system based on prevalence estimates of low weight-for-height (WFH), combined with 'aggravating factors', in order to determine the need for different types of feeding programmes (Young & Jaspars, 2009)

The Integrated Food Security Phase Classification (IPC), for example, is a food security severity scale developed globally by a partnership of UN agencies, NGOs and donor agencies. It aims to

provide a common technical approach to classify food security according to reference outcomes that are based on recognised international indicators of food security, nutrition and mortality, in order to facilitate comparisons between countries, and over time for decision-making about appropriate policies, programmes and resource allocation. As an institutional process it aims to engage stakeholders in reaching consensus about the current and likely food security situation based on the available evidence in the form of indicators (Young & Jaspars, 2009). The IPC, one of the good methods of classification, has been introduced in several parts of Africa and Asia and continues to gain momentum among governments, UN, NGO, donors and academic organisations. Indicators of wasting and chronic malnutrition and mortality have been included in the IPC, along with those of food security, as "Key Reference Outcome indicators" since its inception in 2004. Reference levels for each indicator (thresholds) have been attributed to each of the five phases of the classification, from generally food secure to famine/humanitarian catastrophe (Young & Jaspars, 2009). Table 2.1 shows the IPC five phases of classification and their reference levels.

Table 2.1: IPC five phases of classification and their reference levels

No.	Phase Classification	Key reference outcome	Reference level %
1	Generally Food Secure	Wasting Stunting	<5% <20%
2	Moderately/Borderline Food Insecure	Wasting Stunting	5-9% 20-40%
3	Acute Food and Livelihood Crisis	Crude Death Rate Wasting Stunting	0.5 – 1 /10,000/ day 10-15% >40%
4	Humanitarian Emergency	Crude Death Rate Wasting	> 1 – 5 / 10,000/ day >15%
5	Famine/Humanitarian Catastrophe	Crude Death Rate Wasting	> 5/ 10,000/ day 40%

The RNIS classification system refers to “acute malnutrition” and the WHO classification to “wasting”.

Source: Young & Jaspars, 2009

The UN agencies, NGOs and donor agencies concluded that the inclusion of HFA in the early phases of the IPC is appropriate (particularly phases 1 and 2, but also phase 3, as recommended by WFP) as an indicator of underlying vulnerability, rather than as a key reference outcome, because there was no consensus on the latter (some argued there was insufficient evidence linking changes in HFA with food security). However, some of them called strongly for the inclusion of HFA as a reference outcome in the early phases, particularly as a

recent study indicated that prevalence of stunting among young children (0 to 24 months) is related to food insecurity, while other studies have shown a significant association between severe stunting and longer-term mortality risk among the same age group. Stunting is therefore likely to be of most relevance to the IPC when considered among children aged between 0 and 24 months (Young & Jaspars, 2009).

2.5 CHILDREN'S ANTHROPOMETRIC INDICES AND HOUSEHOLD FOOD SECURITY

Food insecurity is a critical variable for understanding the nutritional status of low-income populations. Limited research is available on the relationship between household food insecurity and children's nutritional status (Matheson, 2002). Food insecurity is defined as limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Matheson, 2002). Although household food insecurity is associated with socio-economic status, 50% of food-insecure households have incomes above the poverty line. Therefore the construct of food insecurity adds to our understanding of the relationship between poverty and nutritional status, beyond what is discerned by socio-economic variables, such as household income and employment status. Furthermore, food insecurity may be a more sensitive measure of the food issues experienced by low-income families, especially the psychological and social ramifications of a lack of food, than is household income alone (Matheson, 2002). From a methodological standpoint, the present study demonstrates how even very simple indicators, such as the number of sources of income, can be useful for targeting purposes and for prioritising HFS interventions (Maxwell & Frankenberger, 1992). The data at hand revealed that a strikingly large number of households, particularly in Asia, derive their income from one source only. This finding indicates a potential entry point for projects concerned with stabilising the access of poor households to food. However, to limit attention to these factors alone can be misleading. In general, no single determinant of HFS is sufficient to guarantee food adequacy. Its contribution to food security must be evaluated in relation to other interrelated variables and to the specific socio-economic context. To this end, composite indicators can add substantially to the specificity and accuracy of analyses geared towards the identification of archetypes of households, based on their vulnerability to food insecurity (Maxwell & Frankenberger, 1992). Although comparison with some benchmark indicator of food and nutrition security – such as anthropometric measures – would add to the validation process, the composite indicator proposed in this study appears to perform well in locating the most food insecure households (Maxwell & Frankenberger, 1992).

However, whereas household food security may be a necessary prerequisite for good nutrition outcomes, it is insufficient on its own. In line with our analytical methods, many studies suggest that the influence of food availability and access on the nutritional status of children can be confounded by other key determinants of child nutrition, such as maternal knowledge of nutrition and healthcare practices, maternal nutritional status, intra-household food allocation and utilisation, access to health services and healthful environmental conditions such as good hygiene and sanitation (Osei *et al.*, 2010).

Other studies have reported that household-level poverty, rather than food insecurity, is predictive of malnutrition among children. Although our study did not measure poverty, the significant associations between household wealth index and child stunting and underweight suggest that poverty may be a major determining factor of the nutritional status of children aged 0 to 23 months (Osei *et al.*, 2010).

Assessing the health of children in developing countries is an imperative goal of national and international organisations, because of their vulnerable character, and assessing food security is urgently needed for practical and operational classifications of food security that will take into account the specific problems of children. Monitoring food security can help to identify and understand the basic necessity for well-being of the population especially children under five years and to identify population subgroups with malnutrition. It would also help public officials, policy-makers, service-providers and the public at large to assess the changing needs for assistance and the effectiveness of existing programmes (Bickel, 2000). Health of children is a mirror on the health, social standing and economic resources of their parents (Trapp & Menken, 2005). Anthropometric measurements have the additional advantage of providing information on past nutritional history, which cannot be obtained with equal confidence using other assessment techniques (Gibson, 2005).

2.6 HOUSEHOLD SOCIO-ECONOMIC FACTORS AND CHILDREN'S ANTHROPOMETRIC INDICES

Nutritional status is a result of more complex social and behavioural determinants that affect child care, including feeding. Socio-economic and environmental conditions, together with feeding practices, are important determinants of malnutrition in developing countries (Adeladza, 2009). Lower household income and a greater number of children in the household increase the probability that households will be food insecure, regardless of how food insecurity is defined (Adeladza, 2009). The macro-level association between poverty and child malnutrition is well documented, with the risk factors for poor nutritional status largely coinciding with the correlates of poverty.

Poverty is the root cause of malnutrition. Food security, health and care are the underlying causes. Most nutrient deficiencies primarily affect poor and disadvantaged households, whose members cannot produce or procure adequate food, who live in marginal or unsanitary environments without access to clean water and basic services, who lack access to appropriate education and information, or are otherwise socially disadvantaged. However, over-nutrition and dietary imbalances, which may lead to chronic diseases, cut across many socio-economic boundaries. Nutritional status is influenced by multiple and interrelated factors.

Diet and health are the most significant proximate risk factors of child malnutrition, but are themselves rooted in underlying household issues, such as household food security, maternal and childcare practices, water and sanitation and basic, societal issues, such as cultural, political, economic and societal systems (Lesiapeto *et al.*, 2010).

The most important factors can be grouped under the broad categories of basic, underlying and immediate factors affecting food and nutrition security. These factors are interrelated and actions affecting one area may have significant consequences on another (FAO, 2007).

2.6.1 Basic factors or socio-economic factors

2.6.1.1 Age

Children's nutritional status is more sensitive to factors such as feeding/weaning practices, care and exposure to infection at specific ages. A cumulative indicator of growth retardation (height-for-age) in children is positively associated with age (Woldemariam, 2002).

The study conducted by Woldemariam (2002) showed that the risk of stunting increases with age. This is not surprising, since stunting is a cumulative process that occurs over the course of many instances of dietary inadequacy and/or illnesses. Children in the youngest age group, from birth to five months, were at a significantly lower risk of stunting compared with children in the older age groups. This low risk of stunting may be due to the protective effect of breastfeeding, since almost all children continue to breastfeed during their first year of life. A high risk of stunting among children aged 12 to 23 months was compared with children in the age group six to 11 months. It was shown that this risk may be an indication of either inappropriate food supplementation in quantity and/or quality during the weaning period, or exposure to disease (Woldemariam, 2002).

2.6.1.2 Gender

In keeping with other studies done in Africa, a higher prevalence of stunting was observed in males than in females by Lamontagne *et al.*, 1997. The cause of this discrepancy is not well-established in the literature, but there is a belief that boys are more influenced by environmental stress than girls. A number of studies in Africa suggest that rates of malnutrition among boys are consistently higher than among girls (Mekonnen *et al*., 2002). The second belief is that girls are genetically more robust than boys. There is some evidence that among pre‑adolescent children there is an increment of fat in preparation for the growth spurt. This increase in fat is greater for girls than boys (Mekonnen *et al*., 2002). We may also add a fourth possible explanation: that it reflects boys' and girls' gender-specific roles; girls have better access to food through their roles in cooking, while boys' have a higher energy expenditure and lack food during the day when they are involved in tasks, such as herding animals (Mekonnen *et al*., 2002).

2.6.1.3 Household income

The household's socio-economic factors mainly influence its member's health through the income and wealth effects. In the absence of reliable information on income, many indicators may capture the household's financial ability to secure goods and services that promote better health, help to maintain a more hygienic environment and ensure adequate nutritional needs (Fotso, 2005). One study shows that almost one-third of the households depended on grants/welfare and child support/maintenance as sources of cash income. These sources of cash income contributed significantly to the 72% of households having some kind of regular source of income (Lesiapeto *et al.,* 2010).

The macro-level association between poverty and child malnutrition is well documented, with the risk factors for poor nutritional status largely coinciding with the correlates of poverty (Adeladza, 2009). Lower household income and a greater number of children in the household are associated with a greater variance in household food insecurity, over time. These factors can adversely affect child nutritional status and, together with other socio-economic factors, contribute to the poor nutritional status of children (Adeladza, 2009). In the face of the continuing degradation of the health situation and the endemic nature of poverty, in general, and the increasing gap between the poverty levels of urban households and those of rural ones, in particular, it is appropriate to study the possible relationships between the poverty phenomenon and child health and nutritional status in the country. A study of infant poverty can be further justified from two perspectives: from the economic point of view, children constitute a long-term essential investment in human capital for society and from the social ethics point of view, they must be protected by the community, as they are not responsible for their socio-economic situation, but benefit or suffer from the situation of their parents (Kodjo, 2009).

2.6.1.4 Poor education

As reported elsewhere, an inverse relationship between level of stunting and maternal education was observed, suggesting a need to promote gender-balanced formal education in rural communities. Education is one of the most important resources that enable women to provide appropriate care for their children, which is an important determinant of children's growth and development (Engle & Menon, 1996). Some studies show that a decreased incidence of malnutrition among young children is caused by an increased level of mothers' education (Woldemariam, 2002).

Women who receive even a minimal education are generally more aware than those who have no education of how to utilise available resources for the improvement of their own nutritional status and that of their families. Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status (Woldemariam, 2002). A comparative study on maternal malnutrition in 10 countries in sub-Saharan and in Ethiopia, conducted by Loaiza (1997), Teller and Yimar (2000), cited by Woldemariam, showed that the higher the level of education, the lower the proportion of undernourished women (Woldemariam, 2002).

2.6.1.5 Family size

The direct relationship between size of household and food security was confirmed for the review period, in both rural and urban areas. On average, the size of *severely food insecure* households was 5.3 members, moderately food insecure households 4.7 members and food secure households 3.3 members (Dhur, 2010).

2.6.1.6 Women's employment

Women's employment increases household income, with consequent benefit to household nutrition, in general, and the woman's nutritional status, in particular. Employment may increase women's status and power and may strengthen a woman's preference to spend her earnings on health and nutrition. Though employed, women without control over their income and decision-making authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being. Although women's employment enhances the household's accessibility to income, it may also have negative effects on the nutritional status of the children, as it reduces a mother's time for childcare. Some studies have revealed that mothers of the most malnourished children work outside their homes. Another study reasoned that there is no association between maternal employment and children's nutritional status (Woldemariam, 2002). The effects of maternal employment on child welfare are of enormous importance to development policy. This extensive review shows some positive and negative relationships between women's work for earnings and the nutritional status of their children (Lamontagne *et al.*, 1997). Economists have proposed that there is a trade-off between the benefit for children of mothers' increased income and the cost of the reduced time that the mother spends on child care. Maternal employment results in loss of child care time. Presumably the mother is less available for breastfeeding, making frequent meats, etc.

However, it is possible that non-working women mothers also spend relatively little time on child care (Lamontagne *et al.*, 1997).

2.6.1.6 Water and electricity

A household's access to facilities is likely to be correlated with community economic characteristics. Households living in wealthier communities might have a relatively healthy environment, which implies better sanitation facilities, access to clean water and healthcare facilities. Water and sanitation play a particularly important role in child nutrition, due to their impact on diarrhoeal diseases (Mekonnen *et al*., 2002).

2.6.2 Underlying factors of food security

2.6.2.1 Performance of the food economy

The availability and access to adequate quantities of safe, good quality and nutritious food is an important factor influencing nutritional status. Household food security may be a necessary prerequisite for good nutrition outcomes; it is insufficient on its own. In line with this study, many studies suggest that the influence of food availability and access on the nutritional status of children can be confounded by other key determinants of child nutrition, such as maternal knowledge of nutrition and healthcare practices, maternal nutritional status, intra-household food allocation and utilisation, access to health services and healthful environmental conditions such as good hygiene and sanitation (Osei *et al*., 2010).

2.6.2.2 Health and sanitary

Health and sanitation are essential for nutrition. Infectious diseases and inadequate diets act together, each aggravating the effects of the other, to produce what is referred to as the "malnutrition and infection cycle". Nutritional requirements are higher during and following episodes of infection. Chronic or frequent acute infections make it almost impossible to maintain adequate nutritional status (EC-FAO, 2007).

Poor population groups are particularly affected by environmental factors that increase exposure to infectious disease. These factors include limited water supply, inadequate sewage disposal and general sanitation, contaminated surface water, overcrowded and poor housing conditions and unhygienic food preparation. Diarrhoea and other infectious diseases, manifested in the form of fever, affect both dietary intake and utilisation, which may have a negative effect on child nutritional status. A comparative study of children's nutritional status

indicated that stunting was highest among children with recent diarrhoea (Woldemariam, 2002). The poor are also particularly susceptible to infectious diseases, because of their frequently limited access to health care. They have limited money to pay for needed medications and services, including immunisation and family planning, and insufficient time and other resources to care adequately for family members during periods of acute illness or to promote their nutritional recovery during convalescence. As a consequence, the treatment of infection is often inadequate or late, and the resulting prolonging of the disease places children at increased nutritional risk. Local health services are often understaffed or have limited supplies of essential drugs. Attitudes to health care, and education, are also important factors affecting mothers' willingness to make use of available services (Woldemariam, 2002).

2.6.2.3 Care practices

Care and feeding practices require time, attention and support and are essential to meet the physical, mental and social needs of individuals. The knowledge, attitudes and practices of household members largely determine the nutritional status of the household. An incomplete understanding of the body's nutritional needs and lack of knowledge of how to meet these needs with available foods can lead to malnutrition (EC-FAO, 2007).

2.6.3 Immediate factors

2.6.3.1 Food intake

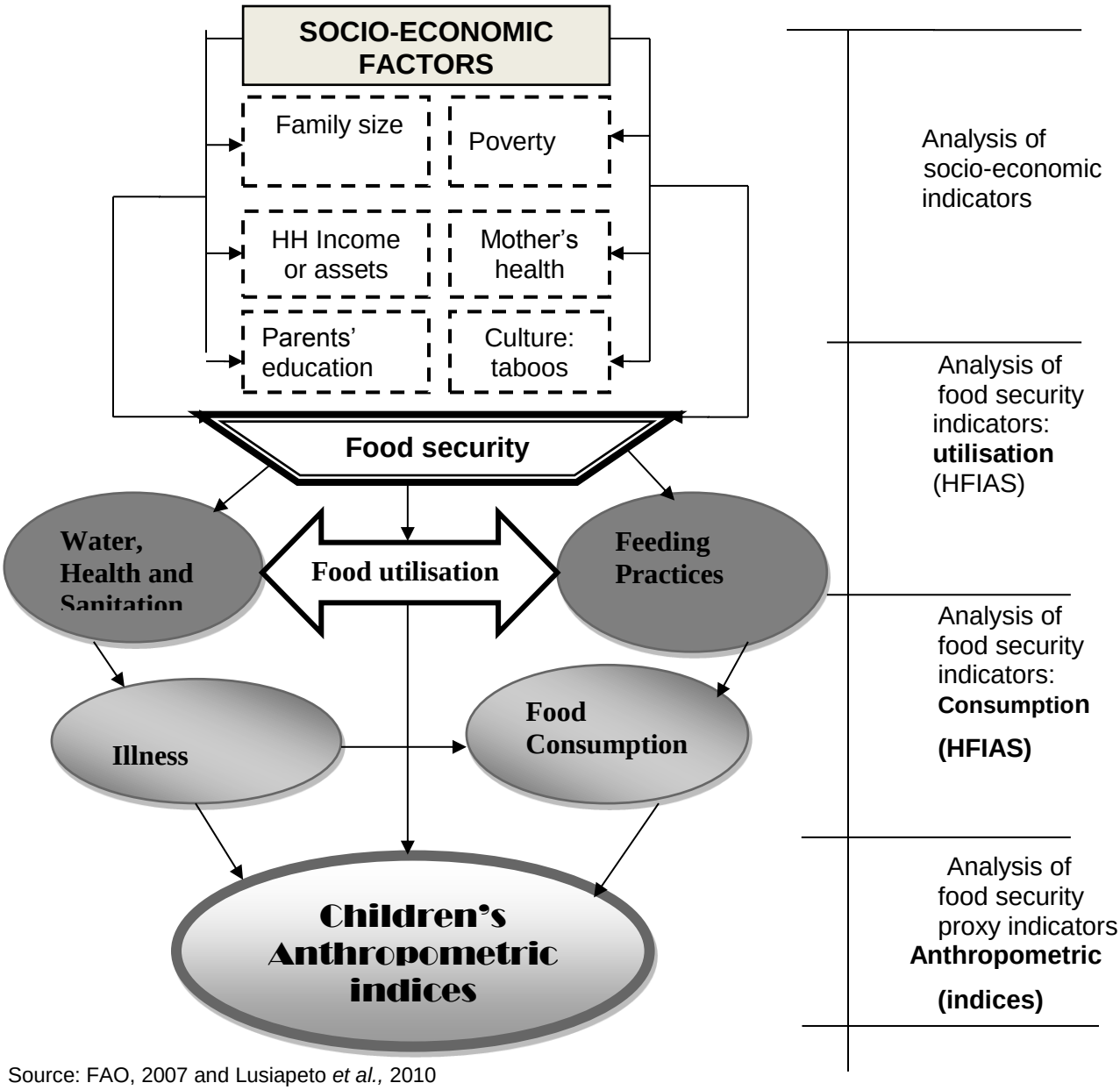
Adequate growth is not the only indicator of nutritional well-being in children living in food-insecure households. Nutritional status is also influenced by the quality of food consumed. It was found that, the types of foods children consumed were significantly associated with their household food supplies (Lamontagne *et al.*, 1997).

2.6.3.2 Illness

Infectious diseases constitute one of the major factors contributing to child malnutrition; conversely, malnutrition makes a child more susceptible to these infectious diseases. The interaction between nutrition and infection, known as the malnutrition-infection complex, accounts for the severity of many infections and the high mortality rate associated with diarrhoea, respiratory infections, measles, worm infestations and malaria. The burden of these largely preventable or inexpensively curable diseases of children is very high in sub-Saharan Africa (Woldemariam, 2002). Several factors may contribute to deteriorating nutritional status during severe and prolonged infection. These include decreased food intake, inefficient nutrient

absorption, loss of body nutrient stores and increased nutritional requirements. People who are sick frequently lose their appetite and are thus unlikely to maintain their dietary intake, unless encouraged to do so (Woldemariam, 2002). It is estimated that, each year, 24 million babies are born with low birth weight (LBW), which means less than 2.5 kg. Ninety-five percent of these events occur in developing countries. LBW puts infants at greater risk of neonatal death and is a major cause of poor growth and development in later childhood. Under-nutrition *in utero* is also associated with certain chronic diseases in adult life. Although LBW can be due to a number of factors, such as a woman's small size, uterine infections, smoking and malarial infection, the most significant cause is poor maternal nutrition (FAO, 2007).

The framework below shows how the socio-economic factors could have a great impact on children's anthropometric indices through food preparation (care practices), health, sanitation and food security.



Source: FAO, 2007 and Lusiapeto *et al.,* 2010

Figure 2.1: Framework for measuring food security

According on FAO assessment, the key difference between the UNICEF and FIVIMS framework is that the latter gives a substantial importance to food availability, access, consumption and utilisation and their determinants. Health and sanitation and care practices could also occupy an important place within the framework (FAO, 2007).

2.7 SUMMARY

Food security is a complex concept that involves economic, social, cultural, environmental and political aspects. In order to really understand the food situation and the causes of food insecurity, it is important to understand the fundamental notion of food security. Food security depends on four key factors: food availability; access to sufficient food; stability of food stocks and utilisation of food, which is related to cultural practices (Khemmarath, 2002). Malnutrition is a major health problem, especially in developing countries. Water supply, sanitation and hygiene, given their direct impact on infectious disease, especially diarrhoea, are important for preventing malnutrition. Both malnutrition and inadequate water supply and sanitation are linked to poverty. The impact of repeated or persistent diarrhoea on nutrition-related poverty and the effect of malnutrition on susceptibility to infectious diarrhoea are reinforcing elements of the same vicious cycle, especially amongst children in developing countries (WHO, 2012). Food insecurity is a critical variable for understanding the nutritional status of low-income populations. However, limited research is available on the relation between household food insecurity and children's nutritional status (Matheson, 2002). The search for viable indicators is driven by the lack of a 'gold standard' measure for food security. Measures of consumption, poverty and malnutrition are all used as *proxy measures*; there are increasingly strong calls for improved food security indicators, including food utilisation and perception, which have an impact on children's anthropometry. Although comparison with some benchmark indicator of food and nutrition security – such as anthropometric measures – would add to the validation process, the composite indicator proposed in this study appears to perform well in locating the most food insecure households (Maxwell & Frankenberger, 1992). Measurement is necessary at the outset of any development project to identify the food insecure, to assess the severity of their food shortfall and to characterise the nature of their insecurity (seasonal versus chronic). It provides the basis for monitoring progress and assessing the impact of these projects on the beneficiaries' food security (Hoddinott, 1999).

Obviously, food insecurity and malnutrition cannot be eradicated simply through increases in global, national or regional food availability. Increased food supplies do not automatically enhance access to food by the poorer groups of society. Food security measures alone will have a limited effect on the nutritional well-being of individuals, unless the reinforcing, detrimental linkages between food insecurity, disease, poor sanitation and inadequate education are considered. IFAD, and its partners in the developing community, are challenged to design policies, programmes and projects that give due attention to improved food security at

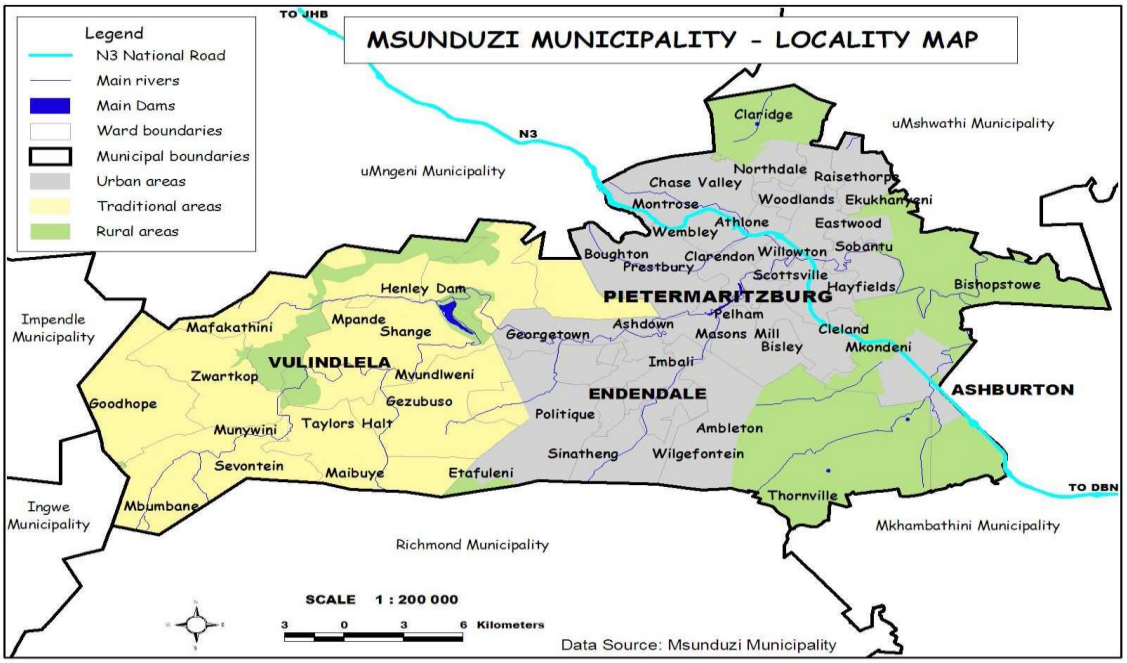
the household level. Better health services, water supply, sanitation and child-care practices are the complementary and indispensable factors that influence not only the nutritional status of individuals but also their overall poverty status (Maxwell & Frankenberger, 1992).

CHAPTER III: DESCRIPTION OF THE STUDY AREA

This section gives an overview of conditions in which the respondents live, so that the underlying situation that can affect households, in general, and children, in particular, can be highlighted. Health, food security and socio-economic and environmental situations are discussed in this section.

3.1 DESCRIPTION OF THE AREA

This study was conducted in the Msunduzi Municipality that encompasses Pietermaritzburg (Figure 3.1). It is one of the municipalities in UMgungundlovu District.



Sourece; AMICAALL, 2005

Figure 3.1: Msunduzi Municipality locality map

Msunduzi Municipality is located approximately 80km inland from Durban. The municipality is the second-largest urban centre in KwaZulu-Natal and includes the city of Pietermaritzburg (administrative capital of the Province) and the surrounding peri-urban or semi-urban area. Msunduzi Municipality has a total population of just over 600 000 inhabitants and an economically active population of approximately 250 000 inhabitants. Of these, 39% are unemployed and 36.5% have a monthly income between R1 and R800. Approximately 25% of these live in informal or traditional housing and 20% of residents aged 20 years and over are

functionally illiterate (Thandanani Children's Foundation, 2009). Msunduzi is characterised by a complex racial mix, with about 77% of the population being black.

Msunduzi is a typical South Africa city, divided between the rich and the poor, formal and informal, and advantaged and disadvantaged. Areas such as the Greater Edendale and Vulindlela remain predominantly black, and are characterised by massive poverty. A growing black middle class has moved to the former white areas, creating a more integrated society in those areas.

The number of people residing in the Msunduzi region increased from 518 961 in 1996 to 616 733 in 2007. This represents 1.71% per annum. This is higher than the national average, which suggests that the Msunduzi region is experiencing a net inflow of people. Similarly, the number of households in Msunduzi has increased. The number of persons per square kilometre (km^2) in 2007 was 953. The population density for the province is around 102 persons/ km^2. The high density is indicative of a relatively small area and an exceptionally high urbanisation level, with a large economically specialised city population drawing on rural resources outside the area. The municipality accounts for the highest growth in population of uMgungundlovu District. This is attributed to the economic dominance of Msunduzi in the District. The declaration of Pietermaritzburg as the KwaZulu-Natal provincial capital significantly boosted the local economy.

Pietermaritzburg is nationally renowned for its educational institutions, including the internationally acclaimed University of KwaZulu-Natal, attracting a significant population for a significant period of the year.

The remaining local municipalities harbour 40% of the uMgungundlovu District population. UMshwathi has the second largest population, making up 11.4% of the District population. All the other municipalities contribute less than 10% to the District population, with Impendle holding the least number of people at 2.9% of the district population. Msunduzi is the most urbanised municipality, while uMshwathi is a predominantly rural municipality, accounting for 81% of rural households in the District. Impendle and Mkhambathini are the most rural in nature of all the municipalities in the District.

3.2 HEALTH SITUATION

The study used two sites of Edendale and Northdale hospitals, which are at the district level. Edendale hospital offers District services, as well as provincial level services, to UMgungundlovu District, as well as parts of Sisonke, UMzinyathi, and EThekwini.

Public health services are rendered within this district through a network of Primary Health Care (PHC) centre, clinics (fixed/mobile), four Community Health Centres and two District hospitals. A District/Regional, Regional/Tertiary and Specialised Hospital are part of the District, creating unique opportunities for service delivery (KwaZulu-Natal Department of Health, 2005).

There is also a high prevalence of HIV/AIDS in the area. In 2008, 45% of women visiting local clinics within the uMgungundlovu District were HIV positive. Most deaths related to AIDS occur in the 20 to 39 year age group. It is estimated that in 2010 KwaZulu-Natal should have 500 000 orphans and Pietermaritzburg 50 000 (Thandanani Children's Foundation, 2009). The diseases that most commonly cause children morbidity in the Health District of uMgungundlovu include: scabies, lower respiratory tract infections in under-fives, diarrhoea (five years and older), Diabetes mellitus, melminthiasis (< five years), gynae conditions, mental health, epilepsy, male urethral, discharge trauma/injuries and severe malnutrition (KwaZulu-Natal Department of Health, 2005).

3.3 FOOD SECURITY SITUATION

Within the context of ongoing urbanisation, research reveals major policy issues for city and national levels of government, because of the persistent household food insecurity in urban centres in South Africa. The levels of chronic food insecurity among poor urban households in the Msunduzi Municipality are estimated at 87% (Frayne *et al.*, 2009). With urbanisation, the transfer of rural poverty to urban areas is raising globally (Frayne *et al.*, 2009). Ravallion (2007), cited by Frayne *et al.*, (2009), states that the proportion of food insecure households found in urban areas rose from 19% to 24% between 1993 and 2002. Compounding the rising levels of urban poverty in the world is the fact that the cost of living in cities is some 30% higher than in rural areas.

The link between poverty, food security and informal housing, which is so characteristic of South African cities, is of great importance. The national data on HIV for South Africa show that

informal housing is an important cause of prevalence in HIV, with the highest rates being recorded in the informal urban areas of the country. This appears to be the consequence of a number of poverty-related factors, including overcrowding, poor access to medical facilities, high levels of mobility, risky poverty-induced behaviour, and substance abuse (Frayne *et al.*, 2009). In addition to the lack of access to medical facilities, it is plausible that generally poor levels of physical and social infrastructure in informal areas would contribute directly to poor levels of social, psychological, emotional and physical health, thus increasing susceptibility to HIV and other diseases.

The cycle of poverty and unsustainable urban growth can be broken. one way of doing this is through an effort from all levels of government that focuses on food as the major requirement for well-being.

3.4 SOCIO-ECONOMIC AND ENVIRONMENTAL SITUATION

3.4.1 Employment

The average unemployment rate in the district is about 40%, with some local municipalities recording up to 50 to 70% unemployment rates. The greater part of employment opportunities are in the farming, manufacturing and social services, sectors as well as private households. The literacy rate is estimated at 60%. Gender distribution follows the national pattern of males 48% and females 52% (KwaZulu-Natal Department of Health: 2005).

The *per capital* lower bound poverty line is estimated at R322 and the upper bound line is R593, both at year 2000 prices. With the recent adjustment, the lower bound poverty line, for 2006, rose from R322 to R431. With the global economic recession, job losses and increases in food prices, it may be reasonable to expect that the proportion of people living in poverty has increased (Frayne *et al*., 2009). It is clear that many of the households in Msunduzi Municipality live in poor circumstances, well below even the 2000 poverty line. Inflation will reduce this ‘surplus’ significantly, bringing even the relatively wealthier households closer to the real lower bound poverty line (Frayne *et al*., 2009).

3.4.2 Market

Frayne *et al*. (2009) show that households obtain food from a wide variety of sources (Table 4.2). For Msunduzi municipalities, the main sources are supermarkets (34%), small shops,

restaurants and takeaways (14%), and informal and street food (15%). In contrast, only 11% grow their own food, while 25% of households obtain food from sources that may be described as 'coping strategies' (food aid, food remittances, shared meals with neighbours and/or other households, food provided by neighbours and/or other households, community food kitchens, and borrow food from others). It could be argued that the limited urban agriculture as a source of food is likely to be a survival strategy, too; this would bring the total number of households obtaining food from sources that are typically associated with high levels of food insecurity to more than 34% as show in the table 3.1 (Frayne *et al*., 2009).

Table 3.1: Source from which household normally obtains its food

Source of food	**%**
Supermarket	34
Small shop/restaurant/take away	14
Informal market/street food	15
Grow it	11
Food aid	2
Remittances (food)	2
Shared meal with neighbours and/or other households	6
Food provided by neighbours and/or other households	7
Borrow food from others	8
Total	100

Frayne *et al.*, 2009

The high incidence of use of informal sources of food on a regular, almost daily, basis is consistent with limited food income and speaks to the question of urban food poverty

3.4.3 Access to goods and services

Most of the households (91 308) have relatively good access to water connection on their premises, but only 6% of households have access to basic service levels (borehole, dam, river). It is of concern that Msunduzi is the only city where this percentage did not decrease between 1996 and 2007. Of further concern is that the backlog in water provision remains higher than the 1996 backlog level in Msunduzi. An estimated 72.4% of households have their refuse removed

weekly; the remainder either does not have access to these services (3%) or utilise their own dumps (36%) for waste disposal (Department of Agriculture, 2010). The municipal landfill site has limited remaining capacity and there are high levels of illegal dumping of domestic and industrial waste; 51.3% of households have access to full waterborne sanitation facilities and 4.3% to septic tanks. Msunduzi has a high reliance on pit and bucket latrine systems and one in three households in Msunduzi do not have adequate access to sanitation. The capacity of the Darvill Sewage Treatment Works is problematic, due to the ingress of storm-water into the system that compromises the functioning of the treatment works during and after storms (Department of Agriculture, 2010).

3.5 SUMMARY

In summary, the study targeted two sites, the Edendale and Northdale hospitals, which are at the district level, and work through a network of Primary Health Care (PHC) centres. In keeping with the health situation of Msunduzi Municipality, this area is characterised by a high prevalence of HIV/AIDS and 45% of women visiting antenatal clinics within uMgungundlovu district were HIV positive. Most AIDS-related deaths occur in the 20 to 39 year age group. KwaZulu-Natal has 500 000 orphans and Pietermaritzburg 50 000, due to AIDS. Other issues affecting children include lower respiratory tract infections in under-fives, diarrhoea (five years and older), diabetes mellitus, helminthiasis (less than five years), mental health, epilepsy, male urethral, discharge trauma/injuries and severe malnutrition.

Within the context of ongoing urbanisation, the average food insecurity level in Msunduzi Municipality is estimated at 87%. In line with global trends, the transfer of rural poverty to urban areas and the generally higher cost of living in urban areas seem to be major drivers of food insecurity. The average unemployment rate in the District is about 40%, with some local municipalities recording up to 50 to 70% unemployment rates.

For Msunduzi Municipality, households obtain food from a wide variety of sources. Only 5% grow their own food, while 25% of households obtain food from sources that may be described as ‘coping strategies’ (food aid, food remittances, shared meals with neighbours and/or other households, food provided by neighbours and/or other households, community food kitchens, and borrow food from others). An estimated 72.4% of households have their refuse removed weekly; the remainders either do not have access to these services (3%) or utilise their own

dumps (36%) for waste disposal. Six percent of households do not have access to tap water and enjoy only very basic service levels (borehole, dam, and river).

The link between poverty, food security and informal housing, which is so characteristic of South African cities, is of great importance. This cycle of poverty and unsustainable urban growth can be broken, and one way of doing this is through an orchestrated effort from all levels of government that focuses on food as the major requirement for well-being and as the major driving force behind the re-engineering of cities into sustainable, inclusive and healthy environments.

CHAPTER IV: METHODOLOGY

4.1 RESEARCH APPROACH

Children's anthropometry indices and household food Insecurity measures are studied in the framework of a survey, using a quantitative research approach because of the numerical nature of the data.

4.2 GAINING ENTRY

The target heath facilities were Edendale Hospital, CHC Imbalenhle, CHC Boom Street and Northdale Hospital. Three health institutions out of four responded positively. These were Edendale Hospital, CHC Imbalenhle and Northdale Hospital. Permission to conduct research was granted by Health District of uMgungundlovu, through the KwaZulu-Natal Department of Health, especially Health Research & Knowledge.

4.3 SUBJECTS AND SAMPLING TECHNIQUE

The data used for this study derive from a survey of 180 children (from 180 households), under five years old, from mainly poor, food insecure communities of Msunduzi, which encompasses Pietermaritzburg. Edendale and Northdale areas, were purposefully selected. The inclusion criterion for the children (households) was that they were aged between 0 and five years at the time of survey who had a particular nutritional problem. Each area comprises a number of suburbs, which were regrouped into nine areas, including France, Pietermaritzburg central, Raisethorpe, Sobantu/Eastwood, Edendale, Imbali, Hilton/Woodland, Sweetwater and other suburbs outside of Msunduzi. The site of Edendale was represented by Edendale Hospital and CHC Imbalenhle, while Northdale was represented by Northdale Hospital. These two hospitals are at the District level. They accept patients from the entire Health District of uMgungundlovu. Edendale was coupled with CHC Imbalenhle, because the former does not have an integrated nutritional programme. A total of 180 children were recruited from these institutions, 90 children from Edendale/Imbalenhle and another 90 from Northdale Hospital.

4.4 DATA COLLECTION

There were two levels of measurement, including using a digital scale and an interview by questionnaire. The weight of each child was measured using a portable infant digital scale for infants more than one year, and an electronic scale, for children whose age was greater than one year. The horizontal length of the infants was measured with a pediatric length-measuring mat. For older children who could stand, height was measured using a wall-mounted tape measure. For each child, weight, height and age were collected and compared to the international standard population using the chart curve of children, as given by the Centre for Disease Control/World Health Organization reference. For each child, a Z-score, that is the number of standard deviations (SDs) from the reference population median, was read for weight-for-height, weight-for-age and height-for-age.

If the Z-scores were less than –2 SDs or greater than +2 SDs, the child was recruited for the interview. Before interviewing the mothers, they would be given a short explanation about the survey and then asked about their commitment to the research project, followed by their signing a consent document.

The questionnaire used structured questions, approximately 30, divided into five sections (Appendix B). Interviews were conducted by two enumerators, fluent in both English and isiZulu. IsiZulu was used by a female enumerator trained for that purpose. All materials such as questionnaires were available in English and translated into isiZulu, where necessary, especially when questions were asked to the mothers who could not read or understand English.

4.5 DATA ANALYSIS

The anthropometric data of the children were assessed using the WHO Anthropometric Software version 2014 and the chart curve of children, as given by the Centre for Disease Control/World Health Organization reference. A Z-score, that is the number of standard deviations (SDs) from the reference population median, was read for weight-for-height, weight-for-age and height-for-age either side (appendix B). The records were verified for accuracy for data entry and data entry was done using SPSS. Chi-square test and Mann–Whitney test were used in the descriptive analysis to evaluate the associations and proportions (percentages) between different variables. Chi-square test was used for categorical variables, Mann–Whitney and ANOVA tests were used for continuous and nominal variables, respectively. Linear regression analysis was conducted to determine the predictors of stunted growth, underweight and wasting, even overweight children. SPSS 21 for Windows was used to analyse children's anthropometric measures and household food security situation. Multiple linear regressions was run to allow specific factors to enter the analysis for determining the association between these predictor variables and predicted variables: children's anthropometrics indices, so that the effect of each could be estimated. It is valuable for quantifying the impact of various simultaneous influences of these household characteristics or socio-economic factors upon an anthropometric index variable analysis. The analysis ended by assessing the advantages of using children's anthropometric indices as indicators of food security.

Table 4.1: Summary of methodological approach

General objective: To develop a specific and analytic approach of food security measurements, building upon combined approaches that use simultaneously children's anthropometric indices and the HFIAS method for measuring household food security.			
Specific-objectives	**Data collection**	**Indicators**	**Analytical methods**
To determine the relationship between children's anthropometric indices and household food security, including their causal links.	Primary Data from a nutritional survey in two clusters: one side with combined Edendale Hospital and CHC Embalenhle, the other side with Northdale Hospital	*Stunting(h/a) *Underweight(w/a) *Wasting (h/w) *HFIAS/categories *HFIAS/conditions *Household scores *Socio-economic factors	Descriptive statistic (age, gender, income, residence, etc.) cross-table/chi-square and Mann–Whitney test (combined socio-economic variables). Simple linear regression (indices and H. scores) Multiple linear regression (indices, HH Scores +Factors) ,
To assess the advantages of using children's anthropometric indices as indicators of food security.	-	Result from testing	Discussion about the advantages of using children's anthropometric indices as indicators of food security

CHAPTER V: RESULTS AND DISCUSSION

5.1 RELATIONSHIP BETWEEN CHILDREN'S ANTHROPOMETRIC INDICES AND HOUSEHOLD FOOD SECURITY

The objective of this empirical survey in the Msunduzi Municipality was to determine the relationship between children's anthropometric indices and household food security, as measured using Household Food Insecurity Access Scale (HFIAS). Four categories of HFIAS were used to assess three children's health conditions, i.e. "weight-for-age", "height-for-age" and "weight-for-height". In the health and related professions, anthropometry is generally used to determine the nutritional status of individuals and populations, but this study tests whether or not it can be used as an indicator of household food security. Chapter V describes the sample data and gives the results of the study.

5.1.1 General demographic analysis

One hundred and eighty children younger than 60 months took part in the study. The sample was geographically broken down into two clusters: Edendale and Northdale, with 90 respondents each.

5.1.1.1 Children's background

- **Gender**

Out of the 180 children recruited for this research, 49% were boys and 51% were girls. These follow the general Msunduzi Municipality trend, with 48% males and 52% females.

The mean age of the children was 14.03 months. The mean birth weight of the children was 2.8 kg. The children in the survey had a mean weight and height of 8.7 kg and 69.2 cm, respectively. Age of child, birth weight of child and weight and height of child did not differ significantly between boys and girls (Table 5.1). Boys had a mean of 70.3 cm and were taller than girls whose mean was 68.0 cm. This follows the normal children's growth trend, as shown in the chart curve of children given by the Centre for Disease Control/World Health Organization (see Appendix B). Girls were heavier (8.8 kg) than boys (8.6 kg), in contrast to the same chart curve of child growth, although the difference was not statistically significant.

Table 5.1: Children's age and anthropometric measurements (a)

Variables	Boys Means (n=88)	Girls Means (n=92)	Total Means (n=180)	Level of Significance
Child age (months)	13.8	14.2	14.0	0.668
Birth weight (kg)	2.80	2.70	2.78	0.431
Weight of child (kg)	8.60	8.80	8.69	0.186
Height of child (cm)	70.3	68.0	69.2	0.531

*p<0.1, **p<0.05, ***p<0.01

(a) According to t- test

The gender of the children compared to their anthropometric indices reveals that boys had significantly higher means in height-for-age (≥ + 2 SD Z-score) with a mean of 3.0 SD against a mean of 2.3 SD for girls (Table 5.2). These findings show that, in the Msunduzi Municipality, the gender of the child was statistically significantly associated with high height-for-age in such a way that boys are likely be taller than girls. This follows the normal trends in children growth as shown in the chart for children, given by the Centre for Disease Control/World Health Organization. According to that chart, boys are taller that girls. In the other respects, concern may be on "stunting" (≤ - 2 SD Z-score), where boys had a lower mean (-2.80 SD) than girls (-2.70 SD), although the difference was not statistically significant for boys and girls. According to other studies done in Africa, a higher prevalence of stunting was observed in males than in females. The cause of this discrepancy is not well established in the literature, but there is a belief that boys are more affected by environmental stress than girls (Lamontagne *et al.*, 1997).

Table 5.2: Children's anthropometric indices and gender of respondent (a)

Children's indices	Boys Means n=88	Girls Means n=92	Total Means n=180	Level of Significance
Weight-for-age Z-scores	-0.70	-0.60	-0.65	0.790
< -2 SD	-3.10	-2.80	-2.97	0.232
> 2 SD	2.30	2.20	2.24	0.660
Height-for-age Z-scores	-0.05	-1.10	-1.08	0.761
< -2 SD	-2.80	-2.70	-2.75	0.412
> 2 SD	3.00	2.30	2.70	0.030**
Weight-for-height Z-scores	-0.40	0.10	-0.16	0.836
< -2 SD	-3.00	-3.10	-3.07	0.769
> 2 SD	2.40	2.4 0	2.41	0.836

*p<0.1, **p<0.05, ***p<0.01

(a) According to t- test

- **Age**

Figure 5.1 shows the simple distribution of the age of a child. The majority of children (42%) were aged between zero and six months. The number of children by age group decreases with the age increase. This period coincides with the beginning of child immunisation at their local clinics. Attendance is important at this time.

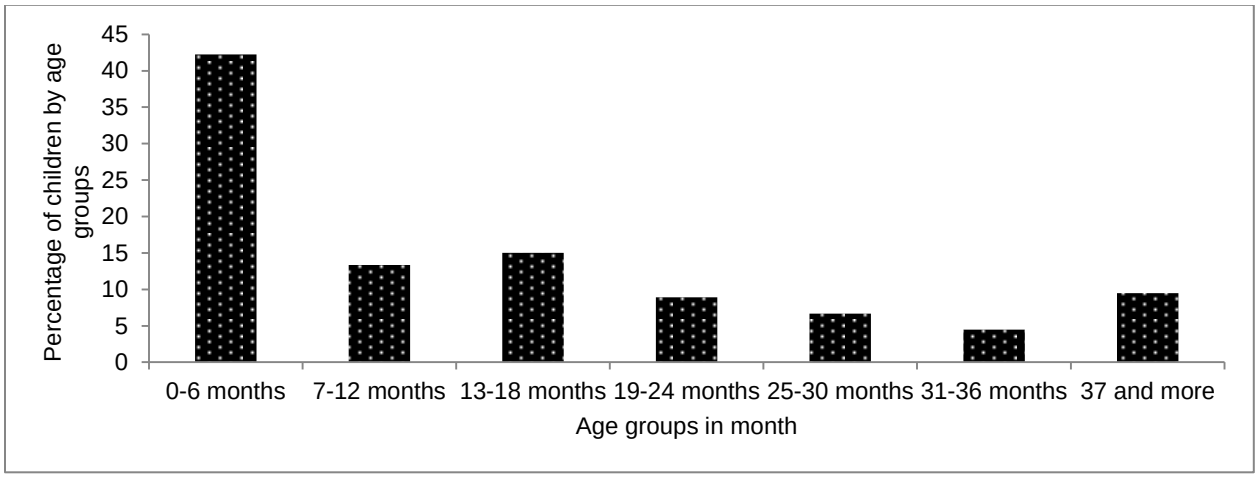


Figure 5.1 Age of the child by age group

Table 5.3 shows a significant association between the age group of the child and his/her health situation (p<0.01). That is, 65.6% of the children were sick and the highest proportion was found in the age group from birth to six month. Generally, children and women who are nursing mothers are the most vulnerable group in communities, compared to the rest of the population.

Table 5.3: Percentage of children's age group and health situation of the child (a)

Health	n (%)	0-6 (mths)	7-12 (mths)	13-18 (mths)	19-24 (mths)	25-30 (mths)	31-36 (mths)	37 more	Total	p-value
Average	180(100)	42.0	13.0	15.0	8.9	6.7	4.4	9.4	100	0.001***
Not sick	62 (34.4)	61.3	16.1	8.1	1.6	3.2	1.6	8.1	100	
Sick	118 (65.6)	32.2	11.9	18.6	12.7	8.5	5.9	10.2	100	

*p<0.1, **p<0.05, ***p<0.01

(a) According to chi-square test

Table 5.4 shows that the age of the child was significantly associated with the weight and the height of the child in the Msunduzi Municipality, with p<0.01 and p<0.01, respectively. It was found that the mean birth weight (2.78 kg) was below the universally accepted birth weight (2.5 kg). Low birth weight is an indicator of food insecurity, because the low birth weight of the nursing mother and her nutritional and health status have an important impact on child development, especially during pregnancy and lactation. The mean weight and height of the child in the Msunduzi municipality were lower (8.4kg and 69.1cm), compared to the standard reference means given in the chart curve of child growth (10.5 kg and 80 cm).

Table 5.4: Means of children's weight and height across age groups (a)

Characteristics of children	0-6 mths (Mean)	7-12 mths (Mean)	13-18 mths (Mean)	19-24 mths (Mean)	25-30 mths (Mean)	31-36 mths (Mean)	37 more (Mean)	Total	p-value
Weight of child	5.36	8.38	9.73	10.7	11.7	13.9	13.1	8.42	0.001***
Height of child:	55.4	67.7	75.8	77.9	83.9	87.8	94.6	69.2	0.001***

*p<0.1, **p<0.05, ***p<0.01

(a) According to Anova test

- **Children's anthropometric indices**

The proportions of children of different nutritional status are shown in Figure 5.2. The highest rate across each anthropometric category is for stunting (57%), underweight (33%) and wasting (25%). The rates of stunting, wasting and low birth weight are indicators of the extent to which food is adequately utilised and converted into a satisfactory nutritional situation (Reinhard, 2000). Low height-for-age among children under-five years of age (stunting) is an appropriate indicator for poverty or food insecurity in the population, since it reflects deprivation of basic needs during the first five years of life. Therefore the fact that the majority are stunting, suggests a long-term poverty problem among the population.

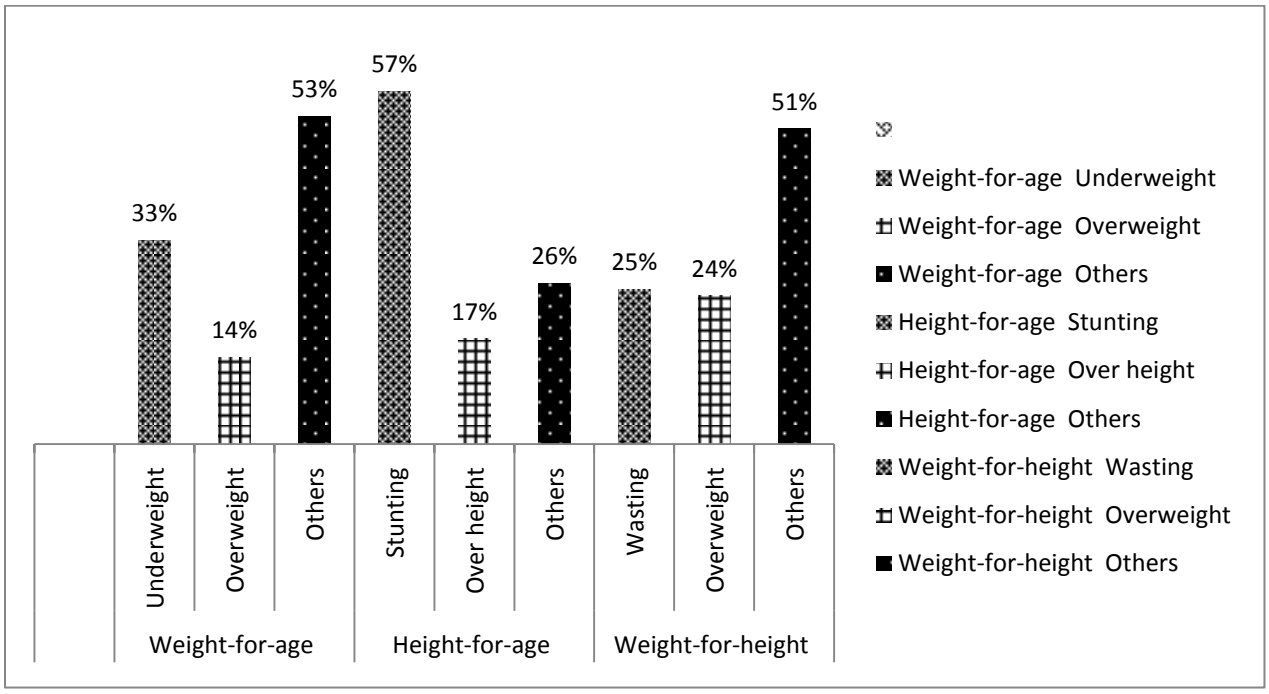


Figure 5.2 Proportion of children of different nutritional status

5.1.1.2 Mother's background

- **Marital status**

Figure 5.3 shows that about 81.1% of household heads were single while 18.9% were married.

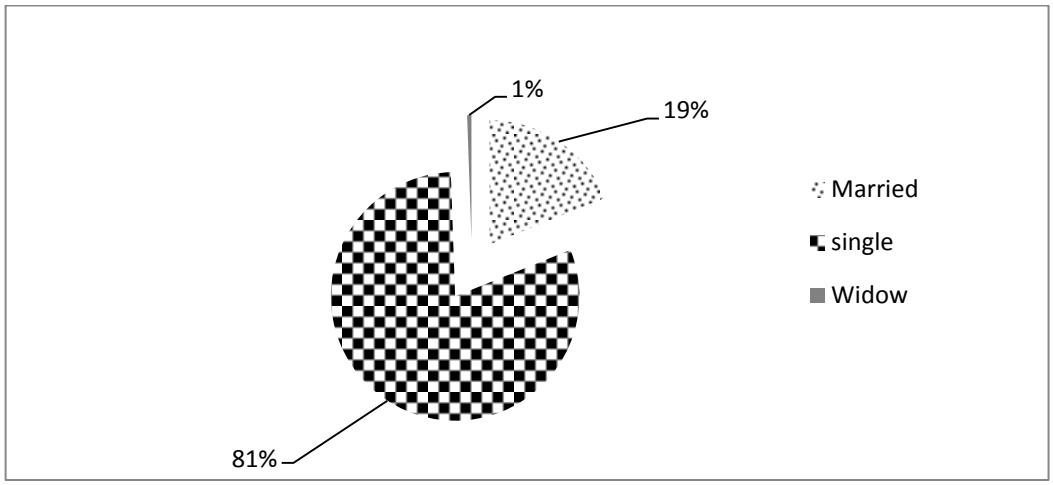


Figure 5.3: Marital status of the mother

The mean age and weight of the mother were, respectively, 27.46 years and 70.5 kg. Means of the age and weight of the mother differed significantly across categories of marital status of the mother, with $p<0.01$ and $p<0.01$, respectively (Table 5.5). This indicates the influence of mother's age on marital status. For example, the older mothers are likely to be married, while widows and singles are often young.

Table 5.5: Association between mother's age and weight and her marital status (a)

Variables	n	Single (Mean)	Married (Mean)	Widow (Mean)	Total (Mean)	p-value
Age of the mother (years)	180	26.41	31.26	50.00	27.46	0.001***(b)
Weight of the mother (kg)	180	68.48	78.36	97.50	70.51	0.007***(b)

*p<0.1, **p<0.05, ***p<0.01

(a) According to Anova test

(b) Post hoc test was not performed because at least one group (widow) had fewer than two cases.

The study found that the mother's marital status influenced her weight. For example the weight of the mothers was significantly higher for the married women compared to the singles. It was

shown that low maternal weight during pregnancy is associated with lower birth weight of children; in such a way that a small mother during pregnancy is likely to have a small child at birth (Robinsona, 2000).

Table 5.6 gives the health situation of the mother. There was a significant association between marital status and health of mothers during pregnancy ($p<0.01$). For example, 27.8% of mothers in the study area were sick during pregnancy and the majority of them (66 %) were single. Probably they were poorer due to no spousal support, hence food insecure.

Table 5.6: Relationship between Health situation of the mother and her marital status (a)

Variables	N (%)	Married (%)	Single (%)	Widow (%)	Total (%)	p-value
Average (%)	180 (100)	18.9	80.6	0.6	100	0.002***
Sick	50 (27.8)	32.0	66.0	2.0	100	
Not sick	130 (72.2)	13.8	86.2	0.0	100	

*p<0.1, **p<0.05, ***p<0.01

(a) According to chi-square test

- **Education of the mother**

Figure 5.4 provides the distribution of the level of education of the mothers. The percentage of mothers who achieved secondary school was 85.6%, that is, the highest rate. The lowest proportion was of illiterate mothers, 2.2%. The level of education in the community among mothers is not high. The average level of mothers education was estimated at 11 years, although the majority were literate. Different levels of formal education of the mother were statistically significantly associated with variables that indicate poverty, such as “household with access to clean water” and “electricity” and “household using wood fuel” (Table 5.7). This means, that these socio-economic factors, are likely to affect the level of formal education of the mother. Educated mothers are expected to be able to protect children against diseases, select appropriate food and have good utilisation of health services.

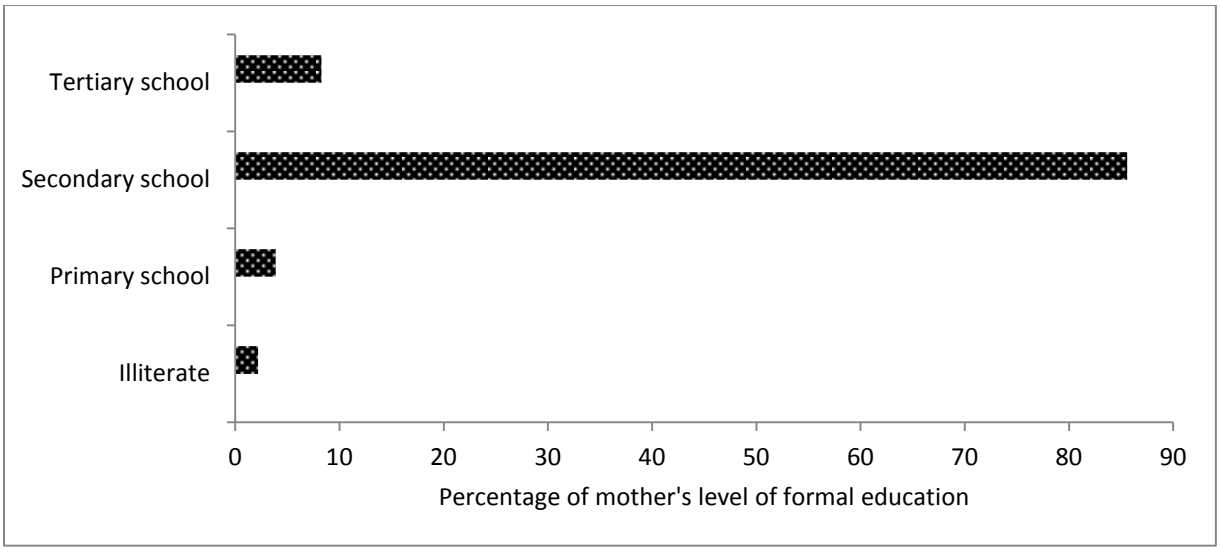


Figure 5.4: Distribution of level of formal education achieved by mothers

Table 5.7: Relationship between household characteristics and formal education of the mother' (**a**)

Physical environment:	n	Illiterate (%)	Primary school (%)	Secondary school (%)	Tertiary school (%)	Total (%)	p-value
Household with clean water							
Yes	158	0.5	3.3	75.9	8.3	88	
No	22	1.7	0.6	9.7	0.0	12	
Total	180	2.2	3.9	85.6	8.3	100	0.004 ***
Household with electricity							
Yes	161	0.5	2.2	78	8.3	89	
No	19	1.7	1.7	7.6	0.0	11	
Total	180	2.2	3.9	85.6	8.3	100	0.001 ***
Household with children > 5							
Yes	135	1.7	3.3	65	5.0	75	
No	45	0.5	0.6	20.6	3.3	25	
Total	180	2.2	3.9	85.6	8.3	100	0.684
Household using wood fuel							
Yes	83	2.2	2.8	38.8	2.2	46	
No	97	0.0	1.1	46.8	6.1	54	
Total	180	2.2	3.9	85.6	8.3	100	0.023 **

*p<0.1, **p<0.05, ***p<0.01
(a) According to chi-square test

- **Mother's employment**

Women's employment increases household income, with consequent benefits to household nutrition, in general, and children's nutritional status, in particular (Woldemariam, 2002). In the Msunduzi Municipality, 83.3% of respondent mothers were unemployed, compared with 16.7%

who were employed, as shown in Table 5.8. Mothers' employment compared to their marital status shows that employment differed significantly across marital status categories (p< 0.1). Among unemployed mothers, the majority were single (81.3%)**.** Women's employment strengthens household income, with consequent benefit to household nutrition, in general, and the children's nutritional status, in particular.

Table 5.8: Mother's employment and her marital status (a)

Variables	N (%)	Married (%)	Single (%)	Widow (%)	Total (%)	p-value
Mother work	180 (100)	18.9	80.6	0.6	100	0.078*
Working	30 (16.7)	20.0	76.7	3.3	100	
Not working	150 (83.3)	18.7	81.3	0.0	100	

*p<0.1, **p<0.05, ***p<0.01

(a) According to chi-square test

Employment enhances women's status in decision-making and power and encourages the woman's preference to spend earnings on health and nutrition. However, employed women without control over their income and decision-making authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being and the well-being of their children (Woldemariam, 2002).

5.1.1.3 Household socio-economic and area of residence

- **Households' area of residence**

The area of residence was broken down into three categories, peri-urban areas, rural areas and areas outside Msunduzi. Peri-urban represented 53%, rural 15.6 % and areas outside Msunduzi 31% (Figure 5.5).

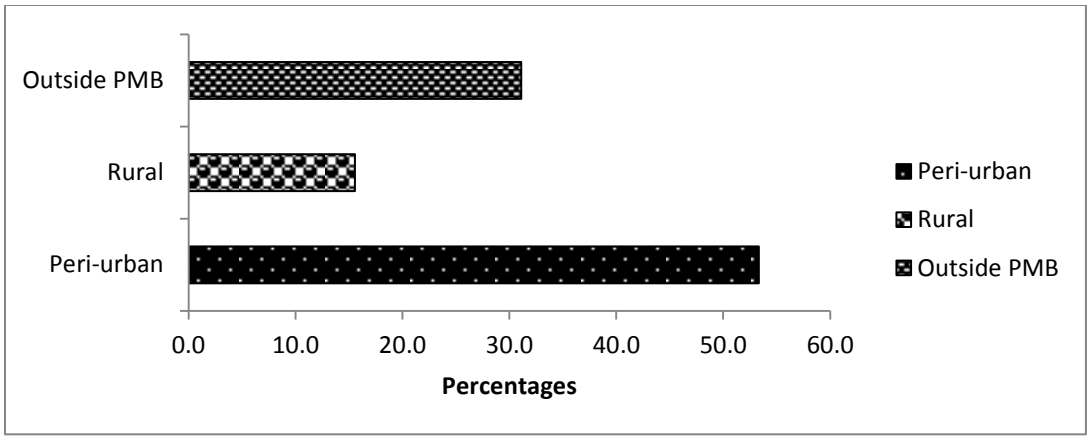


Figure 5.5: Children's areas of residence

In Table 5.9, the weight-for-height index was statisticaly significantly associated with children residencial categories ($p<0.1$). This suggests that children from peri-urban or township area were heavier than those from rural areas and those outside of Msunduzi. The peri-urban areas usually have better socio-economic opportunities than rural areas and areas outside Msunduzi. These findings concur with those of Osrin (2000), who said that the geographic location of households poses a potential impact on children's nutritional status.

Table 5.9: Relationship between children's anthopometric indices and area of residence (a)

Z- Scores	n	Peri-urban (mean)	Rural (mean)	Outside pmb (mean)	Total (mean)	p-value
Weight-for-age	180	-0.57	-0.56	-0.86	-0.66	0.621
Height-for-age	180	-0.91	-1.30	-1.25	-1.08	0.581
Weight-for-height	180	0.17	-0.59	-0.47	-0.15	0.079*

*p<0.1, **p<0.05, ***p<0.01

(a) According to Anova test

- **Household food security**

Figure 5.6 shows the proportion of households facing different levels of food security in the study area. The proportion of moderate household food insecurity was the highest with 35.6% followed by severe household food insecurity, with 32.8%, mild household food insecurity, at 18% and food secure households, at 13.9% being the lowest.

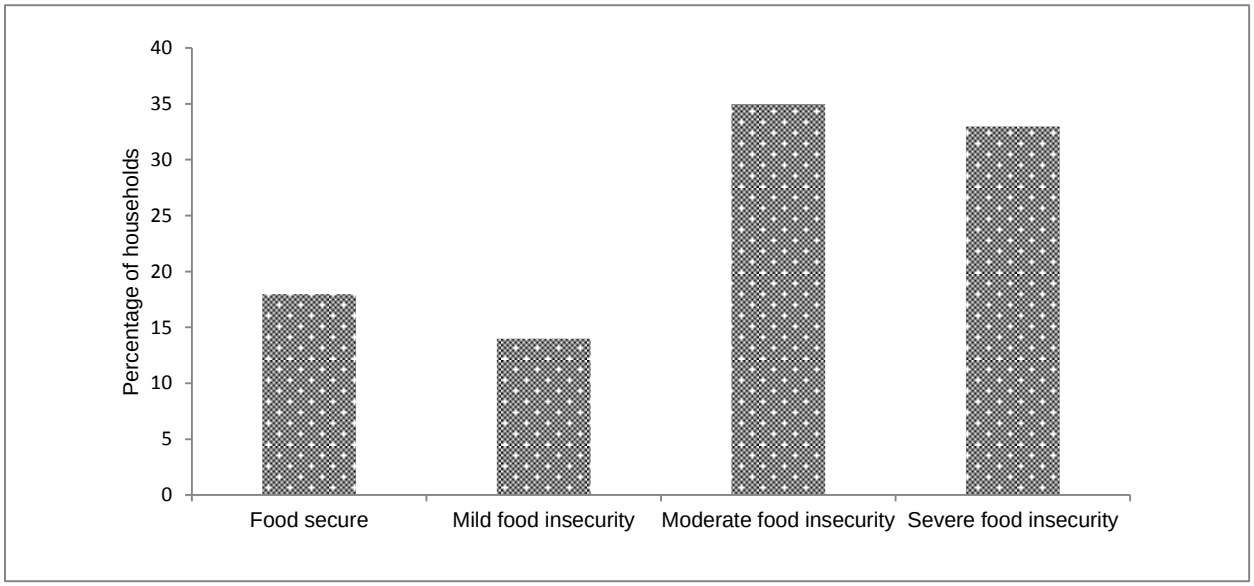


Figure 5.6: Proportion of households of different food security status

The relationship between household food security and children's anthropometric indices is shown in Table 5.10. The analysis shows that the weight-for-height index, especially overweight (≥ + 2SD Z-Scores) were only statistically significantly different across categories of HIAS ($p<0.05$). Weight-for-age and height-for-age indices were not significantly associated with categories of HFIAS. This suggested that, in the Msunduzi Municipality, overweight is an issue of concern. Contradictorily, the heaviest children (mean = 2.79) were found in severe food insecurity households and the lightest children were found among mild food insecurity households. It suggests that household food security is not the only issue which affects children's anthropometric indices, but there were other factors which affect children's nutritional status, such as health and environmental areas.

Table 5.10: Relationship between HFIAS and children's anthropometric indices (a)

Variables	n	Food secure (Mean)	Mild food insecurity (Mean)	Moderate food insecurity (Mean)	Severe food insecurity (Mean)	Total (Mean)	p-value
Weight-for-age	180	-0.70	-0.36	-0.90	-0.51	-0.66	0.543
≤-2 SD	59	-2.82	-2.71	-2.92	-3.25	-2.97	0.454
≥+2SD	25	2.00	2.00	2.29	2.44	2.24	0.189
Height-for-age	180	-0.85	-0.96	-1.16	-1.17	-1.08	0.900
≤-2 SD	103	-2.76	-2.83	-2.76	-2.69	-2.75	0.960
≥+2SD	33	2.71	2.50	2.67	2.80	2.70	0.934
Weight-for-height	180	-0.27	0.08	-0.25	-0.07	-0.15	0.875
≤-2 SD	45	-2.55	-3.50	-3.12	-3.31	-3.07	0.103
≥+2SD	46	2.38	2.00	2.31	2.79	2.41	0.036**

*p<0.1, **p<0.05, ***p<0.01

(a) According to Anova test

5.1.2 Child anthropometric indices' relationship with household characteristics

5.1.2.1 Relationship between children's anthropometric indices and poverty indicators

In the previous section related to demographic analysis (especially with reference to Table 5.10), it was found that children's anthropometric indices were statistically significantly associated with overweight in weight-for-height only. Proxy indicators of poverty are used in this section to show that children's anthropometric indices are strongly related to the household's poverty indicators, which are proxy indicators of household food security.

Table 5.11 shows the effect of households' use of wood fuel for cooking as proxy indicators of food security. It is known that households using wood fuel instead of electricity are poor. The study found that height-for-age (≤-2SD) and weight-for-height (≤-2SD) indices were both statistically significantly associated with household use of wood fuel (p<0.1). The mean Z-score of stunting children from households which did not use wood fuel (mean = -2.60 SD) was higher than those from households using wood fuel (mean = -2.90 SD). The same occurred with wasting, whose high Z-score was found in households which did not use wood fuel (mean = -2.68 SD vs. mean = -3.43 SD) for households using wood fuel for cooking. The increasing

poverty from informal areas and the levels of chronic food insecurity among poor peri-urban households in Msunduzi Municipality and the transfer of rural poverty to peri-urban areas explain these conditions of households using wood fuel in place of electricity.

Table 5.11: Effect of household use of wood fuel on children's anthropometric indices (a)

Variables	n	Household not using wood (Mean)	Household using wood fuel (Mean)	Total (Mean)	p-value
Weight-for-age	180	-0.45	-0.89	-0.92	0.111
≤-2 SD	59	-2.81	-3.09	-2.97	0.223
≥+2SD	25	2.20	2.30	2.24	0.585
Height-for-age	180	-0.81	-1.38	-1.08	0.088*
≤-2 SD	103	-2.60	-2.90	-2.75	0.055*
≥+2SD	33	2.67	2.75	2.70	0.770
Weight-for-height	180	-0.06	-.25	-.15	0.531
≤-2 SD	45	-2.68	-3.43	-3.07	0.055*
≥+2SD	46	2.30	2.52	2.41	0.263

*p<0.1, **p<0.05, ***p<0.01

(a) According to t-test

Table 5.12 shows that "households without clean water" are associated with three of the children's anthropometric indices: weight-for-age (p<0.01), height-for-age (p<0.1) and weight-for-height (p<0.01). "Households without clean water" is an indicator of poverty, which leads to a spiral of diseases through contaminated water. Water and sanitation play a particularly important role in child nutrition, due to their impact on diarrhoeal diseases. It appears that stunting (mean = -2.69 SD) and wasting (mean = -2.89 SD) from households with access to clean water were heavier than those from households without access to clean water (mean = -3.07 SD) and (mean = -3.70 SD), for stunting and wasting, respectively.

Table 5.12: Households using tap water and children's anthropometric indices (a)

Proxy indicator for food security					
Variables	n	Households do not use tap water (Mean)	Households use tap water (Mean)	Total (Mean)	p-value
Weight-for-age	180	-1.82	-0.50	-1.16	0.002***
≤-2 SD	59	-3.31	-2.87	-3.09	0.110
≥+2SD	25	3.00	2.21	2.605	0.074*
Height-for-age	180	-1.91	-0.96	-1.435	0.062*
≤-2 SD	103	-3.07	-2.69	-2.88	0.093*
≥+2SD	33	2.00	2.74	2.37	0.191
Weight-for-height	180	0.01	1.32	0.665	0.004**
≤-2 SD	45	-3.70	-2.89	-3.295	0.007**
≥+2SD	46	2.67	2.40	2.535	0.492

*p<0.1, **p<0.05, ***p<0.01

(a) According to t-test

Table 5.13 shows that weight-for-age, height-for-age and weight-for-height were statistically significantly associated with "household with access to children grant" (p<0.01, p <0.1 and p<0.01, respectively). It was found that the highest means of weight-for-age (-0.30 SD), height-for-age (-0.83 SD) and height-for-age (-0.24 SD) were for "households which do not rely on child grant", compared to those from "households which rely on child grant". Grants were the main source of income for these households and the monthly average income was about R450. Weak purchasing power or low *per capita* income was accepted as the main indicator of poverty. It is known that the health of children is a mirror on the health, social standing, and economic resources of their parents. Most poor households rely on grants as their resource or income in Msunduzi, especially for single female heads of households. This seems negatively impacting on the food and nutrition security of households or at individual levels.

Table 5.13: Relationship between households which rely on child grant and children's anthropometric indices (a)

		Proxy indicator for food security			
Variables	n	Households do not rely on grant (Mean)	Households rely on grant (Mean)	Total (Mean)	p-value
Weight-for-age	180	-0.30	-1.17	-0.735	0.002***
Height-for-age	180	-0.83	-1.44	-1.135	0.069*
Height-for-age	180	0.24	-0.68	0.46	0.002***

*p<0.1, **p<0.05, ***p<0.01

(a) According to t-test

5.1.2.2 Relationship between children's anthropometric indices and area of residence

Levels of chronic food insecurity among poor urban households in the Msunduzi Municipality, and the transfer of rural poverty to urban areas, justify grouping residential areas of respondents into Edendale and Northdale areas. The objective was to observe the difference in level of food security or poverty among these clusters.

Table 5.14 shows the association between the degree of malnutrition of children and the residential area of respondents. The mean of high weight-for-age and high height-for-age indices differed significantly across Northdale and Edendale area**.** However, weight-of-height index was not significantly different across the areas. The study found that the mean Z-score of overweight children, using weight-for-age, from the Northdale area (mean = 2.33 SD) were higher than those from the Edendale area (mean = 2.10 SD). The children with a higher height-for-age from the Northdale were also heavier than those from the Edendale (mean = 2.76 SD for Northdale and mean = 2.63 SD for Edendale). The study found that the increasing poverty from informal areas was more accentuated surrounded Edendale than Northdale and overweight or obesity is of concern. This could be through the influence of increasing poverty and the levels of their physical activity. This suggests that absence or difficult access to leisure facilities, either for children or for their parents, can affect physical activity required to reduce gain in energy (*over weight*). Hence children's anthropometric indices seem to be infuenced by the living area of the respondents. The peri-urban environment may also influence eating habits.

The density and proximity of different food stores in an area affect relative costs and dietary choices.

Table 5.14: Relationship between undernourished children and living area of respondents (a)

Z-Scores	Northdale Site Means	Edendale Site Means	Total Means	p-value
Weight-for-age	-0.38	-0.94	-0.66	0.222
≤-2 SD	-3.29	-2.79	-3.04	0.274
≥2 SD	2.33	2.10	2.215	0.004***
Height -for-age	-1.02	-1.13	1.075	0.824
≤-2 SD	-2.72	-2.77	-2.745	0.971
≥2 SD	2.76	2.63	2.695	0.019**
Weight-for-height	0.10	-0.40	0.25	0.459
≤-2 SD	-3.56	-2.74	3.15	0.277
≥2 SD	2.43	2.38	2.405	0.548

*p<0.1, **p<0.05, ***p<0.01

(a) According to t-test

5.1.2.3 Relationship between children's anthropometric indices and HFIAS

The objective was to test the contribution of selected independent variables to predict children's anthropometric indices, so that the effect of each can be estimated. Interest was focused on the effect of these factors together on child growth.

Three multiple linear regression models were performed separately for height-for-age, weight-for-age and weight-for-height, to investigate the effect of combined factors on anthropometric indices of the children.

- **Height-for-age**

Multiple linear regression analysis shows that the combined household characteristics listed in the model were statistically significantly associated with height-for-age (p<0.01) (Table 5.15). There, thus, exists evidence to conclude that all these predictors in combination are useful for predicting the height-for-age index. However, the coefficient of multiple determinations was about 23.10%. As shown in the first column of Table 5.15, it was found that the variables "mild household food insecurity", "formal education of the mother", and "birth weight of child" had a significant positive effect on the height-for-age index. On the other hand, age of child, household

with access to child grant, Sweetwaters area, France area and Edendale area had a significant negative effect on the height-for-age index. A coefficient with a positive or a negative sign explains a positive or negative affect on children's anthropometric indices, respectively. These partial regression coefficients are very important, because they indicate how the predicted could change for every unit increase or decrease in that predictor.

The study found that, "mild household food insecurity" was statistically significantly related to the height-for-age index and the latter had the highest positive partial regression coefficient (1.645), followed by birth weight and formal education, with 1.042 and 0.130, respectively. While the Edendale area had a great negative partial regression coefficient (-1.233), followed by Sweetwater area, France area, household with access to clean water , household with access to children grant and children age, with -1.172, - 0.995, -0.669, -0.600 and -0.049, respectively. It means, for example, if the household food security situation is improved by one point, it affects positively children's anthropometric indices by 1.645. Increasing by one the number of children located in Edendale, this would predict a negative effect on children's nutritional status by 1.233. The availability and access to adequate quantities of safe, good-quality, nutritious food is an important factor which influence nutritional status. Household food security may be a necessary prerequisite for good nutrition outcomes; it is insufficient on its own. It is important to combine the household food security indicator with key determinants of child nutrition, such as formal education of the mother, household with access to child grant, access to clean water, electricity and health services, and healthful environmental conditions such as good hygiene and sanitation.

Table 5.15: Multiple linear regression: Height-for-age and socio-economic factors

Dependent variables: Height-for-age	B	Std. Error	Sig. level
Constant	-3.783	1.712	0.029**
Mild food insecurity	1.645	0.800	0.041**
Formal education of the mother	0.130	0.073	0.078*
Household income	-1.156E-005	0.000	0.846
Child age	-0.049	0.019	0.010**
Gender of child	0.046	0.317	0.885
Birth weight of child	1.042	0.213	0.001***
Health of the child	0.243	0.367	0.509
Households rely on child grant	-0.600	0.338	0.078*
Nutritional education of the mother	0.115	0.415	0.782
Household with clean water	-0.669	0.587	0.256
Household with electricity	1.064	0.675	0.117
Sweetwaters area	-1.172	0.657	0.077*
France area	-0.995	0.565	0.080*
Imbali area	-0.284	0.568	0.618
Edendale area	-1.233	0.625	0.050*
Hilton/Woodland area	0.061	0.576	0.916
Sobantu/Eastwood area	-0.323	0.465	0.488
Raisethorpe area	-0.396	0.497	0.426

*p<0.1, **p<0.05, ***p<0.01

F. sig.: 0.001***

R square: 0.23

- **Weight-for-age and weight-for-height**

Based on Tables 5.16 and 5.17, multiple linear regression analysis shows that the combined predictor variables listed in these two models were statistically significantly associated with weight-for-age and weight-for-height ($p<0.01$ and $p<0.01$), respectively. Thus, there exists enough evidence to conclude that all these predictors collectively are useful for predicting weight-for-age and weight-for-height, respectively. These models were useful and their coefficients R of multiple correlations were at 48% and 49.2%, respectively. Weight-for-age and weight-for-height were not statistically significantly associated with categories of HFIAS. The lack of significant association between household food insecurity and weight-for-age and weight-for-height indices in the study was not expected, because of the substantial evidence that a household's access to food is among the key determinants of the nutritional status of

children. Nevertheless, this lack of association might be explained by several factors, such us usage of HFIAS as a method to assess household food security or, simply, in the regression analysis, the influence of household food security was confounded by other key poverty indicators of child nutrition, such as the formal education of the mother, the marital status of the mother, caring practices or feeding practices, household income, household with access to children grant, clean water, electricity, birth weight and healthful environmental area. It appears that for every increase in rate of households with access to clean water, from household with clean water to household without clean water, it would predict a decrease in children's anthropometric measures by 0.906. An increase in the rate of households with access to a child grant, from "household with child grant to "household without child grant", would predict a decrease in children's anthropometric measures by 0.434.

Findings of this study have shown that, although there was a lack of evidence of relationships between weight-for-age and weight-for-height and household food security, using the HFIAS method, it was evident that those indices were statistically significantly associated with alternative indicators of poverty. Children's anthropometric indices are determined by multiple factors, especially those related to poverty, and level of household food security. Poverty can lead to low levels of parental education, poor water supply and sanitation, scarce resources for buying food, poor food availabilty and inadequate heath care, all of which contribute to a greater risk of diseases and poor energy and nutrient intake.

Table 5.16: Multiple linear regression: Weight-for-age and socio-economic factors

Dependent variables: weight-for-age	B	Std. Error	Sig. level
Constant	-4.739	1.101	0.001***
Mild food insecurity	0.346	0.394	0.381
Moderate food insecurity	0238	0.312	0.447
Severe food insecurity	0.164	0.333	0.623
Formal education of the mother	0.034	0.051	0.503
Family size of household	0.017	0.035	0.627
Household income	6.923E-005	0.000	0.079*
Birth weight of child	1.339	0.141	0.001***
Household with access to child grant	-0.434	0.230	0.061*
Nutritional education of the mother	0.420	0.280	0.136
Household with access to clean water	-0.906	0.421	0.033**
Household with access to electricity	0.972	0.468	0.039**
Sweetwaters area	-0.392	0.398	0.327
France area	0.144	0.773	0.852
Imbali area	0.181	0.286	0.528
Edendale area	0.347	0.335	0.302
Hilton/Woodland area	-0.370	0.748	0.622
Sobantu/Eastwood area	0.072	0.851	0.933
Raisethorpe area	-0.876	0.446	0.051*

*p<0.1, **p<0.05, ***p<0.01

F. sig.: 0.001***

R square: 0.48

From the results given above, it appears that socio-economic characteristics of households that affect children's anthropometric indices in Msunduzi can be summarised and cited as follows: households with access to safe drinking water (tap/borehole) and electricity in the home, households with access to child grants, mother has schooled for more than five years, mother is married or single, mother employment, household reportedly always has not enough food to eat (food insecurity), residential area of respondents (Lesiapeto *et al.,* 2010).

Table 5.17: Multiple linear regression; Weight-for-height and socio-economic factors

Dependent variables: Weight-for-height	B	Std. Error	Sig. level
Constant)	3.993	2.212	0.073
Mild food insecurity	0.406	0.508	0.425
Moderate food insecurity	0.108	0.403	0.790
Severe food insecurity	0.182	0.426	0.669
Household which relies on child grant	-0.688	0.296	0.021**
Household with access to clean water	-0.830	0.458	0.072*
Birth weight of child	0.657	0.185	0.001***
Married	-3.325	1.915	0.084*
Single	-3.381	1.889	0.075*
Widow	-1.141	0.968	0.240
Girls	0.559	0.284	0.051*
Whether mother smokes	1.054	0.815	0.198
Cases of diarrhoea because of food quality	-0.596	0.358	0.098*
Illiterate	-0.868	1.130	0.443
Primary education	-1.168	0.885	0.188
Secondary education	-1.138	0.519	0.030**

*p<0.1, **p<0.05, ***p<0.01

F. sig.: 0.001***

R square: 0.492

5.1.3 Discussion

5.1.3.1 Relationship between CAI and household food security and poverty indicators

The present study showed a high prevalence of household food insecurity and negative anthropometric indices among children from birth to 60 months of age in the Msundusi Municipality. The main finding was that household food insecurity was associated with weight-for-height, (≥ + 2SD Z-scores), using univariate analysis, and height-for-age using bivariate analysis. The lack of significant association between household food insecurity and weight-for-age and weight-for-height indices in multiple linear regression analysis was not expected, because of the substantial evidence that a household's access to food is among the key determinants of the nutritional status of children. Nevertheless, this lack of association might be explained by several factors, such as the usage of HFIAS as a method to assess household food security, or perhaps the influence of household food security on children's anthropometric

indices can be confounded by other key poverty indicators of child nutrition, such as a household which continuously uses wood fuel for cooking, a household with access to a child grants, clean water and electricity and the child's area of residence. These variables of poverty were used as alternative indicators of household food security to confirm the relationship that exists between CAI and household food security. So, height-for-age (≤-2SD Z-score) and weight-for-height (≤-2SD Z-score) indices were statistically significantly associated with a household which continuously uses wood fuel for cooking, as proxy indicators of poverty and food security. In fact, the increasing poverty from informal areas and the levels of chronic food insecurity among poor peri-urban households in Msunduzi municipality can justify these conditions of using wood fuel as source of energy for cooking.

Households without clean water were associated with three children's anthropometric indices including weight-for-age, height-for-age and weight-for-height. The category household without clean water is an indicator of poverty, since it leads to a spiral of diseases through contaminated water. Water and sanitation play a particularly important role in child nutrition due to their impact on diarrhoeal diseases. Household's access to facilities is likely to be correlated with community characteristics. Households living in wealthier communities might have a relatively healthy environment, which implies better sanitation facilities and access to clean water and healthcare facilities.

Weight-for-age, height-for-age and weight-for-height were statistically significantly associated with the household with access to child grants. Weak purchasing power or low *per capita* income was accepted as the main indicator of poverty. Most poor households rely on grants as resources or income in Msunduzi, especially the single female head households, with an average of R450 per month. Lesiapeto *et al.,* 2010, showed that almost one-third of the households depended on grants/welfare and child support/maintenance as source of cash incomes. These sources of cash income contributed significantly to the 72% of households having some kind of regular source of incomes.

The results indicate that household food security is not the only issue which affects children's anthropometric indices. Other factors that affect children's nutritional status include areas of residence. In fact, the geographic location of children in this study is characterised by the increasing poverty from informal areas and the levels of chronic food insecurity among poor peri-urban households in Msunduzi Municipality, including the transfer of rural poverty to peri-

urban areas. This justifies grouping residential areas of respondents into either peri-urban, rural and other areas or into Edendale and Northdale areas. The objective was to observe the difference in level of food security or poverty among these clusters.

The study found that the weight-for-height index was statisticaly significantly associated with group areas of residence. Children from peri-urban or township areas were heavier than those from rural and outside areas of Msunduzi. Geographic location of household that refers to the rural, peri-urban locations and formal or informal housing (townships), is likely to impact on children's nutritional status. The degree of malnutrition of children was also statistically significantly associated with residential categories that is, Northdale or Edendale. The mean of overweight in weight-for-age and high height-for-age indices differed significantly across Northdale and Edendale**.** The study found that the mean Z-score of overweight children in weight-for-age from the Northdale area were higher than those from the Edendale area. However, high height-for-age children from Northdale were also taller than that from Edendale. This suggests that the increasing poverty from informal areas is more pronounced in Edendale than Northdale and overweight or obesity is the main concern. Absence or difficult access to the leisure facilities, either for children or for their parents can affect physical activity required to reduce gain in energy (*overweight*). The peri-urban environment may also influence eating habits, leading household to rely on cheap meats, often of bad quality, with excessive fat. Difficult access to different food stores in an area affect dietary choices.

The relationship found between children's anthropometric indices, HFIAS categories and proxy indicators of poverty; indicate that children's anthropometric indices can be good indicators of household food security measurement. However, they have to be used in combination with others indicators.

5.1.3.2 Children and mother's demography

In the present study, boys and girls were differing statistically significantly in height-for-age, especially stunting. Boys had significantly higher means in height-for-age than girls. This follows the normal children's growth trend shown in the chart curve of children given by the Centre for Disease Control/World Health Organization reference (Appendix B). Girls were heavier (8.8 kg) than boys (8.6 kg) in contrast to the same chart curve of children's growth, although the differences were not statistically significant. According to some studies done in Africa, a higher

prevalence of stunting was observed in males than in females. The cause of this discrepancy is not well-established in the literature, but there is a belief that boys are more influenced by environmental stress than girls (Lamontagne *et al.*, 1997). It was shown that rates of malnutrition among boys are consistently higher than among girls. Sahn and Stifel cited by Mekonnen (2002), presents three possible explanations for this. The first is related to the gender-specific standard for the African population. The second is that girls are genetically more robust than boys. There is some evidence that among pre-adolescent children there is a boost of fat in preparation for the growth spurt. This increase of fat is greater for girls than boys. The third is that there is greater investment in young girls than boys, since they eventually marry and leave to join their husbands' family. This reflects boys' and girls' gender-specific roles, i.e. girls have better access to food through their roles in cooking than boys who have a higher energy expenditure and lack of food during the day when they are involved in tasks such as herding animals and the energy requirement is different for boys and girls (Mekonnen, 2002).

The study found a significant association between the age bracket of the child and his health situation. That is, 65.6% of children were sick and the highest proportion was found in the age group from zero to six month, a period in which children's anthropometries are sensitive to infectious diseases. The age of child was also significantly associated with the weight and the height of the child in the Msunduzi Municipality. Children's nutritional status is sensitive to food insecurity or poverty early in childhood. Women and children are the most vulnerable groups in communities, compared to the rest of the population. Low weight-for-age, for example, peaks in the second year of life, while low height-for-age may start very early, at around three months of age, with prevalence decreasing at around three years. Hence, the same anthropometric indicator has different meanings or different predictive values at different ages. A high prevalence of low height-for-age among one year-old indicates current health and nutrition problems in the population (stunting) (WHO, 1994). Low birth weight is also an indicator of food insecurity in such a way that a low birth weight of a nursing mother and her nutritional and health status have an important impact on child development, especially during pregnancy and lactation. Poor nutrition of women, especially during pregnancy, is likely to cause growth retardation in the embryo, leading to low birth weight and burdening the child with the physical disadvantage that often cannot be compensated for later.

In the present study, stunting measurement is very relevant because it occurs in young children due to recurrent episodes or prolonged episodes of nutrition deficiency (in terms of calories

and/or protein available to the body tissue), inadequate food intake or persistent or recurrent ill-health. Wasting indicator is of value from a policy perspective for children under five years, since it is an acute condition and can be reversed, given favourable conditions, whereas low height-for-age is largely irreversible in children over three years of age (Mekonnen, 2002).

The study found that the weight of the mother was significantly higher among married women than single mother. Overweight women are at less risk of producing a small-baby than lean women. In a community where marginal nutritional intakes are common, birth weight is positively correlated with increase in fat mass. In contrast, low maternal weight gain has long been associated with poor foetal growth.

Means of age of the mother and weight of the mother differed significantly across categories of marital status of the mother. This means older mothers are likely to be married or widowed and single mother are often younger. Women's age is an important factor that affects maternal capacity of child care, especially in high fertility countries. Surveys conducted in Burkina Faso, Ghana, Malawi, Namibia, Niger, Senegal, and Zambia cited by Woldemariam (2002), show that a greater proportion of mothers aged 15 to 19 and 40 to 49 exhibit chronic energy deficiencies. A local study in Ethiopia showed that women in the youngest age group (15 to19) and women in the oldest age group surveyed (45 to 49) are the most affected by under-nutrition (Woldemariam, 2002).

It was found that 27.8% of mothers in the study area were sick during pregnancy and 66 % of these mothers were single. The health situation of the mother was statistically significantly associated with her marital status. It appears that the marital status of the women is associated with household headship and other health conditions of the women that affects the nutritional status of the children. Nutritional and food security could be endangered by a negative change in marital status (Woldemariam, 2002). The growth of children is also likely to be affected by the presence or absence of both parents in the household.

Education level of mothers (85.6% achieved secondary school) was found to be a limiting factor to job opportunities, thus threatening the household income and nutrition. In this study, different levels of formal education of the mother were statistically significantly associated with variables that indicate poverty, such as a household with tap water, using electricity, and using wood fuel. Educated mothers are expected to be able to protect children against diseases, select

appropriate food and have good utilisation of health service. As key household managers and caregivers, women's education and literacy level is important in ensuring household food security.

The employment status of mother compared to marital status shows that the occupation of the mothers differed significantly across marital status categories and 81.3% of unemployed mothers were single (Table 5.8). Employment enhances women's status in decision-making and power and encourages woman's preference to spend her earnings on health and nutrition. Though employed, women without control over their income and decision-making authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being and the well-being of their children. Studies in Africa have revealed that, at similar levels of income, households in which women have a greater control over their income are more likely to be food secure (Woldemariam, 2002).

It is concluded that children's anthropometric indices are important indicators at the start of any development project aimed to identify food insecurity. The composite indicators proposed in this study appear to confirm that CAI are useful to assess the severity of household food security or poverty and to characterise the nature of their insecurity (socio-economic compared with health).

The improvement of any single determinant among those related to food and nutrition security is, simultaneously, an important contribution to good child development.

5.2 ADVANTAGE OF USING CHILDREN'S ANTHROPOMETRIC INDICES AS INDICATORS OF FOOD SECURITY

This section emphasis the advantages of using children's anthropometric indices as indicators for food security analysis. The measurement of food security in South Africa has been thoroughly discussed. A number of issues concern people working in the field. Some issues are currently being addressed and some remain unresolved. These issues include the assessment of food insecurity and hunger, specifically in children; individual food security and hunger (Radimer, 2002). A good indicator for nutrition and food security assessment needs to be measurable, sensitive, reliable, efficient and cost-effective, as well as politically and culturally

acceptable. In addition, it requires a reasonable time gap between data assessment and the presentation of the results of analyses and recommendations. According to the relationship found between children's anthropometric indices and HFIAS categories, the former can be considered as a good indicator for measuring household food security, if they are used in combination with other indicators. The advantages will be discussed below.

Anthropometric indices have the following advantages: firstly, if implemented correctly, they produce the most accurate measures of individual measurement. They are easy to interpret. They measure trends and provide a good level of disaggregation. CAI is an indicator that targets the vulnerable poor and is used for development planning and policy design or impact monitoring., UN agencies, NGOs and donor agencies believe that the inclusion of a height-for-age index in the early phases of the "Integrated Food Security Phase Classification" method is appropriate (particularly in their three phases, as recommended by WFP), as an indicator of underlying vulnerability. Some of them called strongly for the inclusion of a height-for-age index as a reference outcome in the early phases (Young & Jaspars, 2009).

Secondly, this method is cost-saving because it requires fewer team members, score time is acceptable and it does not require highly skilled enumerators to do measurements. It is recognised that the development agencies, and their local collaborators, face significant financial and time constraints. Undertaking very detailed household and individual surveys on an on-going basis to characterise, monitor and measure impacts is not feasible; either because the time spent on these activities does not fit into the standard project cycle, the skills to implement and analyse such data are not available, or because hiring these skills is prohibitively costly (Hoddinott, 1999). This shows how simple measures of food security outcomes can be constructed and compared. These methods could be chosen so that they are accessible to anyone with a very basic grounding in statistics and access to a spreadsheet of software programs, such as Microsoft Excel (Hoddinott, 1999).

The third advantage is that CAI, particularly for children under five, are universal, as the genetic potential growth for children is uniform (Pangaribowo, 2013). This could facilitate comparisons between countries and over time for decision-making about appropriate policies, programmes and resource allocation concerning food security and poverty alleviation. As a tool of process assessment, it aims to engage stakeholders in reaching consensus about the current and likely

food security situation, based on the available evidence in the form of indicators (Young & Jaspars, 2009).

The fourth advantage is that it is easy for data collection and the presentation of measurements, in term of indices, to quickly classify how malnourished a child is and to determine the nutritional status of a population group. CAI is a good indicator in emergencies. Weight loss among children from birth to 60 months is used as a proxy indicator for the general health and well-being of the entire community. This assumes that children below 60 months are as vulnerable as other age groups to external factors (such as food shortages and illness) and the nutrition status of these children is as sensitive to change as that of other age groups. There are few universally valid indicators of food security that are applicable in crisis situations. Nutritional status, if properly measured, is widely accepted as comparable across different contexts. But while nutritional status can be one indicator of food security status, it may equally reflect elements of health status, care practices, water quality and other determinants of nutrition (The Smart Protocol, 2005).

Considering the complexity of food security, it is unlikely to ever be captured adequately by a single indicator. Thus, children's nutritional status is often assessed in association with factors such as feeding/weaning practices, formal education of the mother and exposure to infection at specific ages. These indices have additional advantages of providing information on past nutritional history, which cannot be obtained with equal confidence using other assessment techniques (Gibson, 2005).

Thus, anthropometric indices of children as a proxy measure for food security are necessary at the outset of any development project to identify the food insecure, to assess the severity of their food shortfall and to characterise the nature of their insecurity. The indices provide the basis for monitoring progress and assessing the impact of these projects on the beneficiaries' food security (Hoddinott, 1999).

5.3 SUMMARY

Chapter V has attempted to bring some clarity to the question of whether children's anthropometric indices are affected by household food insecurity, using univariate and bivariate analyses. In connection with the first, it was found that overweight in weight-for-height was statistically significantly associated with household food insecurity ($p<0.05$). Bivariate multiple linear regressions were conducted so that a fairly consistent picture of the factors contributing to food insecurity emerges across the three anthropometric indices and dependent variables. The study result found that the height-for-age index was statistically significantly associated with mild household food insecurity ($p<0.05$). But, weight-for-age and weight-for-height were not statistically significantly associated with categories of HFIAS.

The second result shows that CAI were also related to proxy indicators of poverty including a household which continuously using wood fuel for cooking, households without clean water and household with access to a child grant. It was found that height-for-age (≤-2SD) and weight-for-height (≤-2SD) indices were statistically significantly associated with a household which continuously using wood fuel for cooking, as proxy indicators of food security ($p<0.1$ and $p<0.1$), respectively. Weight-for-age, height-for-age and weight-for-height were statistically significantly associated with households without clean water ($p<0.01$, $p<0.1$ and $p<0.01$), respectively, and with household with access to child grant ($p<0.01$, $p <0.1$ and $p<0.01$), respectively. Other results were related to children, mothers and household backgrounds,

It was concluded that children's anthropometric indices were important indicators at the start of any development project to identify the food insecure. The composite indicators proposed in this study appear to confirm that CAI were useful to assess the severity of household food security or poverty and to characterise the nature of their insecurity (socio-economic versus health). Further, it would provide a basis for monitoring progress on the beneficiaries' food and nutrition security where children are the centre of the focus. They are also good indicators because of their simple *and* cost-effective measurement for food security outcomes. These methods have been chosen to be accessible to anyone with a basic grounding in statistics and access to a spreadsheet software program such as SPSS or Microsoft Excel. However, they need to be used in combination with other information such as the health situations of child and mother, household income, marital status, environmental living area, market access and availability of sanitary and leisure facilities.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

Measures of household food security are needed for many different applications in situations where households are chronically vulnerable due to deepening poverty, environmental and climatic shocks, rapid economic change and conflict. The search for a solution to this crucial problem of household food security measurement was the main motivation to contribute to the improvement of food security assessment by a combination of proxy indicators.

The objective of the study was to develop a specific analytical approach for measuring food security, by making a comparison of approaches that use children's anthropometric indices (CAI) and a Household Food Insecurity Access Scale (HFIAS). The study aimed at determining the relationship between children's anthropometric indices and household food security.

A survey, using a quantitative research approach, was conducted and data was obtained from administering a questionnaire on a sample of 180 children (households), under five years old from mainly food insecure communities of Msunduzi Municipality, Edendale and Northdale, where generally poor households reside, and which were purposefully selected from the Municipality. The age inclusion criterion was that the children should be between zero and five years at the time of the survey.

6.1 CONCLUSION

The results of the study show broadly, that overweight in the weight-for-height index was statistically significantly different across categories of HIAS ($p<0.05$). Weight-for-age and height-for-age indices were not statistically significantly different across categories of HIAS.

Multiple linear regression analysis which was performed separately for height-for-age, weight-for-age and weight-for-height, shows that mild household food insecurity was statistically significantly associated with CAI and was a good predictor of children's growth. Weight-for-age and weight‑for‑height were not statistically significant across categories of HFIAS. The lack of significant association between household food insecurity and these indices in the present study was not expected. There is substantial evidence that a household's access to food is among the key determinants of the nutritional status of children. Nevertheless, this lack of association might

be explained by several factors, such us usage of HFIAS as a method to assess household food security, or simply the influence of household food security in multiple regression can be confounded by other key poverty indicators of child nutrition, such as formal education of the mother, marital status of the mother, caring practices or food preparation, household income, access to child grants, clean water and electricity, birth weight, and a healthful environmental area, with hygiene and sanitation.

Alternative indicators called poverty indicators were used and performed to show that CAI is related to poverty and is a proxy indicator of household food security. It was found that height-for-age (≤-2SD) and weight-for-height (≤-2SD) indices were statistically significantly associated with “household which continuously uses wood fuel for cooking as proxy indicators of poverty and food security. However, weight-for-age, height-for-age and weight-for-height were significantly associated with households without clean water and with household with access to child grants. Other results were found relating to children, the mother and the background of the household.

In conclusion, children’s anthropometric indices were found to be important indicators to identify a food insecure household. The composite indicators proposed in this study appear to suggest that CAI are useful to assess the severity of household food security or poverty and to characterise the nature of their insecurity (socio-economic versus health). It would provide a basis for monitoring progress on the beneficiaries’ food and nutrition security, where children are the centre of focus. They are also good indicators because of their simple *and* cost-effective measurement for food security outcomes. These methods have been chosen so as to be accessible to anyone with a very basic grounding in statistics and access to a spreadsheet software program. However, they need to be used in combination with others such as the health situation of the child and the mother, household income, marital status, environmental living area, characterised by market access, and the availability sanitary and leisure facilities.

6.2 RECOMMENDATIONS

Food security strategies should consider socio-economic characteristics of households in order to achieve more than a marginal reduction in the number of chronically undernourished people. But in order to address the problem of food access in the study area and ensure that households have adequate access to food, the author suggests further improvement in the following key policy areas:

- Introduce children's anthropometric indices for use as household food security indicators**.** Especially in emergency situation where an accessible and cost-effective indicator is needed in situations where households are chronically vulnerable due to deepening poverty, environmental and climatic shocks, rapid economic change and conflict. In emergencies, weight loss among children from birth to 60 months can be used as a proxy indicator for the general health and food security of the entire community. This assumes that children from birth to 60 months are as vulnerable as other age groups to external factors (such as food shortages and illness) and the nutrition status of these children is as sensitive to change as that of other age groups. So that can reveal household food security situation.

- Nutrition intervention programmes must be linked to poverty reduction policies and strategies, as poverty and food security are the factors that expose children to hunger and malnutrition. It is accepted that stimulating agricultural growth is contributes to increasing household income and provide food from own production or purchase from the market. This study confirmed the importance of household income/wealth for child nutritional wellbeing which suggests that, in order to improve food security, the problem must be considered within broader policy programmes that focus on women income-generation to facilitate household economic wellbeing and the ability to provide children with sufficient food.

- Decision-makers will need to think contextually to deal with factors influencing children's malnutrition, rather than employing a 'one-size-fits-all' approach, because the extent of the effects of different variables on weight-for-age, height-for-age and weight-for-height of children depended on the location of residence.

- Interventions aimed at improving mothers' caring capacity should be geared towards maximising their control of resources and enabling them to spend more time caring for their children. Although the charge of providing care for a child should be that of both parents, in reality the major responsibility of care usually lies on the mother, who also has a role in income-generation, maintaining a clean environment for the household, caring for sick children and preparing food for the household. All these tasks take up a mother's time and may affect her caring capacity.

- Programmes that promote acceptable age of pregnancy and improving the nutritional status of women during pregnancy are required for this particular population. Ensuring that girls have good nutrition in their early childhood might lead to a reduction in child malnutrition. The efforts by the government to combat child malnutrition in rural areas, through the varied project, should also target the urban-rural poor, especially those with lower education levels, as well as households with large family size and those in overcrowded living conditions.

- Rigorous nutrition education meant to change consumption behaviour and awareness of the risks involved in dietary intake deficiencies are required. Educational programmes are also needed to foster hygienic preparation and storage of weaning foods to improve infant growth in disadvantaged populations and encourage frequent feeding, including breast-feeding.

Area of further research

Further research may become necessary to assess the relationship between food security and quality of the living area, as well as the effects of children's food security on their health and mental development.

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APPENDICES

APPENDIX A: RESEARCH QUESTIONNAIRE

RESEARCH QUESTIONNAIRE

A. Identification

SERIAL NUMBER: ……

DATE: ……

LOCATION: ……..

RESPONDANT'S SURNAME: ……..

NAME OF NUMERATOR: ……..

ADRESS OF RESPONDANTS: ……Municipality……

District……..……Province……

HOUSEHOLD'S INCOME: Father (……). Mother (……).Children (……..)

TARGET POPULATION: ……..

NEW CASES: ……

OLD CASES: .....

B. Child information

CHILD'S DETAILS……
AGE: ……
GENDER: ……
BIRTH WEIGHT: ……

1.	Weights			
2.	Lengths or heights			
3.	Z-Scores: Weight for age			
4.	Z-Scores: Height for age			
5.	Z-Scores: Weight for height			
6.	Did your child have vaccines against all diseases? If yes how many vaccines?			Yes= No =
7.	In the past time, did your child get sick? If yes which kind of diseases?	Diarrhoea: Y/N 	Measles: Y/N 	Other Dis: Y/N
8.	Did you exclusively breast feed your child? If yes how many months?			Yes= No =
9.	Did your child receive a grant? If yes how many by months?			Yes= No =

Note: Yes = 1 and No = 0

C. Mother information

RESPONDANT'S SURNAME: ……..
AGE: ……..
BIRTH WEIGHT: ……..
MARITAL STATUS: …….

1.	Did you get sick before or during pregnancy?	Yes= No =
2.	Are you working? If yes how many hours a day?	Yes= No =
4.	Did you Smoking? If yes how many packets a day?	Yes= No =
5.	Did you have a formal education? If yes which level?	Yes= No =
6.	Did you have a nutritional education?	Yes= No =
7.	Did you have a tap in your house with clean water	Yes= No =
	Did you have electricity in your house	Yes= No =
8	Family size < 18 years >10 years ≥5 years	Total

Note: Yes = 1 and No = 0

D. Household information

RESPONDANT'S SURNAME: ……

No.	QUESTION	RESPONSE OPTION	CODE
1	In the past three years, did you worry that your household would not have enough food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
2	In the past three years, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
3	In the past three years, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
4	In the past three years, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0= No (skip to Q2) 1= Yes	

No.	QUESTION	RESPONSE OPTION	CODE
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
5	In the past three years, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
6	In the past three years, did you or any household member have to eat fewer meals in a day because there was not enough food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime (three or ten time) 3= Often (more than ten time)	
7	In the past three years, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime (three or ten time) 3= Often (more than ten time)	
8	In the past three years, did you or any household member go to sleep at night hungry because there was not enough food?	0= No (skip to Q2) 1= Yes	

No.	QUESTION	RESPONSE OPTION	CODE
	How often did this happen?	1= Rarely (once or twice) 2= Sometime (three or ten time) 3= Often (more than ten time)	
9	In the past three years, did you or any household member go a whole day and night without eating anything because there was not enough food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	

E. Additional information

RESPONDANT'S SURNAME:

No.	QUESTION	RESPONSE OPTION	CODE
1	In the past three years, did you use wood fuel for preparing food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
2	In the past three years, did you or any household member have an interdict in keeping with some kind of food?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
3	In the past three years, did you or any household member have to eat foods already prepared from shop or restaurant?	0= No (skip to Q2) 1= Yes	

No.	QUESTION	RESPONSE OPTION	CODE
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	
4	In the past three years, did you or any household member experience a case of diarrhoea because of quality of food intake?	0= No (skip to Q2) 1= Yes	
	How often did this happen?	1= Rarely (once or twice) 2= Sometime(three or ten time) 3= Often(more than ten time)	

COMMENT:

SIGNATURE DATE:

DECLARATION

I…… (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

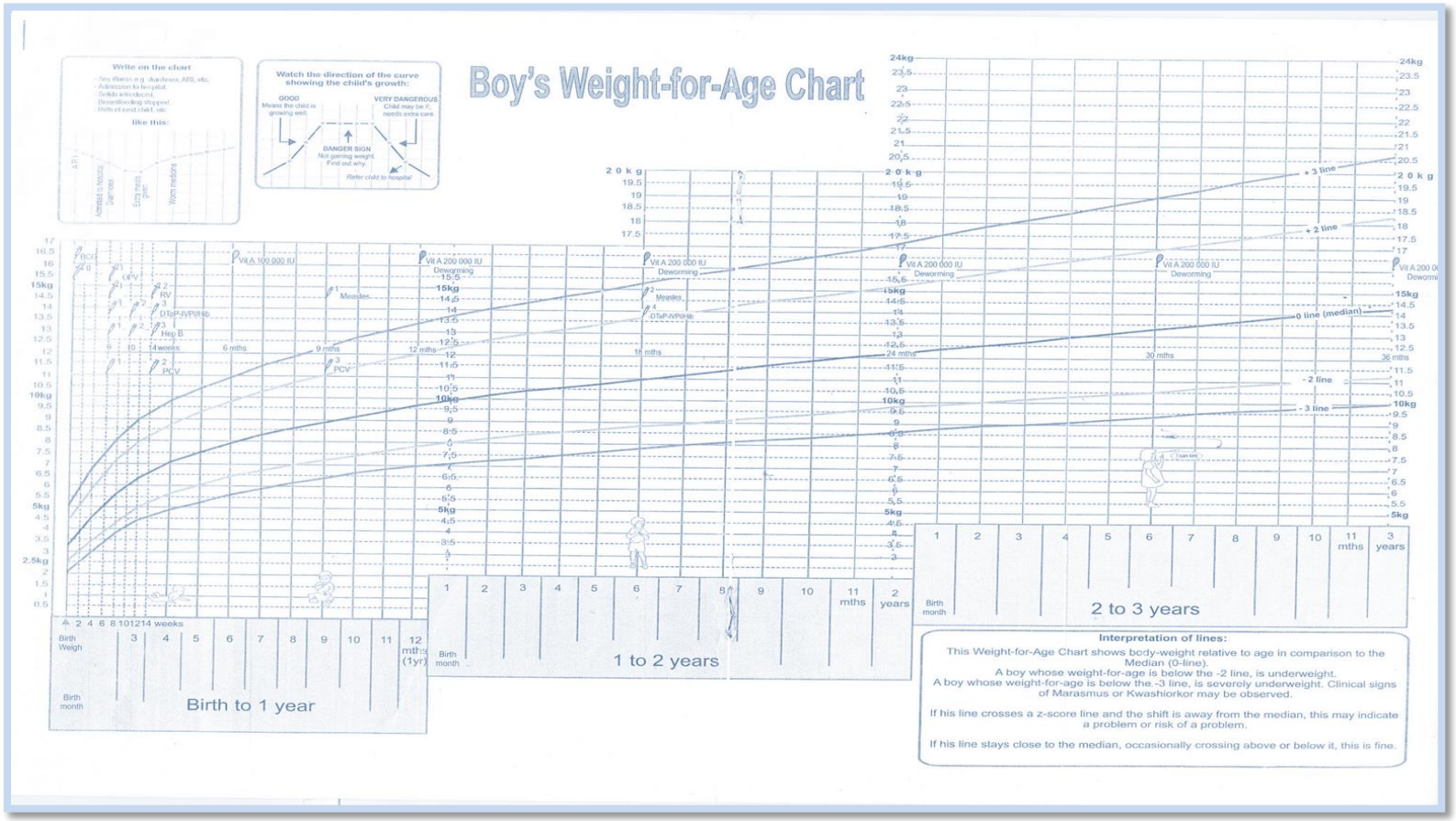
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

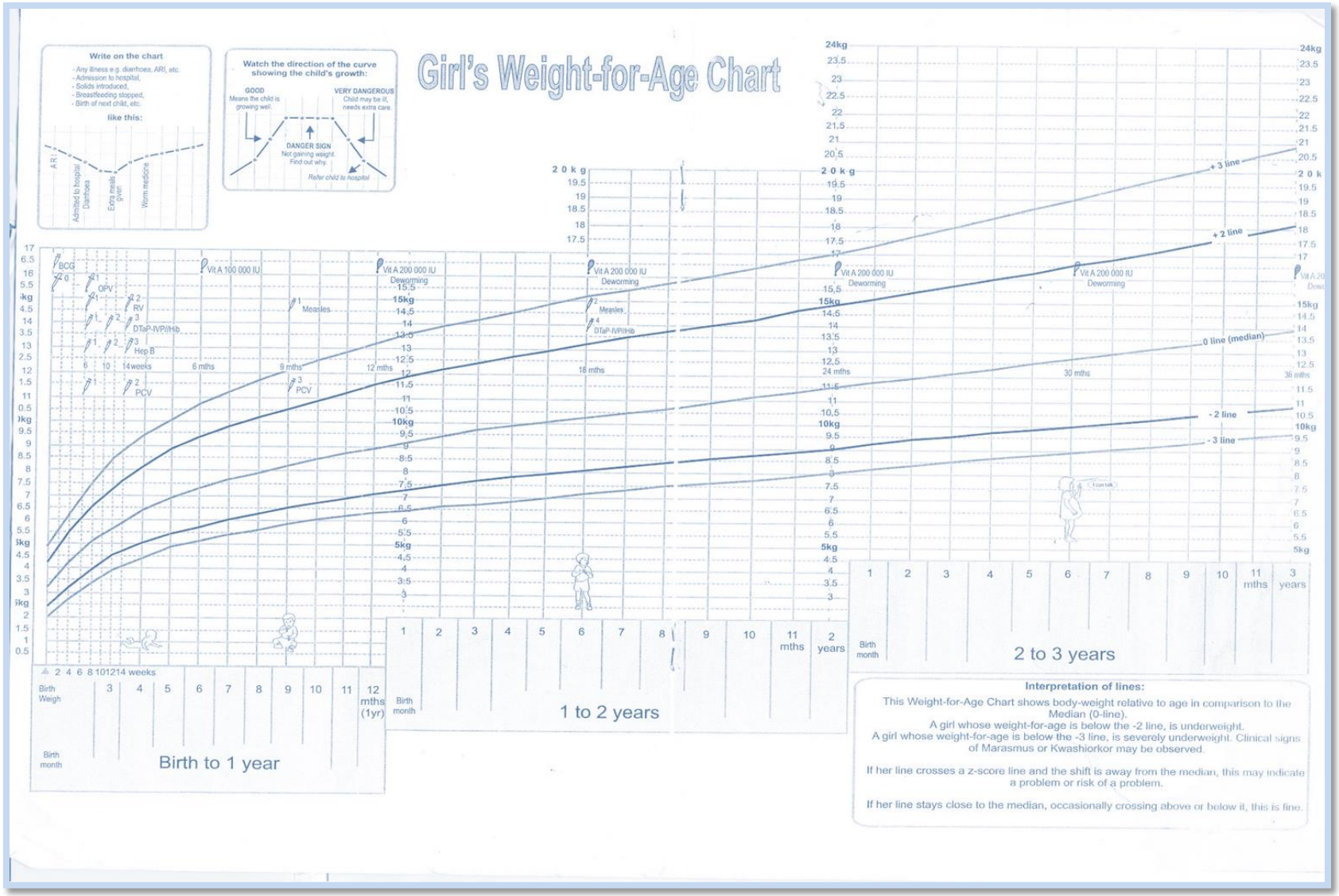
SIGNATURE OF PARTICIPANT DATE

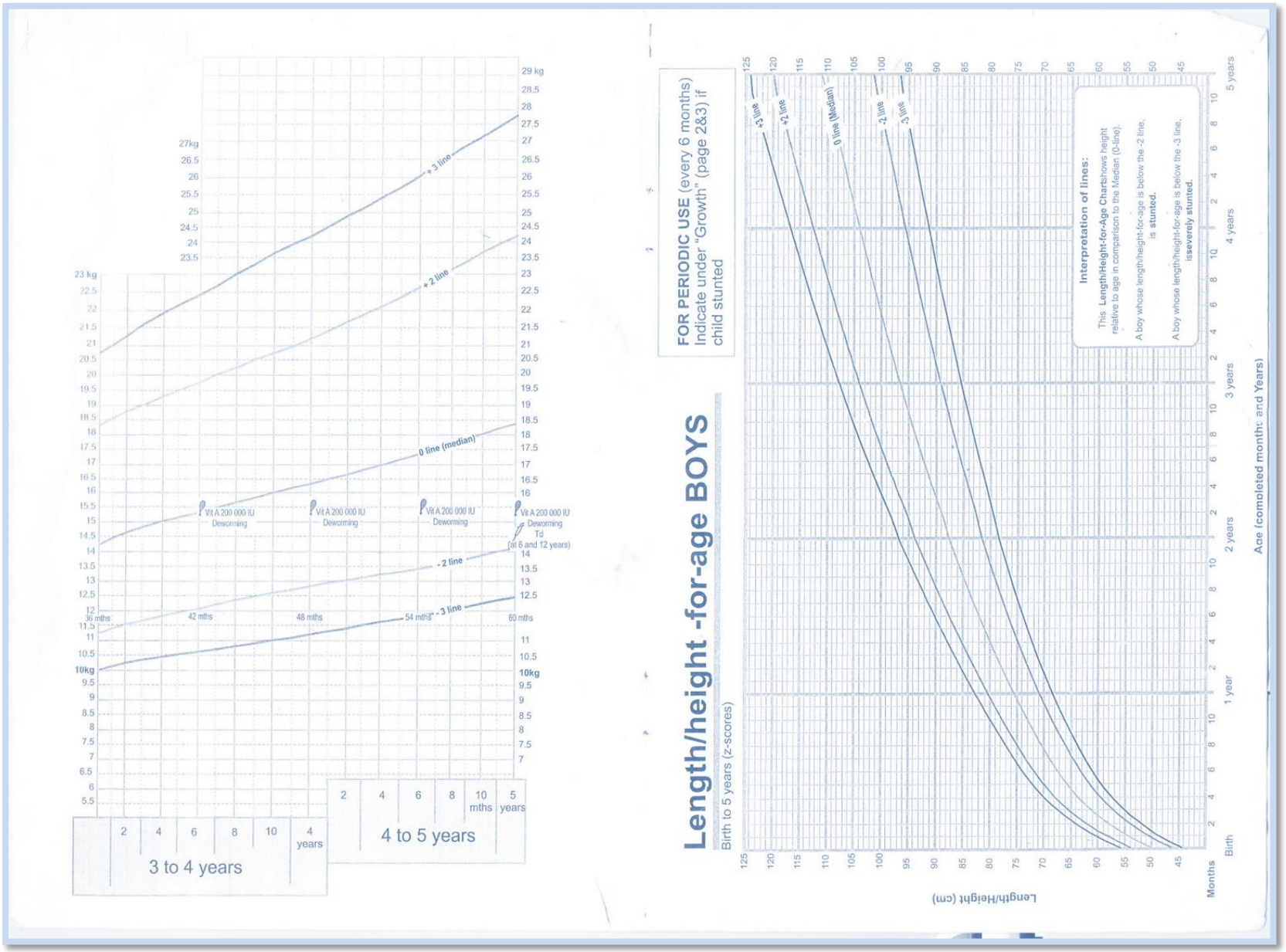
……

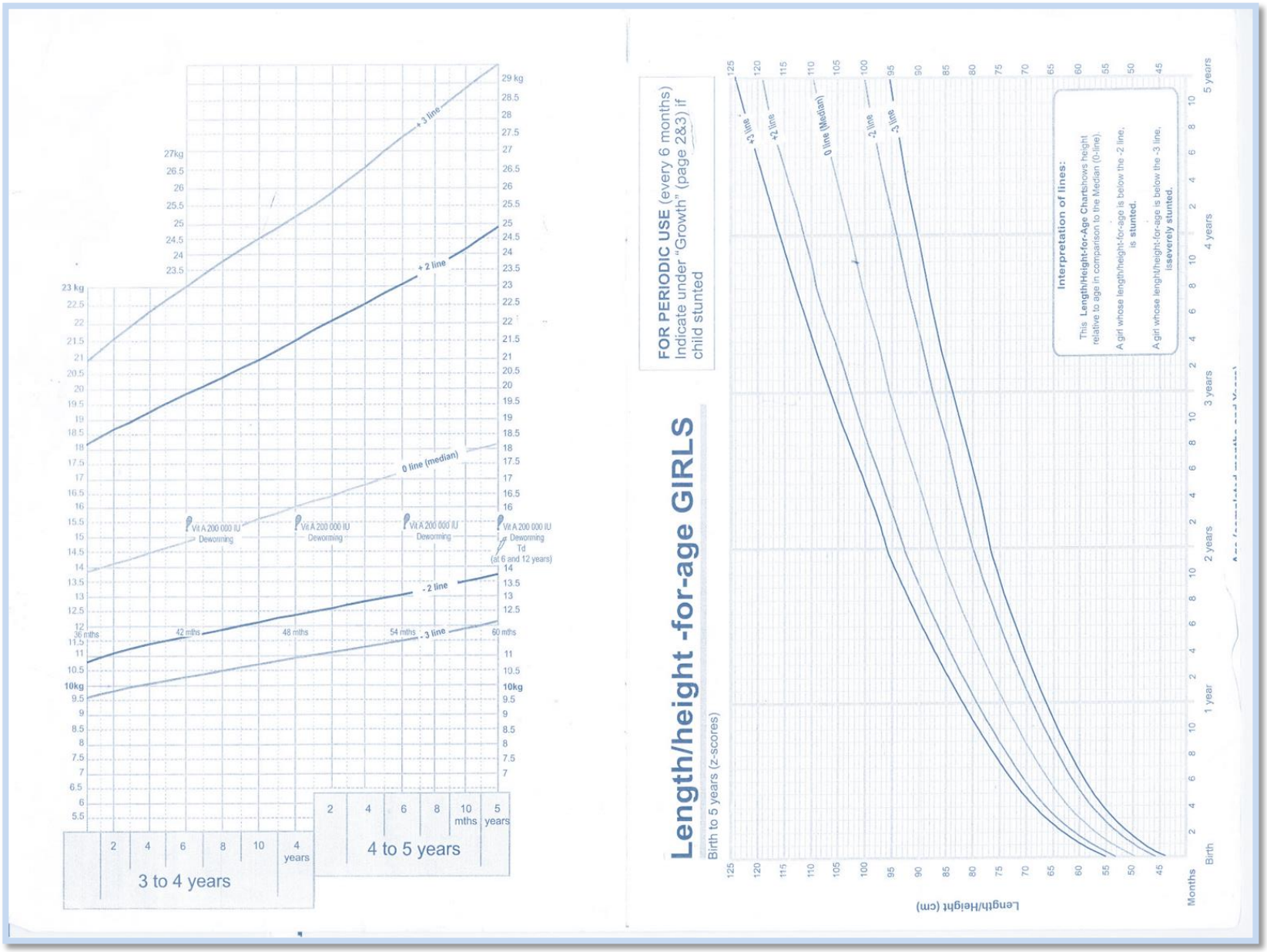
NOTE: Potential subjects should be given time to read, understand and question the information given before giving consent. This should include time out of the presence of the investigator and time to consult friends and/or family.

APPENDIX B: WHO CHILDREN GROWTH CHART

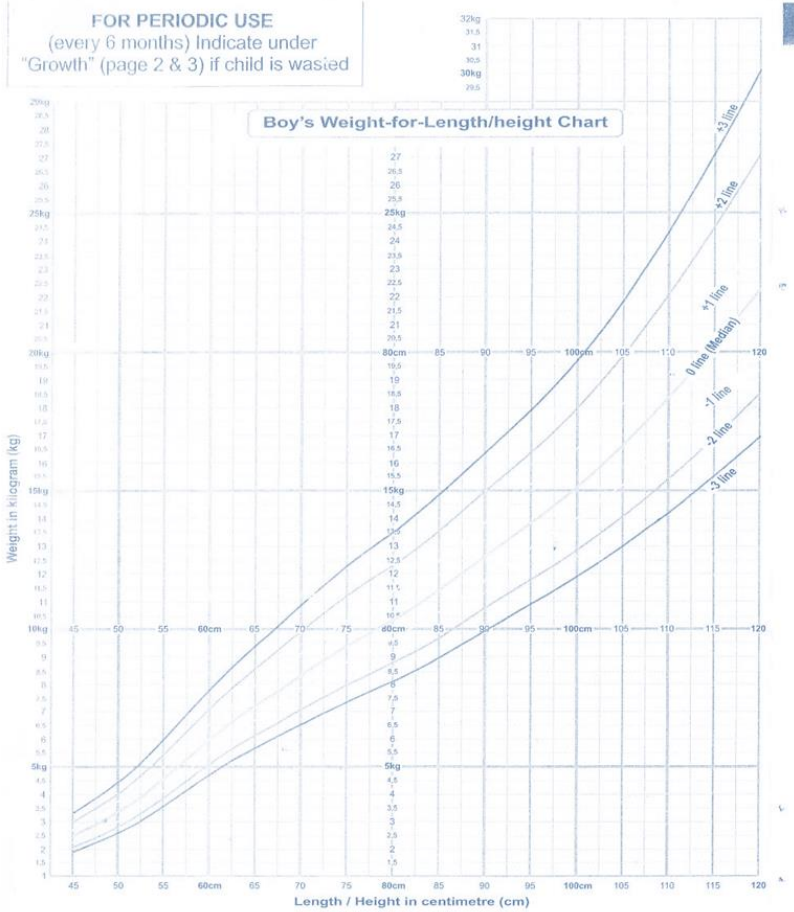



Write on the chart
- Any illness e.g. diarrhoea, ARI, etc.
- Admission to hospital,
- Solids introduced,
- Breastfeeding stopped,
- Birth of next child, etc.
like this:
A.R.I.
Admitted to hospital Diarrhoea
Extra meals given
Worm medicine
Watch the direction of the curve showing the child's growth:
GOOD
Means the child is growing well.
VERY DANGEROUS
Child may be ill, needs extra care.
DANGER SIGN
Not gaining weight. Find out why.
Refer child to hospital
Girl's Weight-for-Age Chart
+ 3 line
+ 2 line
0 line (median)
- 2 line
- 3 line
BCG
OPV
RV
DTaP-IVP/Hib
Hep B
PCV
Measles
Vit A 100 000 IU
Vit A 200 000 IU
Deworming
6 mths
9 mths
12 mths
18 mths
24 mths
30 mths
36 mths
Birth to 1 year
1 to 2 years
2 to 3 years
Birth Weigh
Birth month
Interpretation of lines:
This Weight-for-Age Chart shows body-weight relative to age in comparison to the Median (0-line).
A girl whose weight-for-age is below the -2 line, is underweight.
A girl whose weight-for-age is below the -3 line, is severely underweight. Clinical signs of Marasmus or Kwashiorkor may be observed.
If her line crosses a z-score line and the shift is away from the median, this may indicate a problem or risk of a problem.
If her line stays close to the median, occasionally crossing above or below it, this is fine.


Length/height -for-age BOYS
Birth to 5 years (z-scores)
FOR PERIODIC USE (every 6 months)
Indicate under "Growth" (page 2&3) if child stunted
Interpretation of lines:
This Length/Height-for-Age Chartshows height relative to age in comparison to the Median (0-line).
A boy whose length/height-for-age is below the -2 line, is stunted.
A boy whose length/height-for-age is below the -3 line, issseverely stunted.
+3 line
+2 line
0 line (Median)
-2 line
-3 line
Length/Height (cm)
Months
Birth
1 year
2 years
3 years
4 years
5 years
Age (completed months and Years)
+ 3 line
+ 2 line
0 line (median)
- 2 line
- 3 line
Vit A 200 000 IU Deworming
Vit A 200 000 IU Deworming
Vit A 200 000 IU Deworming
Vit A 200 000 IU Deworming
Td
(at 6 and 12 years)
36 mths
42 mths
48 mths
54 mths
60 mths
3 to 4 years
4 to 5 years


+ 3 line
+ 2 line
0 line (median)
- 2 line
- 3 line
Vit A 200 000 IU
Deworming
Td
(at 6 and 12 years)
36 mths
42 mths
48 mths
54 mths
60 mths
3 to 4 years
4 to 5 years
FOR PERIODIC USE (every 6 months)
Indicate under "Growth" (page 2&3) if child stunted
Length/height -for-age GIRLS
Birth to 5 years (z-scores)
Interpretation of lines:
This Length/Height-for-Age Chartshows height relative to age in comparison to the Median (0-line).
A girl whose length/height-for-age is below the -2 line, is stunted.
A girl whose length/height-for-age is below the -3 line, isseverely stunted.
Length/Height (cm)
Months
Birth
1 year
2 years
3 years
4 years
5 years

FOR PERIODIC USE
(every 6 months) Indicate under "Growth" (page 2 & 3) if child is wasted



This **Weight-for-Length/height Chart** shows body-weight relative to length/height in comparison to the Median (the 0 z-score line).

A boy whose weight-for-length/height is above the +3 line, is **obese.**
A boy whose weight-for-length/height is above the +2 line, is **overweight.**

A boy whose weight-for-length/height is below the -2 line, is **wasted.**
A boy whose weight-for-length/height is below the -3 line, is **severely wasted. Refer for urgent specialised care.**

MID-UPPER ARM CIRCUMFERENCE (MUAC) (Every 3 months)

Date of visit	MUAC	Date of visit	MUAC	Date of visit	MUAC	Date of visit	MUAC

< 11.5 cm indicates severe acute malnutrition (REFER urgently)
≥11.5 < 12.5 cm indicates moderate acute malnutrition (Manage as in IMCI guidelines)

HOSPITAL ADMISSIONS

Hospital name	Admission number	Date of admission dd/mm/yyyy	Date of discharge dd/mm/yyyy	Discharge diagnosis
		/ /	/ /	
		/ /	/ /	
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		/ /	/ /	

NAME OF CLINIC(S) VISITED

Clinic 1:	Clinic 2:
Clinic 3	Clinic 4: