Food Accessibility and Nutrition Status of Tenant Women of Reproductive Age and Under-Five Children on Smallholder Tobacco Farms in the Northern Malawi

by

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Submitted in partial fulfilment of the requirement of the Master of Science Degree in Nutrition

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June 2017

DECLARATION

I, **Justice Munthali**, declare that the thesis submitted by me at the University of Pretoria as partial fulfilment of the Master of Science Degree in Nutrition is my own original work in its entirety. The thesis has not been submitted for any degree before at this or any other university or institution of higher learning. All reference materials contained herein have been appropriately acknowledged.

SIGNATURE: ___________________________ DATE: ___________________________

ACKNOWLEDGEMENTS

This material is based upon work supported by the United States Agency for International Development, as part of the Feed the Future initiative, under the CGIAR Fund, award number BFS-G-11-00002, and the predecessor fund the Food Security and Crisis Mitigation II grant, award number EEM-G-00-04-00013.

The following individuals and organisations are also acknowledged for their incredible contributions to the successful completion of the study:

- Ms Gerda J. Gericke and Dr Jane Muchiri, my supervisors, mentors and role models for their persistent motivation, impartation of constructive advice and expert guidance throughout the course of this study.
- The Malawi Ministry of Agriculture, Irrigation and Water Development (MoAIWD) for granting me study leave and permission to undertake the study.
- The agriculture extension development coordinators (AEDCs), the agriculture extension development officers (AEDOs) and the health surveillance officers (HSAs) in Bwengu, Njuyu and Engucwini extension planning areas (EPAs) for providing tobacco tenants data, coordinating field visits and participating in the data collection exercises.
- The tobacco tenants (mothers and their under-five children) who gave consent as study participants and were very cooperative in providing as much information as the study needed.
- Prof Piet Becker (University of Pretoria) for the assistance with the statistical analysis of the data.
- Mr Christopher Manyamba (PhD student) for the input during proposal development.
- Angellinah Nazombe, Kenaan Mfune, Sugzo Yangairo and Alien Mnyimbiri for assisting in data collection.
- To my beautiful wife, Cynthia Chingama Munthali. Thanks for your awesome support and amazing love. I do not take your understanding for granted.

ABSTRACT

Introduction: Lack of evidence-based information is an impediment to improve the food security and nutrition status of vulnerable tobacco tenant women and their children on smallholder farms in Malawi.

Aim: To assess and describe the food accessibility and nutrition status of the tobacco tenant women of reproductive age and their under-five children on smallholder farms, as well as to determine and report correlational relationships amongst demographic and socio-economic factors, food accessibility measurements and nutrition status indicators.

Design: Quantitative cross-sectional descriptive correlational study.

Setting: Bwengu, Engucwini and Njuyu Extension Planning Areas, Mzimba North district, Malawi.

Sample: 110 women of reproductive age sampled through a proportional systematic random sampling technique, and their 139 under-five children. The sample size was calculated using nQuery version 7 software based on 47% prevalence of malnutrition among under-five children in Malawi, estimated at 95% CI to the accuracy of 10%.

Methodology: Data were captured through face-to-face interviews during the hunger season. Food accessibility was captured using the Household Food Insecurity Access Scale (HFIAS), Household Hunger Scale (HHS), Months of Adequate Household Food Provisioning (MAHFP) and Individual Dietary Diversity Scale (IDDS). Nutrition status was measured using anthropometry according to standard protocol. WHO Anthro software was used to compute Z-scores (W/A, H/A, W/H and BMI/A) for children, based on WHO standards. Microsoft Excel was used to calculate BMI for women, based on WHO cut-off points. Stata software was used to compute regression analyses to establish correlational relationships between independent and dependent variables. Ethical approval was obtained from the University of Pretoria, Natural and Agriculture Science Committee (Number EC151215-028), as well as from the Mzuzu Agriculture Development Division in Malawi.

Results: Mean age of the women was 27.3 ± 6 years and 28.8 ± 15 months for the children. The experience of food insecurity access was severe for 75% of the households. Nearly one-fifth of households were severely hungry, and had adequate food for only about eight months of the year. The women and their children consumed a mean of two food groups in the previous 24 hours. For the women, 21% were malnourished. For the children, 20% were wasted, 31.3% were stunted and 34% were underweight. More male children were malnourished.

For food accessibility measurements, the multivariable linear regression analysis was used. The significant factors influencing the severity of the experience of food insecurity access were loan access (P = 0.015) and household size (P = 0.000). For the prevalence of hunger, the significant factors were food security and nutrition training (P = 0.046), marital status (P = 0.045) and household size (P = 0.000). For the annual prevalence of hunger, the significant factors were labour (P = 0.038), income (P = 0.008) and household size (P = 0.001). For the dietary diversity, the significant factors were labour (P = 0.001), food security and nutrition decisions (P = 0.004), mother's age (P = 0.033) and income (P = 0.000).

Using the multivariable IV regression analysis, the significant factors influencing the BMI of the women were their age (P = 0.054), loan access (P = 0.004), HFIAS scores (P = 0.007) and HHS scores (P = 0.001). For the children's weight-for-age, the significant factors were the mother's BMI (P = 0.014), child's sex (P = 0.005), assets (P = 0.014), mother's age (P = 0.001) and child's age (P = 0.015).

Using the multivariable random-effects GLS regression analysis, the significant factors influencing the children's height-for-age were the mother's age (P = 0.004), child's sex (P = 0.005), assets (P = 0.028) and HFIAS scores (P = 0.006). For the children's weight-for-height, the significant factors were the mother's BMI (P = 0.032), MAHFP scores (P = 0.029), child's age (P = 0.008) and income (P = 0.001). For the children's BMI-for-age, the significant factors were the mother's BMI (P = 0.030), mother's age (P = 0.029), income (P = 0.002) and assets (P = 0.047).

Conclusion: The food accessibility and nutrition status of the tobacco tenant women and their children were seriously poor. The significant factors influencing food accessibility and

nutrition status were loan access, household size, food security and nutrition training, marital status, labour, income, assets, food security and nutrition decisions, mother's BMI, mother's age, child's age, child's sex, HFIAS scores, HHS scores and MAHFP scores. The study findings offer clues to policy makers on where to direct interventions to improve food accessibility and nutrition status of the tobacco tenant women and their children in Malawi.

Key words: Food accessibility, nutrition status, tobacco tenants, women of reproductive age, under-five children.

PRESENTATIONS ARISING FROM THIS STUDY

Munthali, J, Gericke, GJ & Muchiri JW, 2016. Anthropometric status of tenant women of reproductive age and under-five children on smallholder tobacco farms in the northern Malawi. Poster presentation at Faculty Day, Faculty of Health Sciences, University of Pretoria, 23-24 August 2016, Pretoria, South Africa.

Munthali, J, Gericke, GJ & Muchiri JW, 2016. Dietary diversity of tenant women of reproductive age and under-five children on smallholder tobacco farms in the northern Malawi. Poster presentation at Faculty Day, Faculty of Health Sciences, University of Pretoria, 23-24 August 2016, Pretoria, South Africa.

Munthali, J, Gericke, GJ & Muchiri JW, 2016. Anthropometric status of tenant women of reproductive age and under-five children on smallholder tobacco farms in the northern Malawi. Poster presentation at the 26th Congress of the Nutrition Society of South Africa, and 14th Congress of the Association for Dietetics in South Africa, 2-5 September 2016, Cape Town, South Africa.

Munthali, J, Gericke, GJ & Muchiri JW, 2016. Dietary diversity of tenant women of reproductive age and under-five children on smallholder tobacco farms in the northern Malawi. Poster presentation at the 26th Congress of the Nutrition Society of South Africa, and 14th Congress of the Association for Dietetics in South Africa, 2-5 September 2016, Cape Town, South Africa.

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LIST OF ABBREVIATIONS

ADD	Agriculture Development Division
AEDC	Agriculture Extension Development Coordinator
AEDO	Agriculture Extension Development Officer
ASWAp	Agriculture Sector Wide Approach
BMI	Body Mass Index
CDDS	Children Dietary Diversity Scale
DDS	Dietary Diversity Scale
DfID	Department for International Development
EPA	Extension Planning Areas
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FBO	Farmer Based Organisations
FCS	Food Consumption Scores
FEWS NET	Famine Early Warning Systems Network
FIES	Food Insecurity Experience Scale
FISP	Farm Input Subsidy Programme
GLS	Generalised Least Squares
HAS	Health Surveillance Officers
HDDS	Household Dietary Diversity Scale
HFIAS	Household Food Insecurity Access Scale
HHS	Household Hunger Scale
IDDS	Individual Dietary Diversity Scale

IFAD	International Fund for Agricultural Research
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IV	Instrumental Variables (as used in regression)
MAHFP	Months of Adequate Household Food Provisioning
MDHS	Malawi Demographic Health Survey
MGDS	Malawi Growth and Development Strategy
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MRA	Multivariable Regression Analysis
MVAC	Malawi Vulnerability Assessment Committee
NAS	Natural and Agriculture Science
NGO	Non-Governmental Organisations
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SUN	Scaling Up Nutrition
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
UP	University of Pretoria
USAID	United States Agency for International Development
USD	United States Dollar
WDDS	Women Dietary Diversity Scale
WEAI	Women Empowerment in Agriculture Index
WFP	World Food Programme
WHO	World Health Organization

PART I: BACKGROUND AND LITERATURE REVIEW

CHAPTER 1

INTRODUCTION AND OUTLINE

1.1 BACKGROUND INFORMATION

The Government of Malawi, as enshrined in its constitution, recognises that optimal food security for balanced nutrition is a human right for all people (Republic of Malawi, 2011a). Against this notion, the government has strived to create conducive food security and nutrition policy environments. In 2006, the government developed the Malawi Growth and Development Strategy (MGDS), a developmental tool that recognises that food security and nutrition are key ingredients to the national development (World Bank, 2012). During the same year, the government also developed the National Food Security Policy with the aim of achieving a food secure Malawi (Republic of Malawi, 2006). In 2007, the government further developed the National Nutrition Policy with the goal of facilitating improvement of nutrition status for all Malawians (Republic of Malawi, 2009). Within these policy frameworks, as well as building on previous experiences, the government has been embarking on redefining itself and adopting various key strategies and programmes, such as the Farm Input Subsidy Programme (FISP) (Dorward & Chirwa, 2011), the Agriculture Sector Wide Approach (ASWAp) Programme (Republic of Malawi, 2011b) and the Scaling Up Nutrition (SUN) campaign (Government of Malawi, 2012) to consolidate its stance on reducing food insecurity and malnutrition. The government's dignified local policy advancements to make the right to food and balanced nutrition a reality are also in accordance with various international commitments she made, including the Sustainable Development Goals (SDGs) (FAO, 1996; United Nations, 2000; SADC, 2004; United Nations, 2015).

However, up-to-date concerns exist regarding the translation of these national policies into the desired food security and nutrition status at household and individual levels. Figures from the 2010 Malawi Demographic Health Survey (MDHS) indicate that a quarter of women of reproductive age, and around half of under-five children are malnourished (Government of

Malawi & ICF Macro, 2011). This unwarranted situation has not changed much with the latest MDHS reporting that malnutrition is still a big concern with four out of every ten children being malnourished (Government of Malawi & ICF Macro, 2016). Solemn reliance on rain fed agriculture, which is characterised by persistent erratic rainfall, flooding and dry spells have also crippled millions of Malawians who experience hunger almost on a yearly basis (Government of Malawi & MVAC, 2012; Government of Malawi & MVAC, 2013; Government of Malawi & MVAC, 2014; Government of Malawi & MVAC, 2015). As if this is not enough, more than half of the Malawian people live in extreme poverty below USD 1.14 per day (USAID, 2013). Poverty is widely accepted to correlate strongly with the food insecurity and malnutrition levels of a country (United Nations, 2012).

Global initiatives to eradicate food insecurity, hunger, poverty and malnutrition advocate for investment in women and under-five children (United Nations, 2000; Mechlem, 2004; USAID, 2013). Locally, it is conspicuous that policies recognised this need and prioritise the women and children (Republic of Malawi, 2006; Republic of Malawi, 2009). Eradication of food insecurity and malnutrition is sophisticated and on-going (Maxwell & Smith, 1992; Struble & Aomari, 2003; Mechlem, 2004). Much as that is acknowledged, it is still disheartening to note that despite such top prioritisation and heavy investment, the women and children continue to be the most vulnerable to experiencing food insecurity and malnutrition (Ivers & Cullen, 2011; Lancet, 2013).

To this extent, it is clear that despite the government's advancements in creating a conducive policy environment, food insecurity and malnutrition remain problematic, especially to women and under-five children. To contribute to the fight for achieving a food secure and well-nourished nation, a research project was proposed and conducted to assess the extent of food insecurity and malnutrition of the women of reproductive age and their under-five children in the tobacco farming sector. Due to lack of evidence-based research in this smallholder tobacco farming sector, it was argued that provision of such empirical evidence would be beneficial in providing feedback to ongoing programmes and interventions currently underway in Malawi. Further benefits would be realised through advocating for policy formulations and modifications in the long-run for ultimate improvement of the food security and nutrition status of the women of reproductive age and their under-five children.

1.2 DEFINING THE RESEARCH PROBLEM

1.2.1 Problem statement

Women and under-five children are disadvantaged in many sectors despite them constituting more than half of the Malawian population (Government of Malawi & ICF Macro, 2011). The levels of food insecurity and malnutrition for women and under-five children are unacceptable, alarming and counter developmental. Figures from the 2010 MDHS indicate that a whopping 47% of under-five children are stunted, 4% wasted and 13% underweight. For women, 9% are thin, while 17% are overweight (Government of Malawi & ICF Macro, 2011; USAID, 2013).

Approximately 76, 000 children die before they reach the age of five years and in this regard malnutrition is singled out to be among the leading and underlying causes. One-fifth of the under-five children die within one month after birth, and the deaths are linked with high maternal mortality. Protein-energy malnutrition is also highly associated with 38% of all child deaths beyond infancy (Republic of Malawi, 2009).

According to the joint report by the FAO, IFAD and WFP (2014), by 2013 Malawi had already met its national Millennium Development Goal of halving the number of people who suffer from hunger between 1990 and 2015. However, the same report indicated that 21.8% of the population remained undernourished. The USAID (2011) indicated that an estimated 4.7 million Malawians, representing 40% of the population, required food aid in the 2004/2005 season. A review of 2012 to 2015 annual vulnerability assessment reports revealed that the number of people who fail to attain annual food requirements has remained over the one million mark except for the year 2014 which had a slightly lower figure (Government of Malawi & MVAC, 2012; Government of Malawi & MVAC, 2013; Government of Malawi & MVAC, 2014; Government of Malawi & MVAC, 2015). This gives an indication that household and individual food insecurity levels have not changed much for the past two decades in Malawi. The Malawi Vulnerability Assessment Committee (MVAC) warned that this undesirable food insecurity trend is likely to continue or worsen as people's livelihoods continue to deteriorate (Government of Malawi & MVAC, 2013).

Many authors have reported that generally women are disadvantaged in the agriculture sector. Compared to men, women have limited access to agricultural productive resources, and have limited access to extension and financial services. Women also work longer hours and much of their work is not paid for since it is done within the household spheres (FAO, IFAD & ILO, 2010; Doss, Grown & Deere, 2011; Kehler, 2013; Pérez, Jones, Kristjanson, Cramer, Thornton, Förch & Barahona, 2014). In addition, women are also affected by HIV and AIDS, with almost 13% of women in Malawi being HIV-positive as compared to 8% of men (Government of Malawi & ICF Macro, 2011).

The tobacco labour industry is said to be among the agricultural sub-sectors in which women and children are particularly disadvantaged (Torres, 2000). This industry has compromised the health of the children who risk illnesses from nicotine absorption, including green tobacco sickness (US Department of Labour, 2014). Children as young as five years old (US Department of Labour, 2014), and sometimes even under-five children (ILO, 2011), are directly exposed to the hazardous pesticides and chemical substances through working as farm labourers. Therefore, it is evident that chronic food insecurity and high levels of malnutrition are rife in Malawi. The female tenant farmers who provide most of the labour with their children on the farms are also functionally illiterate (Torres, 2000; ILO, 2011). They are affected by chronic hunger, chronic illnesses, and gender inequalities, forcing them to be disempowered (De Schutter, 2013).

Although such is the case, women empowerment is widely advocated as fundamental to the improvement of household food insecurity and reduction of malnutrition, especially in children (Legovini, 2005; Pehu, Lambrou & Hartl, 2009; Blattman, Green, Annan & Jamison, 2013; Kabir, Oliujjaman, Rahman & Akther, 2014; Porter & Zovighian, 2014; Sharaunga, Mudhara & Bogale, 2015; Nagata, Fiorella, Salmen, Hickey, Mattah, Magerenge, Milner, Weiser, Bukusi & Cohen, 2015; Malapit & Quisumbing, 2015). Targeted and realistic programmes and interventions to empower the most vulnerable women in Malawi's agriculture sector need to be supported with locally generated empirical evidence. As far as the researcher is concerned, the reviewed literature indicated lack of data on the food insecurity and malnutrition situation of women of reproductive age working as tenants in the smallholder tobacco farms and their under-five children. This lack of data may be linked to the adoption of a dualistic agricultural system as a result of an agricultural liberalisation programme in the 1980s and early 1990s, and the introduction of a multiparty government in 1994. This system promoted both the large scale and smallholder tobacco farming which led to the abolishment of the ban of smallholder burley tobacco farming. As a result, there has since been a drastic increase in the number of smallholder tobacco farmers (Orr, 2000; Torres, 2000). Arguably, the increase in the number of smallholder tobacco farmers resulted in an influx of tenants working on these smallholder farms, yet, hardly any studies have been conducted on this emerging section of tenants.

A tobacco tenant survey that was conducted by the International Labour Organisation (ILO) did not provide a comprehensive food security situation. It also lacked a nutrition status component since it mainly focused on child labour and AIDS. Unlike the current study, this study was done in large scale tobacco estates (ILO, 2011). However, the findings were concerning as it showed that almost 40% of the respondents argued that they and their households went hungry one or more days during the previous month. Two thirds of the children interviewed reported to eat only once or twice every day (ILO, 2011). It is against this background that the current study embarked to fill the literature gap with a more comprehensive research study that employs a set of tools and techniques to provide empirical evidence on the food insecurity, malnutrition, as well as the demographic and socio-economic situation of tobacco tenants, concentrating specifically on the vulnerable women of reproductive age and their under-five children on smallholder farms in the northern region of Malawi.

Conducting a research study on food insecurity and malnutrition in itself presents problems. For instance, food insecurity alone comprises of four key pillars, namely food availability, accessibility, utilisation and stability. These pillars can be measured at various levels, such as the national, household and individual levels (FAO, 2009). This multifaceted and multidimensional nature of food security has for long been the centre of heated debate and contributed to failure of having the universally accepted and standardised measurement tools (Ivers & Cullen, 2011; Maxwell, Coates & Vaitla, 2013; Cafiero, Melgar-Quiñonez, Ballard & Kepple, 2014). Consequently, this has been manifested in the differences in the strengths and weaknesses of various measurement tools, as well as significant differences in estimations and interpretations of those tools (Ivers & Cullen, 2011; Maxwell *et al.*, 2013; Cafiero *et al.*, 2014). No single measurement tool can claim to entirely explain the complex nature of food insecurity and malnutrition. A growing consensus recommends the use of a set of tools to capture the complex nature, as well as to promote participatory approaches to improving food security and nutrition status (Ballard, Kepple & Cafiero, 2013; Maxwell *et al.*, 2013; Cafiero *et al.*, 2014). This logical reasoning was also considered during the conception of this study, such that five food security and nutrition status assessment tools and techniques were employed. The measurement tools and techniques employed were the Household Food Insecurity Access Scale (HFIAS), Household Hunger Scale (HHS), Individual Dietary Diversity Scale (IDDS), Months of Adequate Household Food Provisioning (MAHFP) tool, as well as appropriate anthropometric measurements of women of reproductive age and their under-five children.

1.3 AIM OF THE STUDY

The aim of the study was to assess and describe the food accessibility and nutrition status of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months) on smallholder farms in the Mzimba North district in the northern region of Malawi, as well as to determine and report correlational relationships amongst demographic and socio-economic factors, food accessibility measurements and nutrition status indicators.

1.4 SIGNIFICANCE OF THE STUDY

The underlying significance of this study is to contribute to the process of implementation and achievement of two Sustainable Development Goals (SDGs). The first is Goal 2 which aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The second is Goal 5 which aims to achieve gender equality and empower all women and girls. This significance could be achieved through the generation of information that could help in identifying policy and programme priority areas for actions.

Specifically, the study intends to provide contextualised information on the problem of food insecurity and malnutrition, adding to the current corpus of knowledge. This is an area that is not fully exploited among women of reproductive age and their under-five children in the smallholder tobacco farms in northern Malawi.

Secondly, as a result of the expansion of the knowledge and insights on food security and nutrition status of women of reproductive age and their under-five children, the food security and nutrition services delivery could be improved in the northern region of Malawi. This is so because the generated knowledge could be crucial in feeding into, and management of the current programmes and interventions through helping in prioritisation, targeting and overall planning.

Thirdly, through advocacy there could be an increase in the number of stakeholders, such as non-governmental organisations (NGOs) working to improve the food security and nutrition status of and empower the women of reproductive age and their under-five children. This could be so because the findings of this study could provide a benchmark for justification and lobbying for funds through proposal development to assist the food security and nutrition status of the women of reproductive age and their under-five children in the northern region of Malawi.

A fourth benefit in the longer run is the expected change in food security, nutrition status, demographic and socio-economic status of the women of reproductive age and their under-five children on the smallholder farms. With the expansion of food security and nutrition knowledge, the improved food security and nutrition services delivery, and an increased number of stakeholders delivering food security and nutrition services, consequential positive impacts on the status of the women of reproductive age and their under-five children in the smallholder farms could occur.

1.5 ORGANISATION OF THE THESIS

This section gives an overview of the organisation of the entire thesis. The thesis is organised in three parts with ten chapters. All the references are presented together at the end of part three; after chapter 10.

PART I: BACKGROUND AND LITERATURE REVIEW

CHAPTER 1

This chapter presents the background information on the food security and nutrition policy environment in Malawi. Questioning why food insecurity and malnutrition are still rampant and emphasising the need to conduct research on vulnerable women of reproductive age and under-five children. Against this background, the research problem and aim of the study were stated; this was followed by stating the significance of the study.

CHAPTER 2

This chapter presents the literature review establishing the platform on which this research study was built. The literature review ranged from the global to Malawi's food security and nutrition status situation, factors affecting food security and nutrition status, the state of women and children, relationship between food security pillars and nutrition status, and the measurement tools for assessing food security and nutrition status.

PART II: EMPIRICAL INVESTIGATION: RESEARCH DESIGN AND DATA COLLECTION

CHAPTER 3

This chapter discusses the methodology overview, including the research perspective; study setting and population; data collection; conceptualisation; assumptions, limitations and delimitations; and ethical considerations. The specific methodologies for the food security measurement tools and nutrition status are discussed in part three of the thesis outline (i.e. chapters 4 to 9).

PART III: EMPIRICAL INVESTIGATION: DATA ANALYSIS, RESULTS AND DISCUSSIONS

CHAPTER 4

This chapter reports on the demographic and socio-economic characteristics in the households of the tobacco tenant women of reproductive age and their under-five children. The chapter reports specific methodology used, including the introduction, objective, data analysis, results, discussion, strength and limitations, conclusion and recommendations on the demographic and socio-economic characteristics of the study participants.

CHAPTER 5

This chapter reports on the severity of the experience of the household food insecurity access using the HFIAS tool. The chapter reports on the specific methodology, including the introduction, objectives, description of the HFIAS tool, data analysis, results, discussion, strength and limitation, conclusion and recommendation related to findings on the HFIAS tool.

CHAPTER 6

This chapter reports on the severity of the prevalence of hunger using the HHS tool. The chapter reports on the specific methodology, including the introduction, objectives, description of the HHS tool, data analysis, results, discussion, strength and limitations, conclusion and recommendation related to findings on the HHS tool.

CHAPTER 7

This chapter reports on the annual prevalence of hunger using the MAHFP tool. The chapter reports on the specific methodology, including the introduction, objectives, description of the MAHFP tool, data analysis, results, discussion, strength and limitations, conclusion and recommendations related to findings on the MAHFP tool.

CHAPTER 8

This chapter reports on the dietary diversity of the women of reproductive age and their under-five children using the FAO's IDDS tool. The chapter reports on the specific methodology, including the introduction, objectives, description of the IDDS tool, data analysis, results, discussion, strength and limitations, conclusion and recommendations related to findings on the IDDS tool.

CHAPTER 9

This chapter reports on the nutrition status of the women of reproductive age and their under-five children using anthropometric data. This chapter reports on the specific methodology, including the introduction, objectives, data analysis, results, discussion, strength and limitations, conclusion and recommendations related to findings on the nutrition status of the women of reproductive age and their under-five children.

CHAPTER 10

In this chapter the executive summary is presented, including the introduction, aims and objectives, study design, main findings, framework summary, strengths and limitations, conclusions and recommendations on the findings for the entire study.

All the appendices appear after chapter 10 (i.e. *Appendices 1 to 16*).

The Harvard (UP EMS) referencing output style 2016, accessed from the University of Pretoria Library through Endnote, was used in this study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This literature review covers five sections. The first section describes the state of global food insecurity and malnutrition with emphasis on the Malawian situation. The second section discusses some fundamental factors that affect food insecurity and malnutrition. The third section justifies why this study has been focused on women and under-five children. The fourth section presents the interdependency relationship amongst the four pillars of food security, and their linkage with nutrition status. Lastly, the review discusses the different types of measurement tools and indicators of the four pillars of food insecurity and malnutrition.

2.2 FOOD INSECURITY AND MALNUTRITION

Global trends of food insecurity and malnutrition have declined considerably since the 1990s (United Nations, 2012). A joint report by the FAO, IFAD and WFP (2015) indicated that of the 7.3 billion people in the world, about 795 million were estimated to be chronically undernourished during the 2014 to 2016 period; a figure reduced by greater than 167 million over the last ten years, and 216 million lesser than the figures estimated in the 1990 to 1992 period. According to the UNICEF, WHO and World Bank (2014), global estimates of under-fives' malnutrition indicates that 161 million were stunted, 51 million wasted, 17 million severely wasted, 42 million overweight, and 99 million underweight in 2013. In terms of trends, stunting, wasting and underweight have also been declining in under-five children, except for overweight which has showed an increase in prevalence from 5% to 6.6% between 1990 and 2013. For example, stunting in under-five children has decreased by 37% from 257 to 161 million between 1990 and 2013 (UNICEF *et al.*, 2014).

Despite positive trends in reduction of the global food insecurity and malnutrition scenarios, there are still unacceptable disparities within and across some regions (United Nations, 2012). Out of the 795 million chronically undernourished people, an estimated 780 million (98%)

lived in the developing region in the 2014 to 2016 period. A large proportion of them were estimated to live in Asia (512 million), seconded by Africa (233 million), then Latin America and the Caribbean (34 million) and finally Oceania (1.4 million). On the contrary, the prevalence of undernourishment is the highest in Africa, estimated at 20% followed by Oceania, Asia and Latin America and the Caribbean at 14%, 12% and 6% respectively (FAO *et al.*, 2015). In general, in sub-Saharan Africa and Southern Asia, progress to meet international hunger targets has been poor and insufficient. For instance, one in every four people in sub-Saharan Africa remains undernourished. In fact, the number of undernourished people in sub-Saharan Africa even increased by 44 million between the 1990 to 1992, and 2014 to 2016 periods (FAO *et al.*, 2015). Again, in 2013 an estimated one third of all stunted, wasted and severely wasted under-five children lived in Africa. In terms of underweight, Africa has also experienced the smallest relative decrease, with a prevalence of 17% in 2013 down from 23% in 1990, while for instance in Asia, for the same period, it reduced from 32% to 18% (UNICEF *et al.*, 2014).

Malawi has a similar but a bit different food insecurity and malnutrition story. At national level, Malawi has made food security and nutrition matters top priorities as observed in both its overarching growth and development strategies (MGDS I and II) that conspicuously recognise that food security and nutrition matters are key ingredients to the national development (World Bank, 2012). Subsequently, Malawi developed the national food security and nutrition policies to provide guiding frameworks for the implementation of food and nutrition matters (Republic of Malawi, 2006; Republic of Malawi, 2009). With these policy advancements, Malawi has been regarded to be making strides in improving national food insecurity and malnutrition. The FAO *et al.* (2014) reported that by the year 2013 Malawi had already met its national Millennium Development Goal (MDG) of halving the number of people who suffer from hunger between 1990 and 2015.

The next review section presents factors affecting food security and nutrition status, demonstrating why current global achievements in improving food security and nutrition status may be challenged.

2.3 FACTORS AFFECTING FOOD SECURITY AND NUTRITION STATUS

Food insecurity and malnutrition are diverse concepts and multidimensional in nature. The list of factors, determinants, characteristics and or causes of food insecurity and malnutrition is long and multifaceted (Smith, El Obeid & Jensen, 2000). Academics and organisations often use frameworks to describe these factors. There is a huge amount of literature on the frameworks and their derivatives (Pieters, Guariso & Vandeplas, 2013) such that the selection of the frameworks depends on the researcher's conceptualisation of the context of food insecurity (Campbell, 1991) and or malnutrition. In this section, a few examples of key frameworks are discussed. At the end, a summary of factors is also discussed.

2.3.1 The UNICEF conceptual framework of malnutrition

The UNICEF developed a framework known as the UNICEF conceptual framework on the causes of malnutrition (*Figure 2.3.1*) as part of its policy strategy to improve mothers' and children's nutrition status in the 1990s (UNICEF, 1998). The framework divides the causes of malnutrition into three categories, namely basic, underlying and immediate, that are correspondingly classified into societal, household and individual levels respectively. The framework further points out that malnutrition is a multisectoral problem encompassing food, health and caring practices that work in an interdisciplinary fashion (UNICEF, 1998).

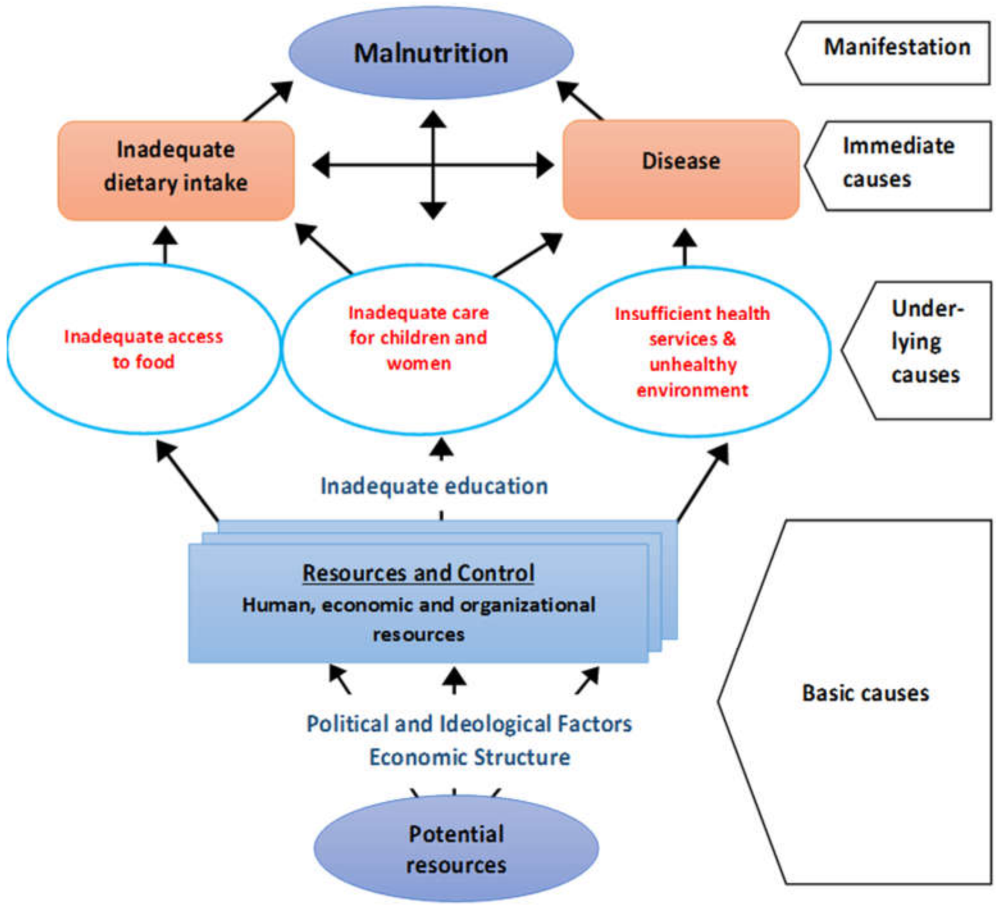

Figure 2.3.1: The UNICEF conceptual framework of malnutrition, sourced from www.foodsecurity.gov.kh

According to the UNICEF framework (*Figure 2.3.1*), malnutrition is a direct result of inadequate dietary intake or the ill health status of a person, and or interaction between the inadequate intake and ill health (immediate causes at an individual level). The next in line are the more complex and interdependency causes to do with unavailability or inadequate access to food, inadequate care practices for women and children, and dysfunctional health systems (underlying causes at the household level). Finally, this conceptual framework recognises that failure to control human and environmental resources, economic systems and political, as well as ideological factors can also contribute to malnutrition at a larger societal level (basic causes at the societal or national level) (UNICEF, 1998; Smith *et al.*, 2000; Pieters *et al.*, 2013).

2.3.2 The FAO-FIVIMS framework of food security

A food insecurity and vulnerability information and mapping system (FIVIMS) is a web of networked systems that collects, analyses and distributes information about people who are at risk or are already food insecure (FAO, 2000). Any framework that fits into the above definition may qualify to be called a FIVIMS framework of food insecurity. In this section, the subject matter is the FAO-FIVIMS framework of food security. The FAO-FIVIMS framework (*Figure 2.3.2*) was developed by the FAO but it originated from the 1996 World Food Summit (FAO, 2000). It serves many functions, but can also be used to analyse the factors, determinants, characteristics and or causes of food insecurity and malnutrition.

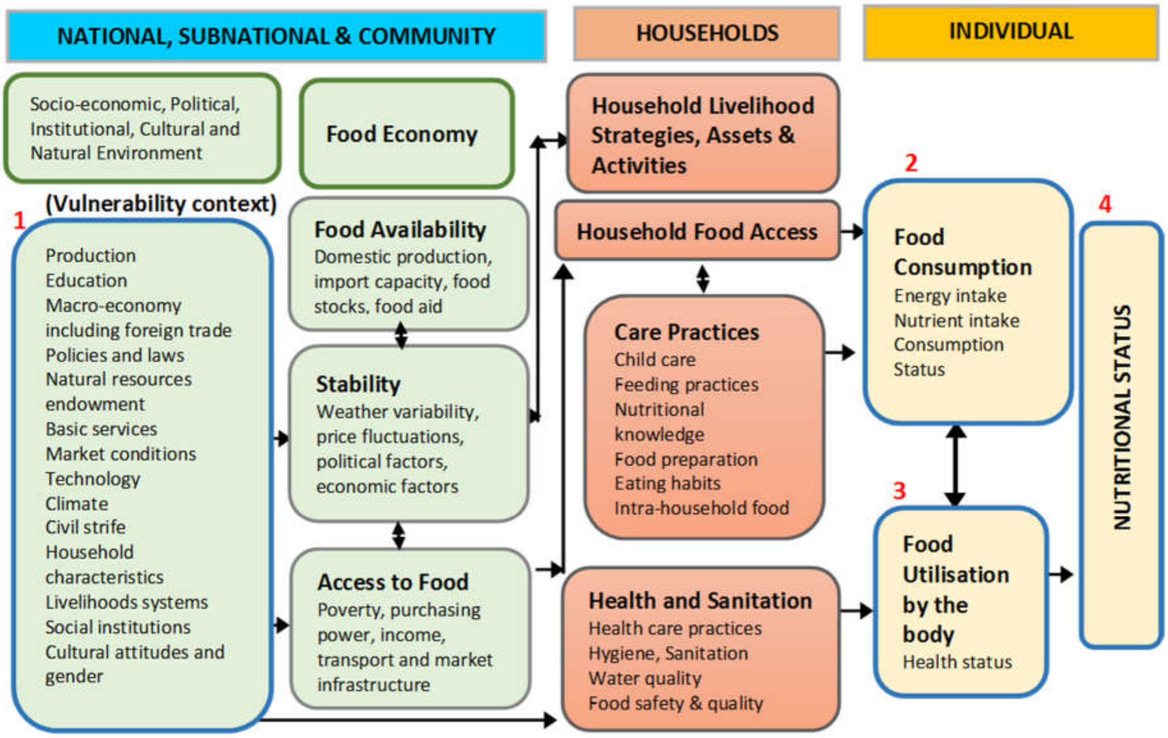

Figure 2.3.2: The FAO_FIVIMS framework of food security, sourced from http://www.fao.org/elearning/course/FC/en/word/trainerresources/learnernotes0413.doc

The FAO-FIVIMS framework (*Figure 2.3.2*) is not very different from the UNICEF framework of malnutrition. For example, the FAO-FIVIMS framework is also classified into three levels of factors of food insecurity, namely individual, household and community. However, the FAO-FIVIMS provides some more distinguished information on the four pillars of food security, namely availability, access, utilisation and stability (*see section 2.5 for a detailed discussion on the four pillars of food insecurity*).

The FAO-FIVIMS framework of food insecurity also acknowledges that food insecurity is a set of sophisticated events attributable to many factors that vary in importance across regions, countries, social groups and over time (FAO, 2000; Verduijn, 2005). The factors in *Figure 2.3.2* may be grouped into six categories: the socio-economic and political environment; performance of the food economy; care practices; health and sanitation; food consumption and utilisation; and nutrition status. According to the FAO (2008b), the FAO-FIVIMS framework is better explained in four steps, namely the (i) socio-economic, political, institutional, cultural and natural environment, (ii) food consumption, (iii) food utilisation, and (iv) nutrition status. A brief discussion follows below.

Step1: Socio-economic, political, institutional, cultural and natural environment

The FAO-FIVIMS framework argues to consider underlying socio-economic, political, institutional, cultural and natural factors that determine the vulnerability context of a country or community, while impacting on different dimensions of food security (food availability, food accessibility, stability, food utilisation). These also affect the care practices, in addition to conditions related to health and sanitation at the household level (FAO, 2008b).

Step 2: Food consumption

Food consumption is argued to be determined by physical and economic access to food, as well as the care practices at the household level. The food access is supposedly determined by relative poverty/income, purchasing power, income transfers (economic access), as well as the quality of transport and market infrastructures (physical access). The care practices may include intra-household food allocation, cultural practices and knowledge related to food preparation (FAO, 2008b). All these factors could have a bearing on the household's food consumption level.

Step 3: Food utilisation

The effectiveness and efficiency of food utilisation by the human body is argued to depend on a person's health status, which in turn is dependent on general health and sanitation conditions.

Step 4: Nutrition status

This FAO-FIVIMS framework shows the relationships and interactions of the main issues that affect an individual's nutrition status. Therefore, the nutrition status outcome is argued to be dependent on two main sub-factors, namely food consumption (food intake in terms of energy and nutrients) and the biological utilisation of the food (determined by a person's health status) (FAO, 2008b).

2.3.3 The conceptual framework for understanding food insecurity

The conceptual framework for the understanding of food insecurity (*Figure 2.3.3*) was proposed by Webb and Rogers (2003) for use in the United States Agency for International Development's (USAID) food security and nutrition programmes. This framework is not very much different from the FAO-FIVIMS framework. It also acknowledges the multidimensional nature of food security that can be better explained in the four pillars of food security (*for a detailed discussion of the four pillars see section 2.5*). Both frameworks also recognise the existence of the link between food security and nutrition status.

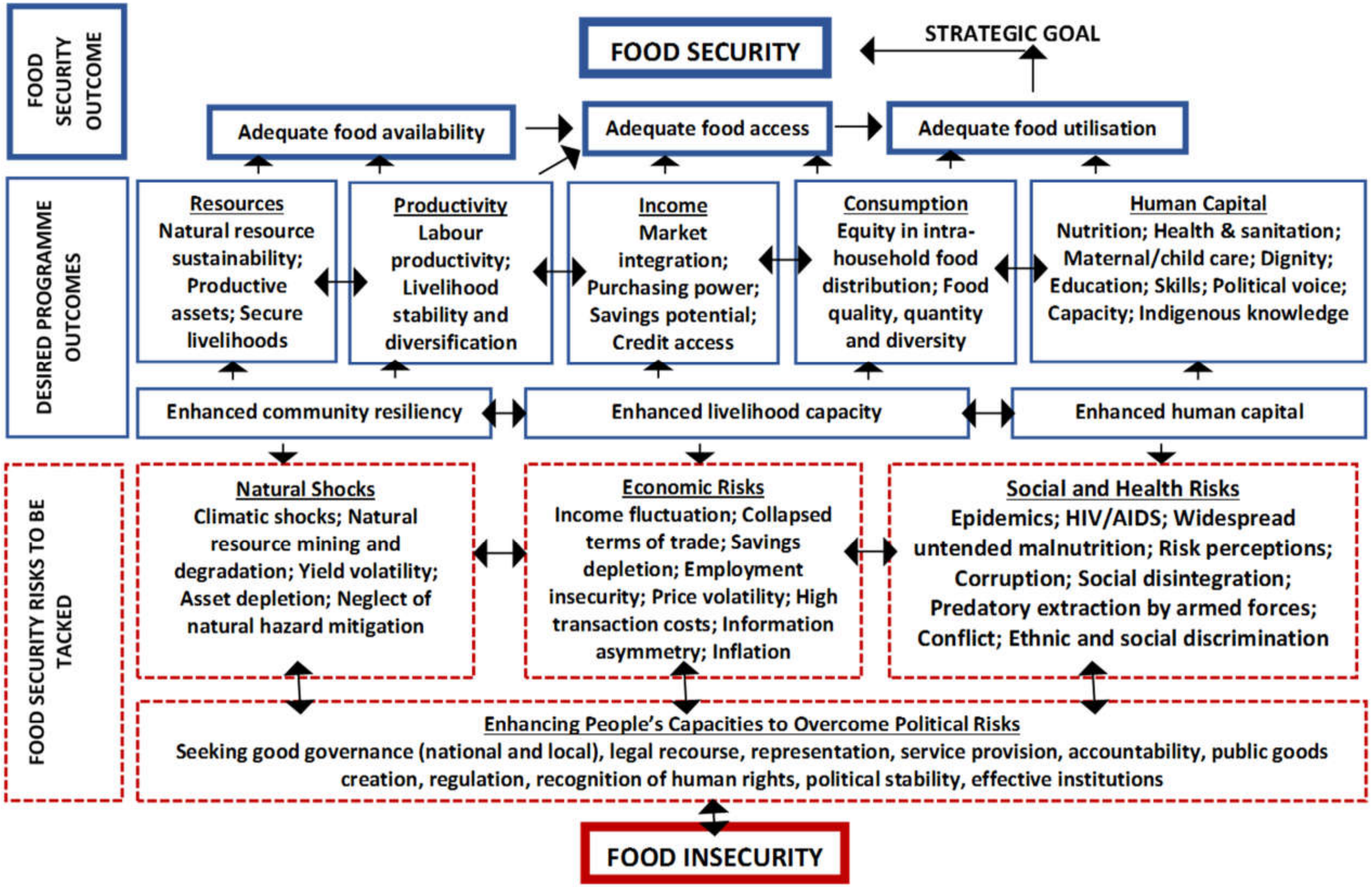

Figure 2.3.3: The conceptual framework for understanding food insecurity (Webb & Rogers, 2003)

According to the conceptual framework for the understanding of food insecurity (*Figure 2.3.3*), food security and food insecurity are two opposite ends of the same continuum, but the utmost goal of all programmes is to achieve food security (Webb & Rogers, 2003). The following are the four steps for conceptualisation to understand this framework.

Step 1: Food availability

The framework argues that to achieve the utmost goal of food security, first adequate food availability need to be ensured. At the national level, natural resource sustainability, productive assets, secure livelihoods and labour productivity are essential factors for the determination of food availability (Webb & Rogers, 2003).

Step 2: Food accessibility

The framework further argues that when the adequate availability of food is ensured, it has an effect on the food access. The adequate food access is a function of income, purchasing power, savings potential and credit accessibility usually at household level (Webb & Rogers, 2003).

Step 3: Food utilisation

The effect of the food access component is passed on to the food utilisation component. Food utilisation is as a result of both consumption and human capital. Hence, food utilisation is a function of intra-household food distribution, quality, quantity and diversity of food. It is also a function of care practices related to health, sanitation, maternal and child care practices, as well as nutrition education. According to this framework, as a result of attaining adequate food utilisation mostly at individual level, the utmost goal of achieving food security is achieved (Webb & Rogers, 2003).

Step 4: Food stability

On the other side of the continuum, food stability in the form of vulnerability affects food availability, accessibility and utilisation. The potential environmental risks in which a nation, household and or an individual is in may affect its food security situation. Natural shocks, economic, social and health risks may affect the outcome of food security programmes, and hence need to be dealt with as failure to do so may lead to food insecurity (Webb & Rogers, 2003).

2.3.4 Summary of factors affecting food insecurity and malnutrition

Across the three frameworks reviewed above, there are some factors that seem to fairly cut across food insecurity and malnutrition, either directly or indirectly. This sub-section summarises the fundamental factors of food insecurity and malnutrition, including production of food, poverty, population, prices of food commodities and services, poor health status, policies, poor investments in agriculture, post-harvest losses and political instability.

2.3.4.1 Production of food

Although the world produces enough food to feed its 7 billion population, still one in every eight people goes to bed hungry (WFP, 2016). Some factors that may affect the food supply include availability of productive land, use of improved agricultural technologies, water and fertiliser usage (Nellemann, 2009). Other factors may include climate change, soil infertility or unproductive household assets (Webb & Rogers, 2003). The WFP emphasised that drought, as a result of climate change, is among common causes of food shortage in the world. The report stated that the persistent drought in 2011 costed Ethiopia, Somalia and Kenya a lot in terms of crop and animal losses. Similar losses were also experienced by many other countries in 2012, especially in the Sahel region of Western Africa (WFP, 2016). Wheeler and von Braun (2013) indicated that climate change has the potential to interrupt progress towards meeting the Millennium Development Goals' hunger target and is capable of affecting all the four pillars of food security.

The World Bank ranked Malawi to be among the world's 12 most vulnerable countries to the adverse effects of climate change (Mearns & Norton, 2010). Climate change impacts can easily be noticed by observing the MVAC survey reports. In these reports it can clearly be seen that erratic rainfalls, floods, dry spells and early cessation of rains are among prime factors contributing to the people's inability to produce enough food to meet their annual food requirements (Government of Malawi & MVAC, 2012; Government of Malawi & MVAC, 2013; Government of Malawi & MVAC, 2014; Government of Malawi & MVAC, 2015).

2.3.4.2 Poverty

Half a billion people live in sub-Saharan Africa, out of which one in every two lives on less than USD 1.0 a day, and almost seven in every ten live in rural areas (Burch, Lawrence, Green, Ichijo, Nonaka, Pimentel, Bower, Gilbert, Couto Filho & Flavio, 2007). Poverty is widely viewed as a principle cause of food insecurity and malnutrition in the world (United Nations, 2012). In as early as the 1990s, a study that analysed data from 58 countries reported consistent results supporting the notion that poverty is the most widespread cause of food insecurity (Smith *et al.*, 2000). People trapped in poverty cannot afford to access nutritious food and balanced meals (WFP, 2016).

The FAO *et al.* (2014) reported that Malawi had met its national Millennium Development Goal's hunger target. However, the same report also hinted that although such was the case, 21.8% of Malawi's population was still undernourished. The first factor that was highlighted as a cause of this discrepancy is poverty. Poverty in Malawi is rampant and wide spread. The latest poverty estimates show that 52.4% and 50.7% of the people lived below the national poverty line in 2004-05, and in 2010-11 respectively. This shows a comparative improvement in the poverty levels. However, over the same years, there has been accelerated rural economic inequalities as extreme poverty increased from 22.4% to 24.5% of the total population (FAO *et al.*, 2014).

2.3.4.3 Population

Population pressure is another aspect that can arguably exacerbate food insecurity and malnutrition in the world. The world's human population was projected to increase from 6.7 billion people in the year 2006 to 9.2 billion people by the year 2050. Although the largest population increase is projected to occur in Asia, the rate of population growth, however, is still relatively high in Central America, and the highest in Central and part of Western Africa. Relatively spoken, Africa will experience the most rapid growth, over 70% faster than in

Asia. The population in sub-Saharan Africa is projected to increase from about 770 million to nearly 1.7 billion by 2050 (Nellemann, 2009).

In the case of Malawi, the population has increased rapidly and in just over 40 years, it increased from 4 million people in 1966 to 13.1 million in 2008. The Malawi population continues to increase with a projected growth of up to 26 million in 2030 (Government of Malawi & PRB, 2012). Latham (2004) stated that if the nutrition status of the people is to improve, there must be increased food availability and services to outpace the rapid population growth. This matter may be challenged in Malawi when looking at the current high projection of the population growth. Geissler and Powers (2011) presented the same worry that the growth of the human population will outdo global capabilities to supply sufficient food.

2.3.4.4 Prices of food, commodities and services

World food and commodity price volatility resulted in 110 million people plunging into poverty and added 44 million more onto the undernourished bandwagon (Nellemann, 2009). When the prices of food and the related commodities and services rise, people usually tend to opt for less expensive and nutritionally compromised food, thereby increasing the likelihood of the risks of micro-nutrient deficiencies and other forms of malnutrition (WFP, 2016).

In Malawi, prices of food and associated commodities and services are fondly explained together with unfavourable climatic conditions as being responsible for people's inability to produce enough food to meet their annual food requirements (Government of Malawi & MVAC, 2012; Government of Malawi & MVAC, 2013; Government of Malawi & MVAC, 2014; Government of Malawi & MVAC, 2015).

2.3.4.5 Poor health status

Widespread illness and death from HIV/AIDS and malaria can greatly reduce agricultural productivity and devastate livelihoods of people (Burch *et al.*, 2007). These could have detrimental effects on food security and malnutrition globally.

In Malawi, the under-five children and women malnutrition levels have not changed significantly for a long period of time. Current estimates still stand extremely high for under-five children; stunting at 47%, while 4% are wasted, and 13% are underweight. Women's malnutrition stands at 26% of the Malawian population (Government of Malawi & ICF Macro, 2011; FAO *et al.*, 2014). Micronutrient deficiency disorders are also high. For example, 63% of children aged six to 59 months, 38% of pregnant women aged 15 to 49 years, and 28% of non-pregnant women aged 15 to 49 years were classified as having anaemia in 2010 (Government of Malawi & ICF Macro, 2011). The malnutrition status in Malawi is precipitated by the immediate causes of malnutrition according to the UNICEF's conceptual framework (Galli, 1998). These immediate causes include sub-optimal intake of foods in both quality and quantity, as well as frequent episodes of diseases like malaria, diarrhoea, pneumonia and HIV and AIDS, which lead to poor appetite and low absorption of nutrients (DfID, 2012). As argued by Babu, Gajanan and Sanyal (2014b), the achievement of food security is taken as one of the fundamental determinants of the nutrition status of individuals. However, in Malawi it can be claimed that the achievement of food security, as alluded by the FAO *et al.* (2014), has not necessarily impacted positively on the nutrition status of individuals since it is observed that the levels of malnutrition have not changed significantly for the past ten years.

2.3.4.6 Policies

Certainly, the factors to do with government policies have a bearing on the food security and nutrition status situation at all levels of international, national and sub-national spheres. Policies could negatively or positively affect food security and nutrition status. Usually, the question of whether government policies are effective is asked, especially when rural and poor farmers are still suffering from food insecurity and malnutrition.

It is understood that attainment of food security needs consideration in multidisciplinary policy and investment reforms, including human resources, agricultural research, rural infrastructure, water resources and agricultural and natural resources management. The understanding is that reformed policy actions should aim at increasing agricultural production, as well as boosting incomes and reduce poverty in rural areas where most of the poor people live (Rosegrant & Cline, 2003). With effective and efficient multidisciplinary policy and investment reforms, Rosegrant and Cline (2003) projected that production of cereals and meats would increase by 71% and 131% respectively between 1997 and 2050. Furthermore, the world would experience a reduction in the number of malnourished children from 33 million in 1997 to 16 million in 2050 in sub-Saharan Africa, and from 85 million to 19 million in South Asia (Rosegrant & Cline, 2003).

A review of the evolution of the agriculture policies in Malawi between 1981 and 2000 paints a clear picture on how the impacts of the changes in the agricultural policies negatively, and in some instances positively, impacted the people in Malawi, especially the smallholder farmers. For example, from 1994 the agriculture policies became more politicised such that ruling political parties explicitly used agricultural policies to promote their own interests to remain in power without necessarily looking at the long-term impacts on the economy, as well as the welfare of the people (Harrigan, 2003).

2.3.4.7 Poor investments' in agriculture

Investing in agriculture is considered of paramount importance in as far as rooting out poverty and promotion of sustainable rural development is concerned (Burch *et al.*, 2007). Many developing countries lack key agricultural infrastructure, such as enough roads, railways, warehouses, markets and irrigation activities. The results are high transport costs, lack of storage facilities and unreliable water supplies which together arrest agricultural yields and limit access to food (WFP, 2016). Poor agriculture research investment is also a contributing factor to food insecurity in many parts of the world (Rosegrant & Cline, 2003). Investments in improving land management, using water more efficiently, and making more resistant seed varieties more available could bring about big improvements in as far as food security and nutrition status are concerned (WFP, 2016).

2.3.4.8 Post-harvest food losses

One third (around 1.3 billion tons) of all food which is produced in both the developed and developing countries is lost through food wastage (WFP, 2016). According to Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas and Toulmin (2010), in the developing countries the losses are mainly due to the lack of infrastructures across the food-chains, and the lack of knowledge or investment in storage technologies. Other authors attributed that post-harvest food losses are mainly due to pest infestations and grain pathogens that are also linked to aflatoxin contamination and poisoning (Tefera, Kanampiu, De Groote, Hellin, Mugo, Kimenju, Beyene, Boddupalli, Shiferaw & Banziger, 2011). Therefore, these factors need to be dealt with as failure could result in smallholder farmers selling their agricultural produce soon after harvesting, thereby falling into poverty traps, and consequentially a compromised food security and nutrition status.

2.3.4.9 Political instability

Food insecurity and malnutrition in some instances are as a result of an unstable political situation across the globe. Conflicts consistently disrupt farming and food production as recently observed in Syria, Somalia and the Democratic Republic of Congo where millions of people are forced to flee their homes, leading to hunger emergencies as the displaced people find themselves without the means to find food (WFP, 2016). A study revealed that the seven most food insecure countries in the developing countries are those struggling with conflicts. The study specifically reported that these countries had the highest prevalence, and the highest increase in prevalence of undernourishment (Deaton & Lipka, 2015), confirming a positive relationship between conflicts and food insecurity. By comparison, hunger is on the retreat in more peaceful parts of Africa, such as Ghana and Rwanda (WFP, 2016). Surprising, although Malawi is apparently not in any huge conflict, it is concerning that the problem of food insecurity and malnutrition is still rampant.

Through this literature section, it can be claimed that Malawi is not faring well in as far as food security and nutrition status of people are concerned. The reviewed factors are continuously working and interacting to create vicious circles of food insecurity and malnutrition. Robust research in the areas of food security and nutrition matters could be among high priority areas to improve the situation.

2.4 WHY CONCERNED ABOUT FOOD SECURITY AND NUTRITION STATUS OF WOMEN AND UNDER-FIVE CHILDREN

According to Government of Malawi and ICF Macro (2011), 51.4% of the Malawian population are composed of females and 17.2% of under-five children. Despite constituting a larger proportion of the population, women and under-five children are disadvantaged in many sectors. Ivers and Cullen (2011) indicated that women need special treatment as far as the topic of food insecurity, and how it relates to nutrition status and general health, is concerned. Ivers and Cullen (2011) further justified that women need special treatment because of the valuable contribution they make towards food production and preparation, their child bearing and care giving roles in the society, and their extremely poor economic status. Additionally, an increased attention in terms of the food security and the health status of the women will have a positive impact on the health status of the generations to come (Struble & Aomari, 2003).

In Malawi, women and under-five children are already singled out as vulnerable categories by major policy documents (Republic of Malawi, 2006; Republic of Malawi, 2009; World Bank, 2012). This is also in line with global initiatives, such as the Scaling up Nutrition (SUN) (Gillespie, 2014) and the Millennium Declaration (United Nations, 2000) that emphasise the need to put women and children at core in the fight against food insecurity and malnutrition. Despite being singled out as vulnerable groups, the levels of food insecurity and malnutrition of women and under-five children are alarming and counter developmental. In Malawi, figures indicate that 47% of under-five children are stunted, 4% wasted and 13% underweight, while 9% of women are thin and 17% overweight (Government of Malawi & ICF Macro, 2011; USAID, 2013). In terms of education, more females (19%) than males (11%) have never attended school (Government of Malawi & ICF Macro, 2011). While this is the case, Mukherjee and Benson (2003) revealed that educational attainment, especially for women, is strongly associated with positive health-related behaviours and attitudes.

The agriculture sector has not spared the women either. Compared to men, women have limited access to agricultural productive resources and have limited access to extension and financial services. Women also work longer hours and much of their work remains undervalued because it is unpaid and is done within the household spheres (FAO *et al.*, 2010; Doss *et al.*, 2011; Kehler, 2013; Pérez *et al.*, 2014). Among the more concerned agriculture sub-sectors is the tobacco labour industry, where the ILO emphasised the vulnerability of women and children (ILO, 2011). Otanez, Muggli, Hurt and Glantz (2006) and the US Department of Labour (2014) pointed out that children as young as five years old may be directly exposed to the hazardous pesticides and chemical substances risking illnesses, such as green tobacco sickness. The ILO (2011) report claimed that in some instances even under-five children are involved in child labour. In addition, women and children are also affected by HIV and AIDS with almost 13% of women in Malawi being HIV-positive as compared to 8% of men (Government of Malawi & ICF Macro, 2011).

Although women are more disadvantaged than men, the findings of the study done by Ibnouf (2009) in Sudan found that in most rural areas the ability of women to use available resources to improved household food security is high. Many other researchers also reported similar sentiments that if women are empowered their household food insecurity and malnutrition will likely improve (Legovini, 2005; Pehu *et al.*, 2009; Blattman *et al.*, 2013; Kabir *et al.*, 2014; Porter & Zovighian, 2014; Sharaunga *et al.*, 2015; Nagata *et al.*, 2015; Malapit & Quisumbing, 2015).

However, targeted and realistic approaches to empower the most vulnerable women in Malawi's agriculture sector need to be supported with locally generated empirical evidence. To the knowledge of the researcher, to date there is no data on the food insecurity and malnutrition of the women of reproductive age and their under-five children working as tenants in the smallholder tobacco farms in the northern region of Malawi. This is a very crucial area in the tobacco industry in Malawi. The implementation of an agricultural liberalisation programme in the 1980s and early 1990s, followed by the introduction of a multiparty government in 1994, has seen the government adopting a dualistic agricultural system. This system promotes both the large scale and smallholder tobacco farming. This led to the abolishment of the ban of smallholder burley tobacco farming. As a result, there has been a drastic increase in the number of smallholder tobacco farmers (Orr, 2000; Torres, 2000). Arguably, this has also led to an increase in tenants working on these smallholder tobacco farms, yet, hardly any studies have been conducted on this emerging section of the tenants. The demographic and healthy surveys, i.e. the Government of Malawi and ICF Macro (2011), are nationwide surveys. Thus, their nutrition status data on women of reproductive age and under-five children are not necessarily applicable to a particular sector or grouping, i.e. tenant farmers. These surveys also lack the food insecurity component.

A tobacco tenant survey that was conducted by the ILO provided a not so comprehensive food insecurity situation. It also lacked a nutrition status component since it mainly concentrated on child labour and AIDS. Again, unlike the current study, this study was done in large scale tobacco estates (ILO, 2011). However, the findings were concerning as it showed that almost 40% of the respondents argued that they and their households went hungry one or more days during the previous month. Again, two thirds of the children interviewed reported to only eat once or twice every day (ILO, 2011). Another tobacco tenant survey in Malawi was done by Torres (2000). This survey was also done in large scale estates and it was merely based on the frequency of meals taken daily to conclude the food security situation of the tenants. The author however acknowledged that there is need to conduct a separate study to look at the type of diet eaten by the tenants. This study reported that 80% of the tenant ate only twice per day, and there were times in which some households went without a meal in a day (Torres, 2000).

This food insecurity situation can be claimed to be more serious on smallholder tobacco farms. The tenancy agreement arrangement may not be as beneficial to the tenants on smallholder farms as it may be to the tenants on the large scale farms. Therefore, a more comprehensive research study that employs a set of tools and techniques is needed to provide empirical evidence on the food insecurity, malnutrition, as well as the demographic and socio-economic situation of tobacco tenants; focusing on the vulnerable women of reproductive age and their under-five children on smallholder farms in the northern region of Malawi.

2.5 INTERDEPENDENCE OF FOOD SECURITY PILLARS AND NUTRITION

2.5.1 Multidimensional nature of food security

This section looks at the multidimensional nature of food security as it will help in understanding the relationship between food security and nutrition status. Historically, food security was understood to be the availability of food to balance unequal food distribution regionally and nationally. However, in the course of time, it was widely understood that availability, although a necessary step, is not sufficient to claim food security, because food may be physically existent but inaccessible for those who are in dire need of it (Gross, Schoeneberger, Pfeifer & Preuss, 2000; Geissler & Powers, 2011; Jones, Ngure, Pelto & Young, 2013). Therefore, the World Food Summit of 1996 came up with a widely acceptable definition of food security that encompasses the four pillars of food security, namely availability, accessibility, stability and utilisation (FAO, 1996). The multidimensionality of food security in this review is explained by these four pillars of food security.

The availability pillar of food security refers to the physical supply of food from all possible sources, including for example all forms of domestic production, commercial imports and food aid (Aurino, 2014). The availability pillar does not only capture the quantity and quality aspects of food, but it also captures food diversity (FAO *et al.*, 2014).

The accessibility pillar of food security represents economic, physical and social ability to acquire adequate amounts of food through a combination of different sources, including own stock, home production and collection, purchases, barter, gifts, borrowing, remittances and food aid (Aurino, 2014).

The utilisation pillar refers to the ability of the individuals in converting acquired food into adequate nutrition for a healthy and active life (Aurino, 2014). Another explanation of food utilisation is provided by Babu *et al.* (2014b), who indicated that it relates to how food consumed is translated into nutrition and health benefits to the individuals.

Lastly, the stability pillar refers to the temporal determinant of food security and it does affect all the three pillars of availability, accessibility and utilisation (Gross *et al.*, 2000). The stability pillar affects the other three pillars in terms of food security risks and shocks. An example of a risk could be too much cereal dependence, while examples of shocks could be price volatility and severe weather conditions (FAO *et al.*, 2014). These food security risks might distort and destabilise food availability, accessibility and utilisation.

2.5.2 Food security framework and interdependence of four pillars and nutrition status

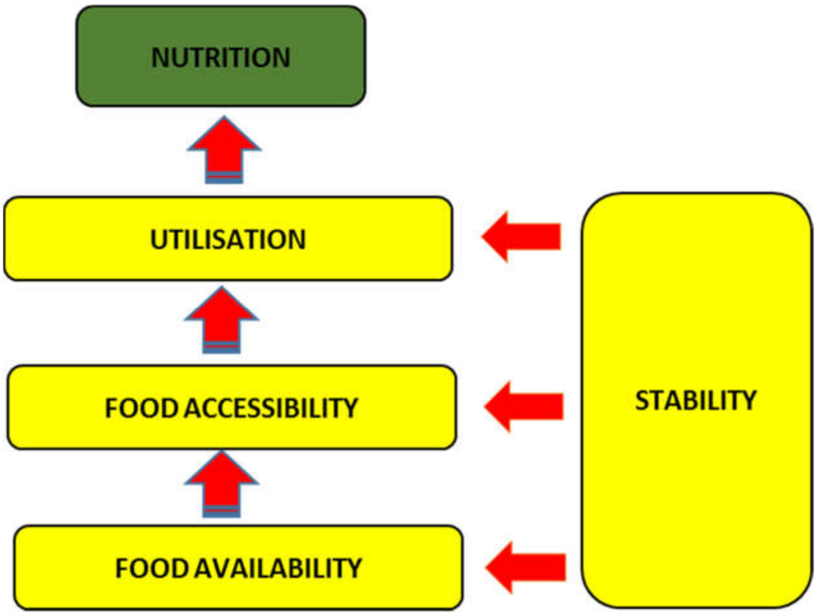

Figure 2.5.1: An illustration of the relationship of the four pillars of food security and nutrition status (Gross *et al.*, 2000)

In the framework (*Figure 2.5.1*), Gross *et al.* (2000) explained the food flow by stating that food availability is achieved if adequate food is readily available to the people. However, the availability of food is not a good indicator of food security of all people as food may be available in an area but not accessible to the people who need it (Gross *et al.*, 2000). This means that food availability needs to go together with food accessibility. But again, food accessibility, which refers to the situation when all households and all individuals within those households have sufficient resources to obtain appropriate foods, is also not enough in deciding the food security level. It is rather the relationship that food accessibility has with food utilisation that enhances the understanding of the food security level, because much as food can be accessible, if the human body is unable to utilise it properly, then the individual may also be declared food insecure (Aurino, 2014). Last but not least, the food utilisation pillar is also not an exhaustive description of the food security level but is related to and tells us more about the nutrition status of an individual. Finally, the food stability pillar affects the sustainability and how all the three pillars (availability, accessibility and utilisation) of food security work in a system (Gross *et al.*, 2000; Geissler & Powers, 2011). Aurino (2014) further emphasised that food security is not only multidimensional, but it is also the outcome of a series of interrelated processes that are dependent on one another. The interdependency of the food security pillars is hierarchical since you cannot achieve any one pillar without the other. This entails that you cannot attain food access without achieving food availability, yet still you cannot attain food utilisation without achieving food access. However, the stability pillar anchors on balancing and sustaining all the three other pillars over time (Aurino, 2014) (*Figure 2.5.1*).

2.6 INDICATORS AND MEASUREMENTS OF FOOD INSECURITY AND MALNUTRITION

Food security is sophisticated as it occurs in various physical conditions resulting from multiple causes and hence is said to be multidimensional (FAO *et al.*, 2014). The complex nature of food security has brought controversies among both academia and policy makers in coming up with a common measurement tool and indicator that exhaustively captures all the aspects of the food security (Wheeler & von Braun, 2013). Aurino (2014) indicated that the confusion surrounding the diffusion of the meaning of the concept of food security is the main culprit responsible for failure to come up with a universally acceptable food security measurement tool. Consequently, literature has been flooded with myriad indicators and measurement tools that come in varying degrees of strengths and weakness, as well as varying levels of technical and financial difficulties when measuring food security (Ballard *et al.*, 2013; Cafiero *et al.*, 2014). To add to this complex web, food security can either be measured directly by measuring the experiences and behaviours of individuals who have lived it or indirectly, for example, by measuring of road or railway networks (Ballard *et al.*, 2013). Whatever the case, in the contemporary understanding, the use of sets of indicators to comprehensively measure food security is recommended rather than relying on a single indicator (Cafiero *et al.*, 2014; Aurino, 2014; FAO *et al.*, 2014).

The following is a review of selected indicators and methods that are used to measure food insecurity and malnutrition based on the four pillars of food insecurity (*refer to section 2.5 for details on the four pillars of food security*).

2.6.1 Food availability

Food availability is measured using information from the FAO's food balance sheets database (Babu *et al.*, 2014b). Many indicators are derived from food balance sheets, including the adequacy of dietary energy supply; the share of energy derived from cereals, roots and tubers; the mean protein supply; the mean supply of animal-source proteins and the mean value of food production (FAO *et al.*, 2014). According to Ballard *et al.* (2013), to monitor the progress of achieving the national Millennium Development Goal to halve the number of people who suffer from hunger, the FAO's prevalence of undernourishment indicator was selected to be one of the ultimate indicators. However, the disadvantage with indicators from food balance sheets is that they provide no information on consumption patterns and relate only to the food supplies at the national level (Ballard *et al.*, 2013). This means that although aggregate national food consumption indicators can be well understood, using food balance sheets does not reflect the household and or individual food security status (Babu *et al.*, 2014b).

It is also worth noting that food availability can also be measured at household level. According to Babu *et al.* (2014b), the small-area estimation method is one of the most common methods in measuring household food availability. The small-area estimation method is a statistical tool that puts together survey and census information to estimate welfare of households and other indicators of various geographical units (Babu *et al.*, 2014b).

2.6.2 Food accessibility

The access pillar of food security comprises indicators of physical access and infrastructure, such as road and rail networks; economic access represented by the domestic food price index; and the prevalence of undernourishment (FAO *et al.*, 2014). In agreement, Babu *et al.* (2014b) pointed out that food availability at the national and regional levels and the associated infrastructure, such as road networks and marketing places to buy food, determine physical accessibility to food. Economic food accessibility is dependent on the ability of the household to purchase food items and the food prices, which could also depend on the physical access to food.

Emphatically, at household level, food accessibility is measured through food or nutrient intake. This is usually reported in "adult equivalent" units to facilitate comparison among individuals within a household, as well as among households (Babu *et al.*, 2014b). The adult equivalent unit depends on the energy requirements of individual household members according to differences in age and sex. Household income and expenditure surveys are a source of information on household characteristics and expenditure patterns that focuses on household food and non-food items. Data from household income and expenditure surveys can be used to assess food accessibility over a prolonged period of time by approximating amounts of food consumption, composition of the diet and nutrient availability at the individual and household levels (Babu *et al.*, 2014b). The following points discuss other measures of food accessibility.

2.6.2.1 Direct measures of food security methods

The confusion associated with the terminology and measurement of food security and malnutrition has led to an evolution in the measurement of the two concepts (Ballard *et al.*, 2013). A notable evolution of food security measurement is the birth of experience-based scales. Experience-based scales present a broader picture of food security and hunger, as well as the existing relationships with over and undernutrition (Ballard *et al.*, 2013). The information to feed into the experience-based scales may either be collected at household or individual levels, and is tailored to measure the food access pillar of food security (Ballard *et al.*, 2013). Experience-based scales are capable of measuring food security by directly asking households or individuals to express their feelings as a result of the previously lived condition of food insecurity. The disadvantage with the experience-based scales as opposed to, for example the household expenditure surveys and individual food intake surveys, is that experience-based scales do not provide any information on the real food consumption, the dietary quality, as well as how food expenditures were done (Ballard *et al.*, 2013). However, the advantages include that the direct measures of food security provide a relatively cheap and easy way for measuring the access pillar (Ballard, Coates, Swindale & Deitchler, 2011; Ballard *et al.*, 2013). Since the methods are easy to apply, analyse and interpret, it is quite easy to inform the intended end users, such as to the decision makers, leaders of civil society and the general public (Ballard *et al.*, 2013). The following is a discussion on common examples of experience-based food insecurity scales.

2.6.2.1.1 Household Food Insecurity Access Scale

The Household Food Insecurity Access Scale (HFIAS) was developed by the Food and Nutrition Technical Assistance Project (FANTA) in 2006. At that time FANTA developed HFIAS with an aim of providing a cross-culturally valid tool suitable to detect the severity of food insecurity occurrence in the developing countries (Coates, Swindale & Bilinsky, 2007). The HFIAS consists of asking respondents to answer nine questions which represent universal domains of the experience of insecure access to food. The domains are mainly grouped into three parts: anxiety and uncertainty about the household food supply, insufficient quality of food and insufficient food intake (Coates *et al.*, 2007).

The nine questions probe whether or not the household experienced one form of insufficient access to food in the previous four weeks, and if yes, with what frequency. Based on these nine questions several indicators could be computed. The first example of the indicator is the HFIAS-score which is a continuous measure of the degree of food accessibility (Coates *et al.*, 2007). The second example is the HFIAS-prevalence which categorises households into four levels of household food insecurity, namely food secure, mildly, moderately and severely food insecure. Households are categorised as increasingly food insecure as they respond in agreement to more severe conditions and or experienced those conditions more frequently (Coates *et al.*, 2007).

However, a validation study that was conducted in 2008 by the FANTA, FAO and Tufts University revealed that the HFIAS has flaws and may not be suitable to describe cross-cultural performance of food security access (Ballard *et al.*, 2011). Despite this shortcoming, the HFIAS was still recommended as a powerful tool because of its unique ability to capture a continuum of domains of food insecurity access unlike, for example, the Household Hunger Scale (HHS) that mainly focuses on food deprivation (Ballard *et al.*, 2011).

The selection of the HFIAS tool to be among the food insecurity measurement tools was due to the want of describing the range of food insecurity domains experienced by the study participants.

2.6.2.1.2 Household Hunger Scale

The Household Hunger Scale (HHS) evolved as an adaptation of the HFIAS after the 2008 validation study that was conducted by the FANTA, FAO and Tufts University (Ballard *et al.*, 2011). The HHS is also an experience-based food insecurity scale based on the assumption that food deprivation experiences are predictable and hence can be captured in surveys and be presented in a summary scale. It was developed and validated for cross-cultural use which is its strength unlike other methods, such as the HFIAS (Ballard *et al.*, 2011). However, the disadvantage with the HHS is that it has a tendency to reflect the more severely cases of food insecurity affected households. It also does not measure dietary quality, and focuses only on the food quantity aspect of food accessibility (Ballard *et al.*, 2011).

Unlike the HFIAS which has nine occurrence questions, the HHS consists of only three occurrence questions. Several indicators can be constructed from the HHS to describe the food insecurity situation of the sampled population, including the categorical HHS indicator and the median HHS score (Ballard *et al.*, 2011).

In this study the HHS was used as part of the measurement tools of food insecurity. The rationale behind this was that the HHS and HFIAS would complement each other, furthermore to take advantage of the cross-cultural comparability strength of the HHS.

2.6.2.1.3 Food Insecurity Experience Scale

The FAO, through the Voices of the Hungry Project, has recently claimed to have developed yet another experience-based food insecurity scale, called the Food Insecurity Experience Scale (FIES) (FAO *et al.*, 2014). The FIES is an outcome of improvements made through building on methods of previously used experience-based food insecurity tools, such as the United States Household Food Security Survey Module (US HFSSM), the HFIAS and the Latin American and Caribbean food security scale (Ballard *et al.*, 2013; FAO *et al.*, 2014). The FIES is said to have full comparability capabilities across nations regardless of different food security situations (FAO *et al.*, 2014), as well as linking between different sectors in a cross-disciplinary manner (Ballard *et al.*, 2013). The FIES is thus claimed to have potential to contribute to defining truly the universal food security measurement standards at individual and household levels (FAO *et al.*, 2014), unlike previous experience-based scales that emphasised food insecurity measures at household level (Ballard *et al.*, 2013).

Despite the hype associated with the FIES, it is cautioned that further validation is needed to claim greater confidence and reliability for the FIES to be a global cross-cultural and cross-disciplinary food insecurity indicator (Ballard *et al.*, 2013; FAO *et al.*, 2014).

2.6.2.2 Food consumption methods

Food consumption scores, dietary diversity indicators and food acquisition data from household expenditure surveys are another crop of food accessibility indicators that closely resemble direct scales in measuring the condition of the food security (Jones *et al.*, 2013). However, differences exist amongst these indicators in such a way that food consumption and dietary diversity present more direct measures of dietary adequacy, while household expenditure surveys present indirect measures that estimate intake of food (Ballard *et al.*, 2013). The following are selected examples of food consumption methods.

2.6.2.2.1 Months of Adequate Household Food Provisioning

The Months of Adequate Household Food Provisioning (MAHFP) tool measures how many months in the previous year a household was not or was able to provide itself with enough food. Two methods are used to measure the MAHFP. The fist method uses quantitative data from a sample of households to calculate a mean MAHFP score. The second method uses participatory rural appraisal (PRA) sessions with the community to qualitatively reach an agreement about the proportion of households in different categories of food security based on the group's perception of MAHFP (Africare, 2007). For the former, the respondents are asked which of the previous 12 months the household did not have access to sufficient food to meet their needs. The responses are then tabulated and a MAHFP score is calculated which ranges from zero to 12. Households can also be put into categories, i.e. least food insecure, moderately food insecure and most food insecure (Bilinsky & Swindale, 2007). The MAHFP measures economic access and food quantity and can be used at regional or household levels (Jones *et al.*, 2013). A study that was done in Bangladesh indicated that the MAHFP was significantly associated with women's dietary diversity score indicators, as well as other determinants of food insecurity, such as literacy levels (Harris-Fry, Azad, Kuddus, Shaha, Nahar, Hossen, Younes, Costello & Fottrell, 2015). The concern with the MAHFP is that of recall bias. A study done in Malawi, Kenya and Uganda on reliability of recall in agricultural data, found some concerns about the quality of some types of agricultural data collected through recall over lengthy periods (Beegle, Carletto & Himelein, 2012).

In this study the MAHFP was used as part of the measurement tools of food insecurity. The rationale behind its inclusion was to provide an annual food accessibility picture. This study was only done between January and March 2016 (one season of the year). Therefore, despite the weaknesses of the MAHFP, it still helps to gather annual food accessibility information.

2.6.2.2.2 Dietary Diversity Scale

The Dietary Diversity Score (DDS) metric captures the number of different kinds of food groups that people consumed (Maxwell, Vaitla & Coates, 2014) in a predetermined reference period (Cafiero *et al.*, 2014). According to Kennedy, Ballard and Dop (2011) the DDS can be measured at household [household dietary diversity score (HDDS)] or at an individual [individual dietary diversity score (IDDS)] levels. Whether captured at household or individual level, the DDS measures the food accessibility pillar. The difference between the HDDS and IDDS is that the HDDS is a proxy of economic access to food, while the IDDS is a proxy of access to adequate nutrients. The number of food groups involved in analysis also vary; with the HDDS having 12 food groups and the IDDS having nine food groups (Kennedy *et al.*, 2011).

There is convincing evidence that the DDS is a valid measure of food security. A study that was done in Bangladesh, Nepal, Pakistan, Tanzania and Uganda reported that the DDS was highly correlated to children's nutrition status (Maxwell *et al.*, 2014). Cafiero *et al.* (2014) also reported that the DDS as proxy for the food *access* pillar of food security is consistently associated with household food security, as well as various other indicators of socio-economic status. Jones *et al.* (2013) concurred with Maxwell *et al.* (2014) and Cafiero *et al.* (2014) that the DDS has been shown to be positively associated with household food security and nutrition status.

However, the reliability of the DDS is questionable as it lacks a formal theory that links the number of food groups consumed to the levels of either nutrient adequacy or food insecurity. Therefore, it is difficult to assess how the DDS values obtained in different contexts can be accurate and precise indicators of the construct they are intended to capture. Until to date, the questions on the optimal number of food groups to be used or the minimal size of food servings to be included in a food group are still unanswered (Cafiero *et al.*, 2014). However, as observed in the literature, the DDS is still promoted because of its fairly validity nature, as well as its inexpensiveness and user friendliness (Cafiero *et al.*, 2014).

In this study the IDDS was used as part of the measurement tools of food insecurity. The rationale behind its inclusion was related to its relative strength to offer diversification of the food groups consumed by the study participants.

2.6.2.2.3 Food Consumption Scores

The Food Consumption Score (FCS) is related to the DDS. It is a specific type of dietary index widely used by the World Food Programme (WFP). The FCS indicator is used to establish the prevalence of food insecurity in a country or region. Unlike the DDS, the FCS combines data on dietary diversity and food frequency using a 7-day recall period from comprehensive food security vulnerability assessments (CFSVAs) and emergency food security assessments (Jones *et al.*, 2013).

The FCS is computed from data on occurrence and frequency of consumption of eight different food groups collected through a survey (Cafiero *et al.*, 2014). The frequency of consumption of each food group is then multiplied by an assigned weight for each group and the resulting values are summed to obtain the FCS. This score is then recoded to a categorical variable using standard cut-off values (Jones *et al.*, 2013). The cut-off values are used to classify households' food consumption levels as poor, borderline and acceptable (Cafiero *et al.*, 2014).

Although the use of the FCS as a food security measure is backed by research studies that found a significant correlational relationship between the FCS and energy consumption, there is still a lot of variation across different contexts (Maxwell *et al.*, 2014). The FCS also lacks minimal characteristics, starting from a proper definition of the construct it aims at measuring, to assessing precision and reliability of the measures, and to ensure comparability across applications (Cafiero *et al.*, 2014). Maxwell *et al.* (2014) even indicated that it is largely due to the influence of the WFP that has made many agencies to adopt the FCS.

2.6.3 Food utilisation

The measurement of the food utilisation pillar may be well understood if explained in two parts. The first encompasses variables that determine the ability to utilise food, notably indicators of access to water and sanitation (FAO *et al.*, 2014). In agreement, Babu *et al.* (2014b) also outlined that health services, caring activities and environment are crucial factors in measuring food utilisation. The second part focuses on outcomes of poor food utilisation, i.e. nutrition status of children under five years of age, such as wasting, stunting and underweight. Besides, micronutrient deficiency indicators in women and children, such as the prevalence of anaemia, vitamin A, iodine and zinc deficiencies are also common outcomes that are measured to proxy poor food utilisation (FAO *et al.*, 2014). In general, consensus on measurement of the food utilisation pillar is centred on various measures of nutrition status (Bilinsky & Swindale, 2007).

According to Moore (1997), assessment of nutrition status has four components. These are anthropometric measurements, biochemical analyses, clinical assessments and dietary or nutrition history. In addition to these components, Geissler and Powers (2011) also mentioned functional assessment of nutrition status. This review sub-section will concentrate on anthropometric measurements, biochemical and clinical components of nutrition status assessment. Dietary assessment as one method of nutrition status assessment will not be discussed under this section. As observed by the researcher in Geissler and Powers (2011), most dietary assessment methods also appear as methods of assessing the previously discussed food security pillars. For instance, food balance sheets are used to assess availability pillar, while household and individual surveys, such as recalls and inventories, are used to assess the accessibility pillar.

2.6.3.1 Anthropometric measurements

Anthropometric measurement is simply the science of measurement of variations of the human body in terms of sizes and shapes (Geissler & Powers, 2011). Fundamental nutrition anthropometry include measurements of height (or length for children less than two years) and weight. But depending on the purpose of the study, other measurements are done, such as mid-upper arm circumference, head circumference, skinfold thicknesses and demi span (Moore, 1997; Geissler & Powers, 2011). Once the human body sizes and shapes have been measured, they are then related to reference or standard values according to age and sex of the subject, which reflect the body growth of healthy and well-nourished individuals (Geissler & Powers, 2011).

In this study anthropometry was used. Compared with the dietary, biochemical and functional and clinical nutrition status assessment methods, nutrition anthropometry has an advantage in that it may provide a relatively quick and inexpensive means for the assessment of nutrition status (Geissler & Powers, 2011). Again, as compared to dietary methods alone, anthropometric measurements have relatively high accuracy and precision (Geissler & Powers, 2011). However, the potential limitation of anthropometry is the extent to which measurement error can influence interpretation of nutrition status. Therefore, to overcome this limitation, it requires thorough training of anthropometrists in order for them to achieve good levels of precision and accuracy (Geissler & Powers, 2011).

2.6.3.2 Biochemical assessment

Chemical analysis of blood, urine, saliva and other body tissues, such as hair and nails provides useful information in predicting levels of nutrient intake and of tissues' status adequacy that occur in human individuals and populations (Moore, 1997). Biochemical status measures or indices are selected and tailored for each nutrient, and are often the concentration of the nutrient or its derivatives in the body. For example, plasma retinol is an index of vitamin A status; 25-hydroxy-vitamin D is an index of vitamin D status and the activation of flavin-dependent red cell enzyme erythrocyte glutathione reductase is an index of riboflavin (vitamin B_2) status (Geissler & Powers, 2011).

Biochemical assessments, when carefully selected and properly validated, provide a powerful and valuable addition to other evidence of nutrition adequacy for individuals and populations. They form an essential component of nutrition research and of public health surveillance programmes (Geissler & Powers, 2011). However, Moore (1997) indicated that some biochemical tests need to be conducted in laboratories, and laboratories may not be reliable since most are affected by factors other than nutrition. In agreement, Geissler and Powers (2011) pointed out that biochemical nutrition status assessment depends on accessibility of samples that require access to suitable analytical equipment, laboratory facilities and relevant expertise for sample collection, storage, sample analysis and interpretation. All in all, Ballard *et al.* (2013) emphasised that biochemical assessments are sophisticated and costly; as such the decision to use them in food security and nutrition status measurement should be scientifically and financially sound.

2.6.3.3 Clinical assessment

Nutrient deficiencies and excesses may be assessed clinically or physically through careful examination of related signs and symptoms of those deficiencies and excesses that become apparent in individuals (Moore, 1997). Examples of clinical signs and symptoms of nutrient deficiency are rickets which is a sign of vitamin D deficiency, and impaired blood clotting which is a symptom of vitamin K deficiency (Geissler & Powers, 2011). Moore (1997) also provided examples of signs and symptoms of nutrient excesses, such as headache, hair loss, dry scaly skin for vitamin A and mottling of teeth for fluoride.

As observed above, compared to biochemical assessment, clinical assessments may lack precision and accuracy since the mentioned signs and symptoms may not be specific to those mentioned nutrients (Geissler & Powers, 2011).

2.6.4 Food stability

According to the FAO *et al.* (2014), to ably understand and measure the food stability pillar, it is advisable to divide it into two groups. The first group represents factors that measure the risks to food security ranging from the cereal dependency ratio, adverse weather, the area under irrigation, and the value of staple food imports as a percentage of total merchandise exports. The second group dwells on factors leading to the incidences of shocks, such as domestic food price volatility, political instability and fluctuations in domestic food supply (FAO *et al.*, 2014).

2.7 SUMMARY

This literature review supports the claim that the state of food insecurity and malnutrition in the world is in bad shape, and even worse in Malawi. It further provides background characteristics and factors that contribute to the state of food insecurity and malnutrition in the world.

The literature review further portrays how worse the women and children are faring and presents their vulnerability context to the atrocities of food insecurity and malnutrition. In addition, it provides for the need to tackle the problems of food insecurity and malnutrition with multidimensional and multidisciplinary lenses since the two problems are related.

Against this background, the review also discusses various indicators and measurement tools and amidst justifies why the HFIAS, HHS, MAHFP, IDDS and specific anthropometry were selected to be part of the measurements in this study. Therefore, the review supports the need of conducting empirical and robust research using cost-effective tools to contribute to improvement of both the food insecurity and malnutrition situation of women of reproductive age and under-five children in Malawi and Africa in general through appropriate intervention(s) based on the findings of this study.

PART II: EMPIRICAL INVESTIGATION: RESEARCH DESIGN AND DATA COLLECTION

CHAPTER 3

METHODOLOGY OVERVIEW

3.1 INTRODUCTION

This chapter discusses the overall research perspective; conceptualisation; study setting, population and sample; data collection; delimitations, assumptions and limitations; and ethical considerations. The specific methodologies for the food security and nutrition status measurements are discussed in part three of the thesis outline (*refer to chapters 4 to 9*).

3.2 RESEARCH PERSPECTIVE

3.2.1 Study approach and design

A quantitative study approach was used. This approach was fit for the demographic, socio-economic, HFIAS, HHS, MAHFP, IDDS and nutrition status indicators from anthropometric measurements used in this study. Although perceived as qualitative by some quarters, the HFIAS, HHS, MAHFP and IDDS also produce numerical values that have statistical properties (Ballard *et al.*, 2013), hence the use of the quantitative domain.

A cross-sectional descriptive correlational design was used. The study design represents the fundamental benchmark from which the study's conclusions emanate (Boushey, Harris, Bruemmer, Archer & Van Horn, 2006). The aim of this study was not to find causal relationships, but to assess and describe the food accessibility situation and nutrition status of the women of reproductive age and their under-five children involved in tobacco tenant farming. Furthermore, to determine and report the correlational relationships amongst the indicators at a given point in the tobacco growing season. Therefore, the cross-sectional descriptive correlational design was assumed to be appropriate. Besides, the use of this design made logical sense in terms of financial, timeframe and technical cost-effectiveness.

3.2.2 Overview of objectives and tools

To achieve the aim of the study, the research addressed the objectives using the respective tools as outlined in *Table 3.2.1*.

Table 3.2.1: Objectives and tools used in the study

ID	Objectives	Tools
1	To assess and describe the demographic and socio-economic characteristics in the households of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	Structured questionnaire (*refer to Appendices 2 to 5, 7 and 8 for demographic and socio-economic questionnaires*)
2	To assess and describe the severity of the experience of food insecurity access in the households of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	The validated Household Food Insecurity Access Scale (HFIAS) (Coates *et al.*, 2007) (*refer to Appendix 10 for the HFIAS questionnaire*)
3	To assess and describe the severity of hunger in the households of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	The validated Household Hunger Scale (HHS) (Ballard *et al.*, 2011) (*refer to last three questions of the HFIAS in Appendix 10 for the HHS questionnaire*)
4	To assess and describe the annual prevalence of hunger in the households of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	The Months of Adequate Household Food Provisioning (MAHFP) tool (Bilinsky & Swindale, 2007) (*refer to Appendix 9 for the MAHFP questionnaire*)

Continued

Table 3.2.1 continued: Objectives and tools used in the study

ID	Objective	Tool
5	To assess and describe the dietary diversity of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	The validated Individual dietary Diversity Scale (IDDS) (Kennedy *et al.*, 2011) (*refer to Appendices 11 and 12 for the IDDS questionnaire for women and children respectively*)
6	To assess and describe the nutrition status of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	Anthropometric measurements (*refer to Appendix 6 for the anthropometric questionnaire*)
7	To determine and report the correlational relationships amongst demographic and socio-economic factors, HFIAS scores, HHS scores, MAHFP scores, IDDS scores, and nutrition status indicators in the households of the tobacco tenant women of reproductive age and their under-five children on smallholder farms	

3.3 CONCEPTUALISATION OF THE STUDY

In this section, the conceptual underpinning of the study, including the conceptual framework, conceptual definitions and explanation of the conceptual framework are presented.

3.3.1 Conceptual framework of the study

A conceptual framework, as illustrated in *Figure 3.3.1*, was developed to serve as a guide to address the set study objectives.

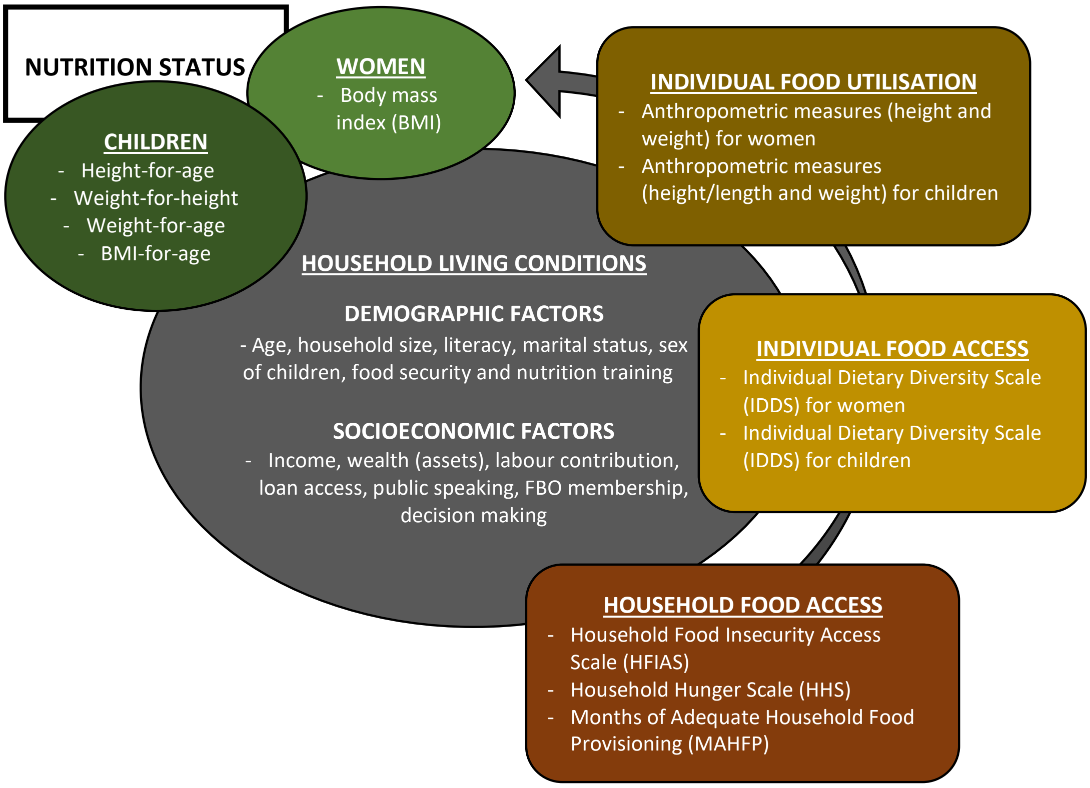

Figure 3.3.1: Conceptual framework of the study

3.3.2 Conceptual definitions

The following section gives conceptualised definitions of terms used in this study. A total of eleven conceptual terms, including women of reproductive age, under-five children, nutrition status, food security, dietary diversity, food accessibility, food utilisation, household, tobacco tenant farmers, smallholder farms, and undernourishment and hunger will be discussed.

- **Women of reproductive age**

These are women in their child bearing age and have specific nutrition requirements because they lose blood regularly during menstruation leading to loss of iron and other essential nutrients (Latham, 2004). They also work much harder and are heavily involved in agricultural activities than men (Latham, 2004). In Malawi the age range of women of reproductive age is from 15 to 49 years (Government of Malawi & ICF Macro, 2011; USAID, 2013).

- **Under-five children**

Under-five children are those children from zero to 59 months old (Government of Malawi & ICF Macro, 2011).

- **Nutrition status**

Nutrition status is the condition of health of a person that is influenced by the intake and utilisation of nutrients. It can either be described as good or poor. A good nutrition status is achieved when all required nutrients in appropriate amounts are consumed and utilised by the body. A poor nutrition status is caused by failure to acquire enough nutrients (undernutrition) or having excessive nutrients (overnutrition) (World Bank, 2013). The term malnutrition was used continuously in this study, meaning the negative end of nutrition status, depending on the prevailing discussion.

The conceptualised nutrition status was reflected in anthropometric measurements, specifically the BMI for the women of reproductive age. For the under-five children, nutrition status was reflected in the various anthropometric indices, including height-for-age (stunting), weight-for-age (underweight), weight-for-height (wasting) and BMI-for-age.

- **Food security**

The FAO states that food security is 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, 1996). This definition comprises the four key pillars or dimensions of food security, namely availability, accessibility, utilisation and stability of food (*refer to section 2.5.1 of the literature review on discussion of the four pillars*).

This study was conceptualised on the accessibility and utilisation pillars of food security. As such the term food security referred to food accessibility and food utilisation. The terms food security and food insecurity were used continuously in this study, meaning the positive and negative ends of food security status, depending on the prevailing discussion (Webb & Rogers, 2003).

Household and or individual food security referred to the ability of the household, and or an individual to obtain enough food to provide all the nutrients to all members of the household, and or to an individual alone (Latham, 2004).

- **Dietary diversity**

Dietary diversity (DD) was defined as the number of different foods or food groups eaten in a pre-determined standard period (Ruel, 2003). The standard period was the previous 24 hours. The DD can be assessed at the household (HDD) or individual (IDD) levels.

In this study DD was administered at the individual level reflecting an individual's access to different food groups, and it was considered as a proxy of an individual's nutrient adequacy from the diet (Kennedy *et al.*, 2011).

When calculating the IDDS for the under-five children, only those from 24 to 59 months were considered. This was so because the FAO's IDDS tool, which was used, is considered not appropriate to comprehensively capture the current guidance on breastfeeding and complementary feeding practices for infants and young children less than 24 months (Kennedy *et al.*, 2011).

When a diet provides the recommended energy and all the essential nutrients required by the body, the situation is referred to as nutrient adequacy (Ruel, 2003). The other terms related to nutrient adequacy are dietary quality and dietary adequacy. These two terms were used interchangeably and referred to a diet that met energy and essential nutrient requirements (Ruel, 2003).

- **Food accessibility**

Food accessibility is when households and or individuals are able to acquire optimal quality and quantity food to meet their nutrition needs for productive lives (Bilinsky & Swindale, 2007). Food access means that the households or individuals are able to get food from own production or other means, such as purchases, transfers or donations. Furthermore, food access is dependent on available household or individual resources and how these resources are used to get other goods and services (Bilinsky & Swindale, 2007).

In this study the conceptualised food accessibility was encapsulated in the experience-based and adequacy of food consumption measures of food security. These are the direct measures of food security that asked respondents directly about their food security situation (Ballard *et al.*, 2013; Cafiero *et al.*, 2014). Hence, food accessibility was reflected in the HFIAS, HHS, IDDS and MHFP indicators.

- **Food utilisation**

Food utilisation refers to how food can ably be eaten and broken down inside the human body (Gross *et al.*, 2000). Food utilisation includes two distinct parts. The first is the biological perspective captured by the anthropometric indicators. The second is captured by a number of indicators that reflect food quality, preparations, health and hygienic conditions that determine how effective the available food can be utilised by the body (FAO, IFAD & WFP, 2013).

In this study the conceptualised food utilisation was reflected in the specific anthropometric measurement indicators. For the women of reproductive age the BMI was used. For under-five children, height-for-age (stunting), weight-for-age (underweight), weight-for-height (wasting) and BMI-for-age indices were used.

- **Household**

In this study a household was referred to as a dwelling arrangement where related or unrelated individuals shared resources and dined together from a common cooking place. This was the same definition as used by the Government of Malawi and ICF Macro (2011).

- **Tobacco tenant farmers**

These are households or individuals who provide informal labour on smallholder tobacco farms in return for an amount of cash at the end of the tobacco growing season (Kerr, 2005). The study focus was on the female tobacco tenant farmers of reproductive age and their under-five children, working and living in the sampled smallholder tobacco farmers' households.

- **Smallholder tobacco farm**

The smallholder tobacco farms were those farms with a mean size of zero point four to four (0.4-4) hectares (ILO, 2011). The distinct characteristics which were used to distinguish smallholder tobacco farmers from large scale farmers was that smallholder tobacco farmers were those who produced tobacco under a quota system of up to 10,000kg per person, and were organised into farmer clubs to negotiate the quotas (ILO, 2011).

- **Undernourishment and hunger**

The undernourished people referred to those whose dietary energy consumption was below the recommended levels (Jones *et al.*, 2013). Hunger was defined as the inadequate consumption of food energy causing an uncomfortable or painful sensation, also scientifically referred to as food deprivation (FAO, 2008a).

These two terms were included because they are widely used in the literature and they are related to food insecurity as all hungry people are said to be food insecure, but not all food insecure people are said to be hungry since there are other causes of food insecurity, including those due to poor intake of micro-nutrients (Ghattas, 2014).

3.3.3 Explanation of the conceptual framework

The conceptual framework of the study (*Figure 3.3.1*) shows that the household's living conditions, i.e. demographic and socio-economic factors, affect household food accessibility, individual food accessibility, food utilisation and nutrition status of women of reproductive age and under-five children. Research has demonstrated that there is a correlational relationship between demographic and socio-economic factors with the food security and nutrition status of individuals (Makombe, Lewin & Fisher, 2010; Teller & Yimer, 2015). The achievement of food security has also shown to be among fundamental precursors of the nutrition status of individuals (Babu *et al.*, 2014b). Therefore, the conceptual framework in *Figure 3.3.1* proposed the relationship between the food security and nutrition status of the women of reproductive age and their under-five children by assessing their demographic and socio-economic status. The demographic and socio-economic factors were assumed to affect the household food accessibility, which in turn would affect the individual food accessibility.

Finally, the coherence of these events would affect food utilisation which would be manifested in the nutrition status. The multivariable regression analysis models [i.e. linear, random-effects Generalised Least Squares (GLS), and or Instrumental Variables (IV)] were run to identify the existence of relationships amongst the indicators.

Most food security measurement indicators are technically complex and costly to come up with (Ballard *et al.*, 2013; Cafiero *et al.*, 2014). Despite the constraints, this study managed to measure food accessibility and partly utilisation pillars of food security (*refer to section 2.5.1 of the literature review on discussion of the four pillars of food security*).

The food accessibility pillar has a strong potential to measure food security directly due to its links with experienced-based and adequacy of food consumption measures (Ballard *et al.*, 2013; Cafiero *et al.*, 2014). Therefore, the use of the HFIAS, HHS, IDDS and MAHFP provided an opportunity to assess food security directly by asking women of reproductive age to describe their direct lived experiences as a result of the condition of food insecurity. In addition, these four measurement tools were selected due to their simplicity and inexpensiveness in measuring food security as well as their potential validity (Jones *et al.*, 2013). The four measurement tools were used as a set of indicators of food insecurity. This was crucial in promoting participatory approaches in food security programme design since the four measurement tools were capturing different aspects of food accessibility. The HFIAS measured the behavioural and psychological effects of household food insecurity in the three domains, namely anxiety and uncertainty, insufficient food quality and insufficient food intake (Ballard *et al.*, 2013; Cafiero *et al.*, 2014). The HHS measured behavioural effects as a result of a more severe form of food insecurity characterised by lack of food and real hunger (Ballard *et al.*, 2011). The IDDS measured the dietary diversity and nutrient adequacy of women and children (Kennedy *et al.*, 2011; Cafiero *et al.*, 2014). The MAHFP measured annual prevalence of hunger of the households (Bilinsky & Swindale, 2007).

Lastly, the measurement of nutrition status of women of reproductive age and under-five children allowed measuring the food utilisation pillar. Consensus on the measurement of the utilisation pillar of food insecurity is centred on various measures of nutrition status (Bilinsky & Swindale, 2007). The decision to use anthropometric measurements of women of reproductive age and under-five children over biochemical tests and clinical examinations to assess nutrition status was made because of the easiness in measuring anthropometry, the researcher's expertise and cost effectiveness.

3.4 STUDY SETTING, POPULATION AND SAMPLE

3.4.1 Study setting and population

The study was done in the Bwengu, Engucwini and Nyuyu Extension Planning Areas (EPAs) in Mzimba North district. The district is under the Mzuzu Agriculture Development Division (Mzuzu ADD), located in the northern region of Malawi (*Figure 3.4.1*).

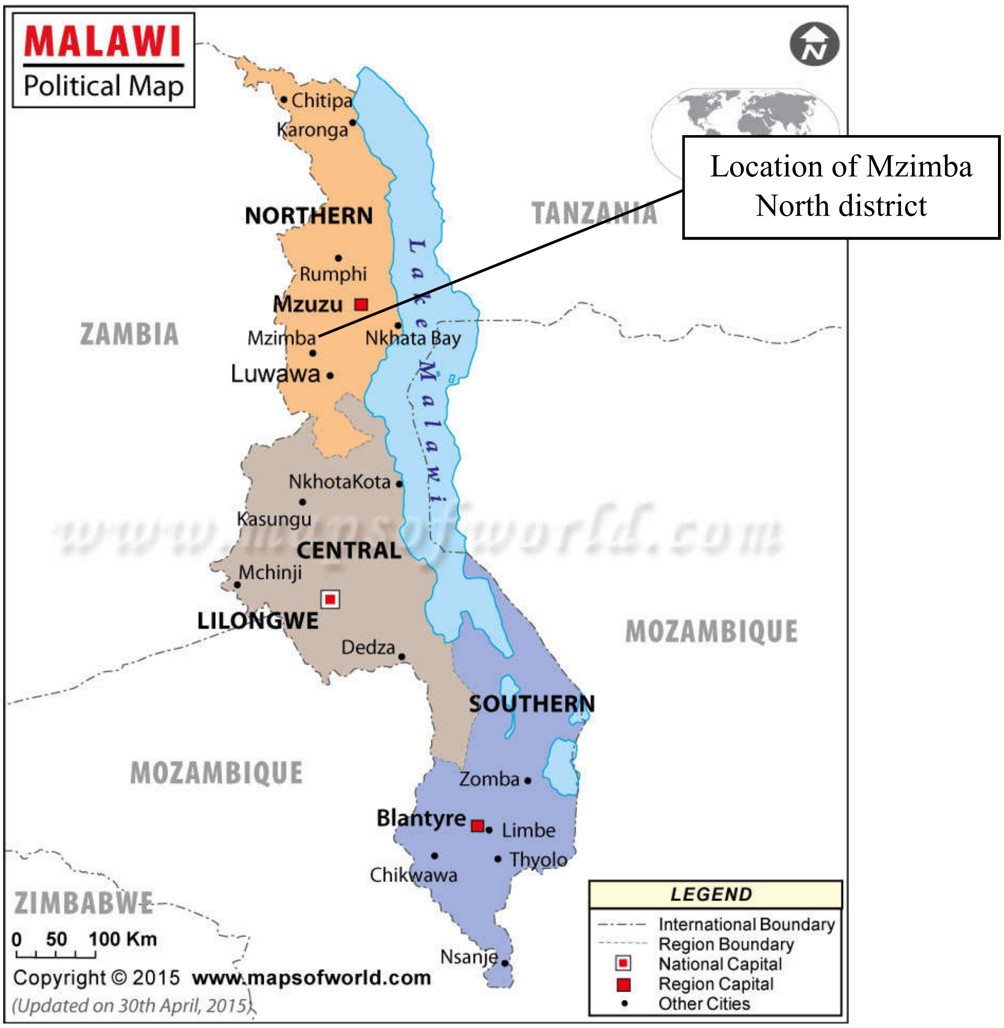

Figure 3.4.1: Map of Malawi, sourced from http://www.mapsofworld.com/malawi/malawi-politicalmap.html

Malawi is divided into the northern, central and southern regions (*Figure 3.4.1*). The regions are further sub-divided into a total of 28 districts: six in the northern region, nine in the central region and 13 in the southern region (Government of Malawi & ICF Macro, 2011).

There are eight ADDs across the country (Masangano & Mthinda, 2012). Mzuzu and Karonga ADDs are in the northern region; Lilongwe, Kasungu and Salima ADDs in the central region; Blantyre, Shire Valley and Machinga ADDs in the southern region. The six districts in the northern region are Mzimba (north and south), Nkhata-Bay, Rumphi, Likoma Island under Mzuzu ADD, and Karonga and Chitipa districts under Karonga ADD.

Mzuzu ADD, Mzimba North district specifically, was chosen because it is one of the districts that grows tobacco. In addition, it is the work station of the researcher, hence, it was easier to conduct and manage the study logistically and financially.

A district is demarcated into geographical and agricultural areas called extension planning areas (EPAs). The EPA is defined as the lowest planning level where a field extension worker is required to work with farmers in their areas of operation, mostly in groups, such as farmer clubs (Masangano & Mthinda, 2012).

Consultation was done with the tobacco officers at the Mzuzu ADD, Mzimba North district and the extension workers at the EPA level. The result was a purposive selection of the three EPAs (Bwengu, Engucwini and Njuyu) chosen due to their high tobacco farming activities.

The study took place in the rainy season. A typical rainy season starts from mid-October to April (FEWS NET, 2013). Specifically, the study was conducted from January to March 2016. This period is characterised as a hunger season since most of the food supplies are expected to be depleted, and it is usually the time that most households are anticipating the next harvest. This is also a period of concern because most households are assumed to be recovering from the December and New Year festive seasons.

3.4.2 Sample size and sampling method

3.4.2.1 Sample size

The researcher managed to sample 110 households through proportional random sampling technique (*refer section 3.4.2.2 on sampling technique*) and collected data from 110 women of reproductive age and their 139 under-five children. Computation of the study sample was done using nQuery version 7 computer package. The calculation was based on the expected prevalence of malnutrition among under-five children in Malawi which stood at 47% (Government of Malawi & ICF Macro, 2011). The sample size was estimated at 95% confidence interval to the accuracy of 10%, yielding a sample size of at least 97 women of reproductive age and under-five children pairs. Therefore, the final sample size of 110 households was increased by 13%. By the norm of including ten to 15 participants per regressor included in the multivariable regression analysis (VanVoorhis & Morgan, 2007), the sample size was believed to be adequate as less than ten regressors were expected to enter the multivariable analysis.

3.4.2.2 Sampling technique

A proportional random sampling technique was used. A sampling frame of all tobacco tenant women of reproductive age and their under-five children, meeting the inclusion and exclusion criteria (*refer to section 3.4.3 on study participant selection*), was retrieved per household per EPA. The researcher consulted the tobacco officers at the Mzuzu ADD and Mzimba North district, and worked hand in hand with the Agriculture Extension Development Coordinators (AEDCs), the Agriculture Extension Development Officers (AEDOs) and the Health Surveillance Officers (HSAs) at the EPA level to retrieve the sampling frame.

The researcher assumed the sampling frame list from the EPA office would be a realistic reflection of all the tobacco farmers and their tenants in the EPAs. This was so because for both auction and contract tobacco marketing systems smallholder farmers have to form clubs which are registered with the Tobacco Control Commission through agriculture offices (EPAs) (Poulton, Kydd & Kabame, 2007).

The EPAs represent different geographic and agricultural areas, hence, the proportional systematic random sampling technique was perceived to be appropriate because it helped to capture the variations in the EPAs. Each EPA contributed the number of tobacco tenants' households that was proportional to the total number of the tobacco tenant households in that EPA.

Therefore, the study participants were chosen randomly through a systematic random sampling technique. The selected households were then visited at agreed dates in liaison with agriculture and health field staffs in the respective EPAs (*Figure 3.4.2*).

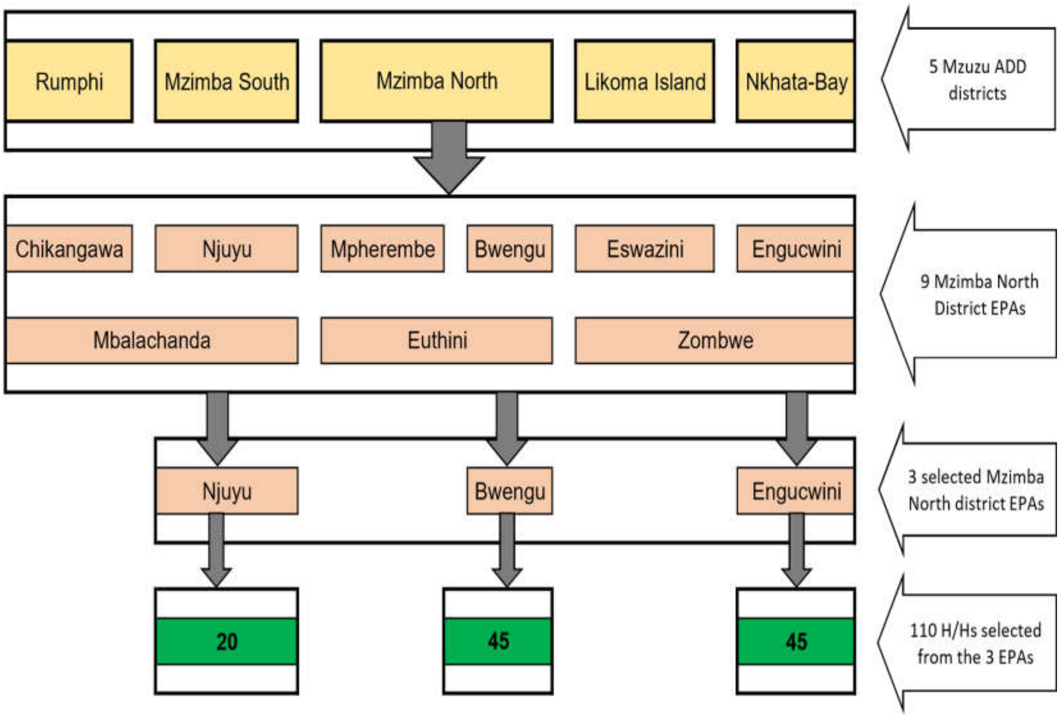

Figure 3.4.2: An overview of study area and study participants' selection

3.4.3 Study participants selection

One woman of reproductive age per household was interviewed. Given the conceptualised definition of a household (*see section 3.3.2 on conceptual definitions),* the researcher argued that there would be no valuable differences in the answers if more than one woman were interviewed per household. However, data for more than one under-five child were solicited from one household as long as they fell into different age groups (i.e. zero to 23 months and 23 to 49 months).

3.4.3.1 Inclusion criteria

The study participants were included in the study if:

- they were women of reproductive age between 15 to 49 years old;
- they had under-five child/ren between zero to 59 months old;
- they were responsible for cooking, and or preparing food for their households;
- they were involved in tobacco farming on smallholder farms as tenants for at least two consecutive seasons;
- they were residing in the selected study areas at the time of data collection; and
- they gave consent (≥ 18 years) and assent (15 to 18 years) for themselves and their under-five children to participate in the study.

3.4.3.2 Exclusion criteria

Willing participants were excluded from the study if:

- they had any health related conditions known to interfere with the data collection process and the results of the study, such as pregnancy status.

3.5 DATA COLLECTION

The data, including demographic and socio-economic (*refer to Appendices 2 to 5, 7 and 8*), HFIAS (*refer to Appendix 10*), HHS (*refer to Appendix 10*), MAHFP (*refer to Appendix 9*), IDDS (*refer to Appendices 11 and 12*) and anthropometric data (*refer to Appendix 6*), were captured through face-to-face interviews by administering the predefined structured questionnaires to the eligible women of reproductive age.

Prior to the data collection, the intent of the visit and the aim of the research study were clearly explained to the women of reproductive age. Furthermore, informed consent and assent were requested and obtained from the women of reproductive age, and or proxy (*refer to section 3.7 on ethical considerations*).

The questionnaires were translated from English to the local Chewa and Tumbuka languages. The translation process followed the six major steps as suggested by Ballard *et al.* (2011). The first step was initial translation, and was done by a separate translator who possessed interview skills and was knowledgeable of both the Chewa and Tumbuka languages. The second step was identification of terms and phrases to be adapted and clarified. The third step was interaction and checking of the translated questionnaires with communities and key informants, such as field staff and leaders. The emphasis was to cross-check the understanding of the identified terms and phrases, as well as to verify the local food names in the case of the IDDS questionnaire. The fourth step was refining of the questionnaires in which feedback from the key informant and community meetings was incorporated in the questionnaires. The fifth step was back translation by an independent translator, who was knowledgeable of the English language and had no prior knowledge of the questionnaires. Lastly, the questionnaires were then pretested in the field with the women of reproductive age. (*Refer to section 3.5.3 for pilot study details*.)

The data collection was done by the researcher and a team of field investigators comprising of the food and nutrition officers at the ADD and district levels, as well as with the assistance from health and agriculture field staff. The team of field investigators was trained on all the data collection tools. The field investigators were also involved in the piloting of the questionnaires. (*Refer to section 3.5.3 for pilot study details*.)

Nutrition status assessments for the women of reproductive age and under-five children were achieved by taking anthropometric measurements (weight and height) during the face-to-face interviews. Electronic scales (Safeway digital scales with a maximum weight of 150kg, made in Cambodia) were used to measure weight, while adjustable wooden height boards were used to measure height. The weight was recorded to the nearest 0.1kg, while height was recorded to the nearest 0.1cm to ensure accuracy (Cogill, 2003).

The children were weighed together with the mothers. The weight of the under-five child was calculated by subtracting the weight of the mother alone from the total weight of mother carrying the under-five child (Cameron, 2013). Length measurement was obtained for the under-five children younger than 24 months with the child lying down on the length board (recumbent length), and standing height was measured for older under-five children (≥ 24 months) (Geissler & Powers, 2011).

Standard protocols were followed during collection of anthropometric data, including taking height and weight measurements twice per subject to find the mean measure, ensuring participants are in minimal clothing and ensuring study participants are familiar with the anthropometric equipment (Cogill, 2003; WHO, 2008; Cameron, 2013). (*Refer to section 3.5.2 on validity and reliability of the measurement tools for details on standard protocols*.)

Age of the under-five children was also collected as it is useful during taking of anthropometric measurements and later during analysis and interpretation of the data. The usefulness of age in anthropometry requires it to be as precise as possible. Documentary evidence of the birth date (e.g. birth and or baptismal certificate) was used to cross-examine the date of birth even if the mother indicated to know it (Cogill, 2003).

3.5.1 Data quality and management

To ensure quality and accurate data, the following data management procedures and techniques were followed:

- Data codes were pre-inserted on the questionnaires. This allowed checking and improvement of legibility of the codes during the pretesting of questionnaires in pilot study.
- Field investigators ensured completeness, accuracy and legibility of data at the end of each data collection session.
- The researcher cross-checked all questionnaires for missing data, implausible codes and logical sequence every day.
- Data capturing was done by separate data entry clerks who did not take part in the data collection exercise. Microsoft Excel version 2013 and Stata version 14 were used for data capturing and analysis.
- The researcher supervised and cross-checked the data entry process to ensure quality.

- After data capturing, the data were kept secret and guarded by using a computer password. Hard copy questionnaires were locked and kept safely for any possible future referencing.
- Data cleaning was done manually by the researcher, whereby all unclear or incorrect data records were discarded from the analysis. Further data cleaning was done with the assistance of the statistician at the University of Pretoria, including identification of unreasonable or impossible values in the preliminary descriptive analysis.

3.5.2 Validity and reliability of the measurement tools

The food security (accessibility) assessment tools that were used were valid and relatively reliable for the achievement of the study objectives (*Table 3.5.1*).

Table 3.5.1: Description of validity and reliability of food security tools

Tool	Description
HFIAS	Evidence for validity and construct equivalence is very strong for different households with varying levels of food insecurity. Validation and reliability studies were done in Costa Rica and Mozambique. The disadvantage is that it depends on cultural and social contexts hence not valid for cross-cultural comparisons (Leroy, Ruel, Frongillo, Harris & Ballard, 2015)
HHS	Evidence for validity and construct equivalence is very strong. Validation studies for cross-cultural comparability were conducted in Malawi, Mozambique, South Africa, West Bank, Kenya, and Zimbabwe (Deitchler, Ballard, Swindale & Coates, 2010; Ballard *et al.*, 2011; Leroy *et al.*, 2015)
MAHFP	No evidence of validity but extensively used in African and Asian countries and it produces consistent results (Leah, Pradel, Cole, Prain, Creed-Kanashiro & Carrasco, 2013; Kabir *et al.*, 2014; Hendriks, van der Merwe, Ngidi, Manyamba, Mbele, McIntyre, Mkandawire, Molefe, Mphephu & Ngwane, 2016)
IDDS	Validated as proxy for micronutrient adequacy in women in Burkina Faso, Mali, Mozambique, Bangladesh, and Philippines Arimond, Wiesmann, Becquey, Carriquiry, Daniels, Deitchler, Fanou-Fogny, Joseph, Kennedy and Martin-Prevel (2010). The IDDS is also reported to be associated with child nutrition status in African, South and South East Asian, and Caribbean regions (Arimond & Ruel, 2004). Although valid and accurate, the reliability of the IDDS is questionable (Leroy *et al.*, 2015)

For validity and reliability of anthropometry measurements, the following steps according to standard protocol (Cogill, 2003; WHO, 2008; Cameron, 2013) were taken:

- Ensured that the study participants were in the minimum of clothing or at least in clothing that in no way interfered with the identification of surface landmarks or the application of measuring instruments.
- Ensured that the study participants were familiar with the anthropometric instrumentation to get their full cooperation.

- Organised the place of data collection so that there was minimum movement and an ambient temperature to make study participants feel comfortable.
- Applied the instruments, for example the headpiece of the height board gently but firmly not to harm study participants, while getting accurate readings.
- Ensured that anthropometric measurements were done by two individuals per subject. This was important to get accurate readings.
- The height measurements were taken twice per subject to find the mean measure. The differences between the two readings ought not to exceed 0.5kg for weight and 1.0cm for height (Cogill, 2003). When the difference exceeded this allowable difference, a third measurement was taken until two measurements, which were within the limits, were found.
- Avoided measuring too many subjects per session to reduce fatigue. Fatigue is known to reduce concentration, resulting in taking inaccurate measurements (Cameron, 2013).
- Ensured that the data collection team had respect for all the subjects at all times by good manners and clothing. This was highly emphasised during the training and piloting sessions.
- Supervision to check for completeness and logical flow of data was done throughout data collection exercise, and entry to ensure that errors were put to a minimum. Identified problems encountered during the course of data collection and entry were shared and resolved with the entire data collection team.
- Birthdate data were cross-examined with tangible evidence, such as birth certificates. Where the mother could not recall her own or her child's birthday, major events, such as famine or election years, were used to estimate the ages.

Other steps taken to ensure quality data were as follows:

- All the questionnaires were translated from English to the local Chewa and Tumbuka languages using the recommended procedures (*refer to section 3.5 for the process of translation*).

- An experienced data collection team was used. Even so, an ample training course and piloting were done to familiarise the data collection team with the needs of the research study.

3.5.3 Pilot study

Prior to the actual data collection, a simulated data collection process was done with the women of reproductive age. A total of ten questionnaires were piloted in Zombwe EPA within Mzuzu ADD. The pilot study participants did not form part of the main study. The rationale behind piloting was to pre-test the questionnaires to examine terms, phrases and words as understood by both study participants and field investigators, to examine completion time, and to allow field investigators' have hands-on practice.

The field investigators seemed to appreciate the need for an assistant when taking anthropometric measurements. In addition, while there were no major challenges with the other questionnaires, it was discovered that the different HFIAS questions were still asked and interpreted similarly. Efforts were made to seek clarity from key informants, field investigators and study participants in a participatory manner. The changes, such as the differences in meaning of phrases, i.e. "Eating a smaller meal than felt", "Eating fewer meals in a day" and "Eating a limited variety of foods", were successfully incorporated in the final questionnaires.

3.6 DELIMITATIONS, ASSUMPTIONS AND LIMITATIONS

3.6.1 Delimitations

The first delimitation was that the study findings would only be generalised to the population from which the sample was drawn. The sample was drawn from the households of tobacco tenant women of reproductive age and under-five children living on smallholder farms in Mzuzu ADD in the northern region of Malawi. The choice of this study population was based on evidence that they are one of the most vulnerable groups in Malawi, in as far as food insecurity and malnutrition are concerned (Torres, 2000; ILO, 2011).

The second delimitation was that only the food security and nutrition status measurement tools used in the study were considered. The tools included the HFIAS developed by Coates *et al.* (2007), the HHS developed by Ballard *et al.* (2011), the IDDS developed by Kennedy *et al.* (2011), the MAHFP developed by Bilinsky and Swindale (2007) and anthropometry. The tools were selected because of their complementary ability to provide wide ranges of the occurrence of food insecurity, the simplicity and inexpensiveness, while also considering their respective potential validity and reliability in capturing the condition of food insecurity and malnutrition.

The third delimitation was that only two food security pillars, namely accessibility and utilisation were considered. This was so because usually the methods used to measure food availability (for example, Food Balance Sheets) and stability (for example, Household Economy Approach and Integrated Phase Classification) are complex and costly (Ballard *et al.*, 2013). Therefore, the food accessibility and utilisation pillars were chosen due to their relative easiness and convenience to measure food security at both household and individual levels.

The last delimitation was that only the demographic and socio-economic factors outlined in the questionnaires were considered for analysis (*refer to Appendices 2 to 5, 7 and 8*). These factors were chosen with evidence from the review of the literature and their bearing on women empowerment as suggested by Alkire, Meinzen-Dick, Peterman, Quisumbing, Seymour and Vaz (2013).

3.6.2 Assumptions

This sub-section presents a summary of key assumptions made during the study.

The first assumption was that the study population followed a normally distributed curve and that the sample that was drawn from it was statistically representative. Related assumptions that would allow use of statistical tests and models, such as the multivariate regression analysis included that:

- the relationship between independent and dependent variables was linear in the study population as well as in the sample. Meaning to say that as the independent variable increases, the dependent variable also increases, or as the independent variable increases, the dependent variable decreases, and vice versa; and

- none of the independent variables was going to be constant and that there are no exact relationships amongst the independent variables. Meaning to say that there would be high variability in the sample.

To make sure that these assumptions were not violated, the sample was obtained by using the proportional systematic random sampling technique in which each EPA contributed a proportional number to the sample size. A probability sample size formula using nQuery computer package was used to justify the use of optimal sample size. (*Refer to section 3.4.2 on sample size and sampling method.*)

The second assumption was that the sampling frame (data for tobacco farmers and their tenants) accessed through the EPAs would be a realistic reflection of all tobacco tenant households living in the selected EPAs. However, this assumption posed difficulty as it was discovered that record keeping in the EPA offices was sub-standard. Through intense consultation with the tobacco officers at the Mzuzu ADD and Mzimba North district, and working hand in hand with the AEDCs, AEDOs and HSAs at the EPA level, the sampling frame was retrieved but caution needs to be noted.

The third assumption was that the experience-based scales, such as the HFIAS and the HHS, assumed that the qualitative experiences resulting from household food deprivation causes predictable reactions and behaviours that can be captured through a survey and summarised quantitatively in a scale. The HHS was actually validated for cross-cultural use using data from Zimbabwe, South Africa, Malawi, Kenya and West Bank (Deitchler *et al.*, 2010). Although with flaws, the HFIAS is also recommended for the purpose of providing a wide range of domains of food insecurity (Ballard *et al.*, 2011). Furthermore, a review of studies indicated that the HFIAS correlated positively with food security parameters, such as household wealth, household assets, dietary diversity, maternal education, per capita income and lower odds of BMI and wasting (Jones *et al.*, 2013).

The fourth assumption was that using the cross-sectional study design through face-to-face interviews, the study participants would give honest answers that reflected the condition of food insecurity at household and individual levels. To consolidate this assumption, the study maximised comfortability of the study participants. Therefore, the researcher strived to tactfully gain confidence of the respondents by letting them know the ways in which anonymity and confidentiality of data would be preserved throughout the study. In addition, before the study commenced, consent and assent on the willingness to participate were obtained from the study participants. The informed consent/assent form contained information, such as the expected benefits and any possible risks of participating in the study, how the findings of the study would be shared with them and that they were not forced to participate. These steps ensured that study participants decided to participate in the study at own will, thereby enhancing the interviewer-interviewee relationship which created an enabling environment for interviewee's honest expressions on the condition of food insecurity.

The fifth assumption was that the methodological approaches adopted in this study would adequately help to address and explore possible answers to the proposed objectives. To this effect, efforts were made to contextualise the study, i.e. technical translation of questionnaires (*refer to section 3.5 for the process of questionnaire translation*). Furthermore, adherence to standard procedures was followed to ensure necessary validity and reliability potentials throughout the study processes.

3.6.3 Limitations

The first limitation of the cross-sectional descriptive correlational study design used was that causal relationships between independent and dependent variables could not be established. Therefore, the findings of this study would only describe mere linear relationships between the variables.

The second limitation was that the seasonality and dietary patterns of food across the year could not be captured. This is due to the fact that the study was only conducted in one season (January to March 2016) that is characterised by hunger. Although the MAHFP tool captured seasonality of food to some extent (World Bank, 2013), this did not necessarily give the types of foods available and the dietary patterns of food consumption during the course of the year.

The MAHFP was also dependent on the ability of the household member to recall their food access during the previous 12 months (Coates *et al.*, 2007).

3.7 ETHICAL CONSIDERATION

- **Ethical approval from relevant academic and institutional committees**

Before the commencement of the study, ethical approval was obtained from the relevant ethics committees. At the University of Pretoria, the Ethics Committee for the Faculty of Natural and Agricultural Sciences (NAS) approved the study (Number EC151215-028). (*Refer to Appendix 13 for letter of acceptance from the University of Pretoria*.)

In Malawi, the Ministry of Agriculture, Irrigation and Water Development (MoAIWD), specifically the Mzuzu ADD provided the study approval.

- **Informed consent from women of reproductive age and under-five children**

The sampled households with women of reproductive age and their under-five children were visited. The purpose and importance of the study, as well as the confidentially of the information which would be collected, were clearly explained. Voluntary and written consent (≥18 years old) and assent (between 15 to 18 years old) to conduct the study were requested from the women of reproductive age (*refer to Appendix 1 for consent form*). The women of reproductive age were also responsible for voluntary and written consent for their under-five children.

For the women of reproductive age between 15 to 18 years of age, consent was obtained from their mothers and or proxy, such as the husband. The consent form was translated into the local Chewa and Tumbuka languages. The consent form was read out to women of reproductive age who did not know how to read. In instances where consent was not granted, the field investigators did not force the women of reproductive age to participate in the study. The women of reproductive age were also told that they were free to withdraw from the study whenever they felt like doing so, and that their withdrawal would not have negative effects.

The study participants were assured that there was not any potential harm in participating in the study, and that the researcher had no conflict of interest. They were also assured that the findings of the study would be made available to them through the EPA offices.

- **Other ethical issues considered**

The collected data were treated confidentially. After data entry, the questionnaires were locked in a protected office at the Department of Human Nutrition (University of Pretoria). During data analysis, no names but identity codes were used and data were protected by a secret computer password.

PART III: EMPIRICAL INVESTIGATION: DATA ANALYSIS, RESULTS AND DISCUSSIONS

CHAPTER 4

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

4.1 INTRODUCTION

This chapter focuses on providing univariate analysis of the study participants' demographic and socio-economic characteristics. The chapter is also presented in such a way that it accommodates the rationale of why these demographic and socio-economic characteristics were included in the study.

The chapter constitutes the following sections: introduction, objective, data analysis, results, discussion, strength and limitations, conclusion and recommendations.

4.2 OBJECTIVE

To assess and describe the demographic and socio-economic characteristics in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms in Mzimba district in Malawi.

4.3 DATA ANALYSIS

Data from the demographic and socio-economic questionnaire were entered into Microsoft Excel version 2013 for analysis. Data quality and management were ensured at all levels from the study conception to analysis. (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.)*

The descriptive analysis included frequencies and relative frequency distributions for categorical data, e.g. literacy level and marital status. Measures of central tendencies, measures of dispersion and relative frequency distributions for numerical data, e.g. age, household size and income are reported.

4.4 RESULTS

4.4.1 Demographic characteristics of study participants

4.4.1.1 Women of reproductive age

A total of 110 women were sampled and interviewed. The mean age of these women was 27.3 ± 6 years with a median of 25.5 years and a mode of 20 years. Most of the women (44%) were between the ages of 21 to 26 years, followed by those (25%) aged between 27 to 32 years. Very few women (1%) were more than 38 years of age (*Figure 4.4.1*).

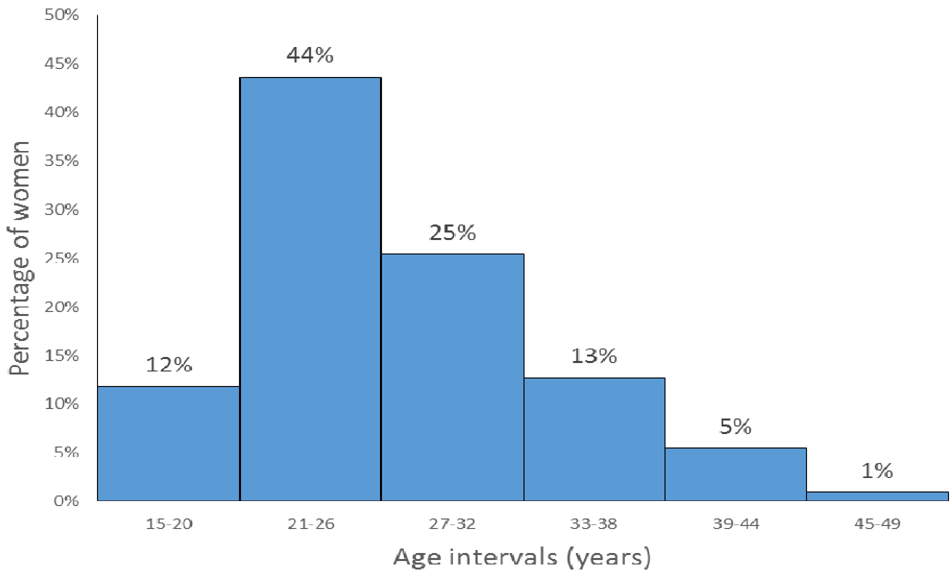

Figure 4.4.1: Relative frequency distribution of age of women (N = 110)

The mean household size was 4.9 ± 1.6 members. Most households (49%) had between five to seven members, followed by those (45%) that had between two to four members. Very few households (5%) had between eight to ten members (*Table 4.4.1*).

Most of the women (95%) were married and living with their spouses on the farms and or villages surrounding the farms. Only 5% were married but not living with their spouses at the time of the interviews. Very few women (1%) were widowed (*Table 4.4.1*).

Most of the women (73%) reported to have attended primary education. Close to one fifth (17%) were illiterate and very few (10%) attended secondary education. None of the women had certificates to depict completion of the level of education they reported to have attended (*Table 4.4.1*).

Table 4.4.1: Frequencies and relative frequencies for some households' characteristics of the study participants (N = 110)

Household size (members)	Frequency (n)	Relative frequency
2-4	50	45%
5-7	54	49%
8-10	6	5%
11+	0	0%
	110	**100%**
Marital status	Frequency (n)	Relative frequency
Married living with spouse	104	95%
Married but spouse away	5	5%
Divorced/separated	0	0%
Widow	1	1%
Never married	0	0%
	110	**100%**
Education level	Frequency (n)	Relative frequency
None/Illiterate	19	17%
Adult education	0	0%
Primary	80	73%
Secondary	11	10%
Tertiary	0	0%
	110	**100%**

4.4.1.2 Under-five children

A total of 139 children were sampled. The mean age of these children was 28.8 ± 15 months with a median of 27 months and a mode of 48 months. Most of the children (52%) were males. More than half of these children (63%) belonged to the age group between 24 to 59 months, while 37% were between zero to 23 (*Table 4.4.2* and *Figure 4.4.2*).

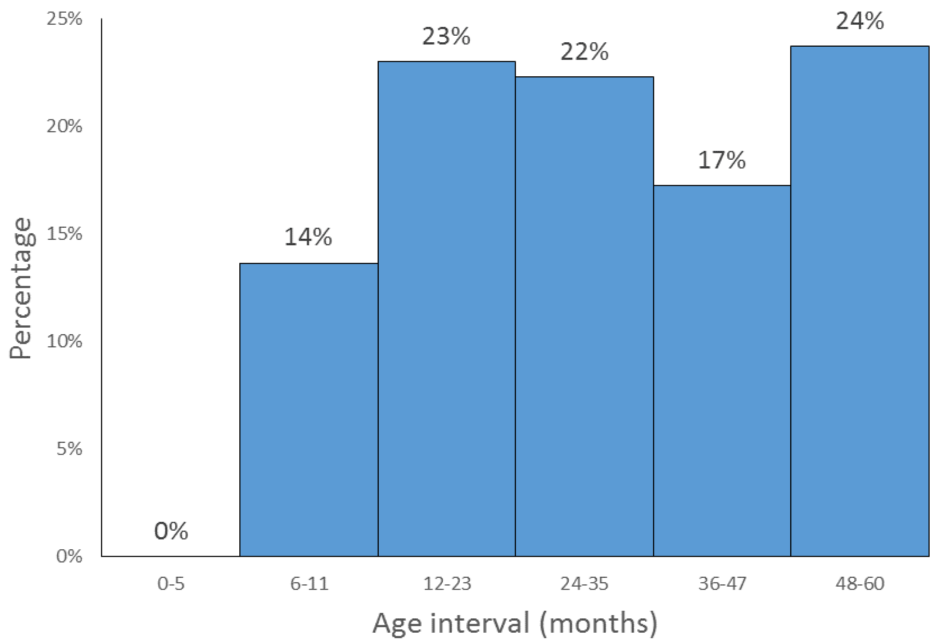

Figure 4.4.2: Relative frequency distribution of age of under-five children (N = 139)

Table 4.4.2: Frequencies and relative frequencies of some households' characteristics pertaining to the under-five children (N = 139)

Sex of under-five children	Frequency (n)	Relative frequency
Female	67	48%
Male	72	52%
	139	**100%**
Visitation to under-five clinics	Frequency (n)	Relative frequency
Yes	138	99%
No	1	1%
Don't know	0	0%
	139	**100%**
How often do you go/visit the under-five clinics	Frequency (n)	Relative frequency
Every six months	133	96%
Whenever I want	4	3%
Not sure	1	1%
	138	**100%**

Almost all of the women (99%) reported to have visited the under-five clinics with their children. The women who indicated to have visited the clinics were asked to recall the frequency of the visits; 96% said every six months, 4% said whenever they wanted, and 1% was unsure (*Table 4.4.2*).

4.4.2 Socio-economic characteristics of study participants

The main occupation for the women (N = 110) was tobacco farming. The mean annual income for their households was USD 209.94 ± 129.69 SD (USD 1.00 = MK 674.00; 2016). However, most of the households (45%) realised between USD 100.00 to 199.00 annually. Only very few (1%) realised up to between USD 600.00 to 699.00 (*Figure 4.4.3*).

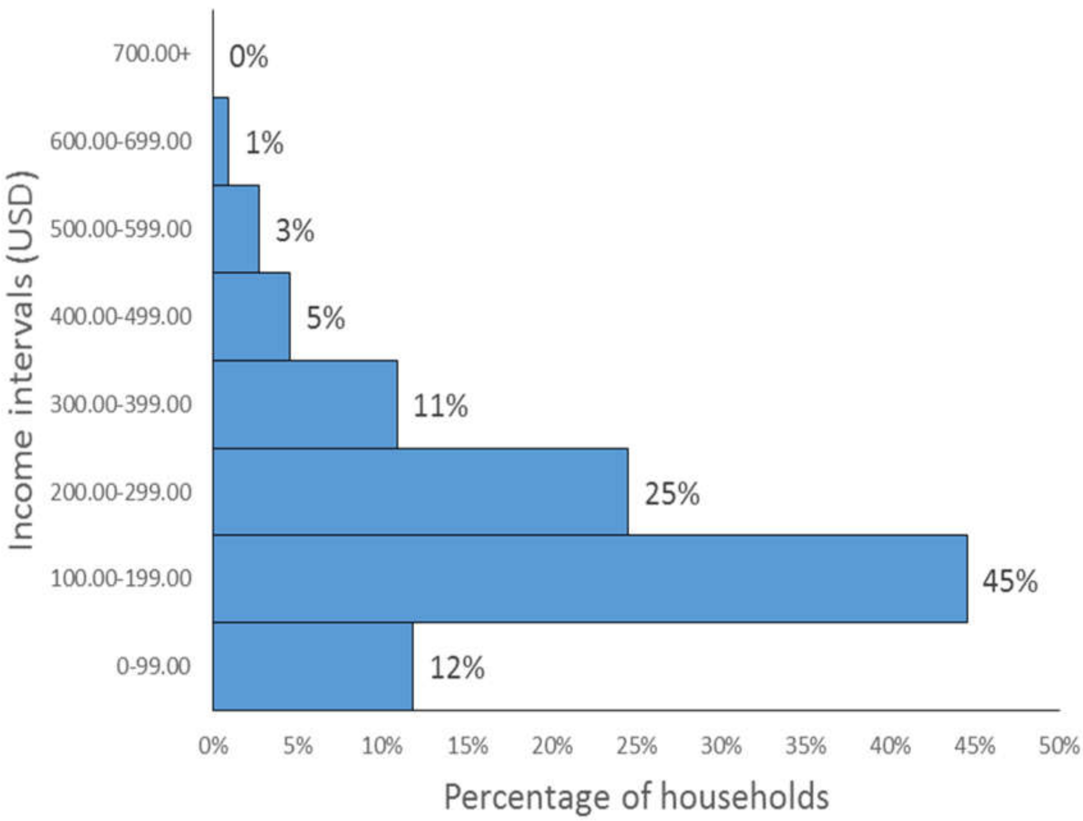

Figure 4.4.3: Relative frequency distribution of annual income (N = 110)

On assets possession, it was found that none of the households possessed assets such as ox-carts, ploughs, sprayers, water pumps, trailers, iron roofed houses, milk churns and motorbikes. Greater than or equal to 50% of the households either owned axes, hoes, grass roofed houses, beddings or combinations of these. Less than 50% of the households possessed assets such as bicycles, cell phones, TVs, radios, sickles, axes, improved charcoal stoves, machetes, shovels, chairs, tables, sofa set, forage choppers, livestock structures or combinations of these. Almost all of the households (92%) were living in grass roofed houses and hardly had a sofa set (1%) (*Figure 4.4.4*).

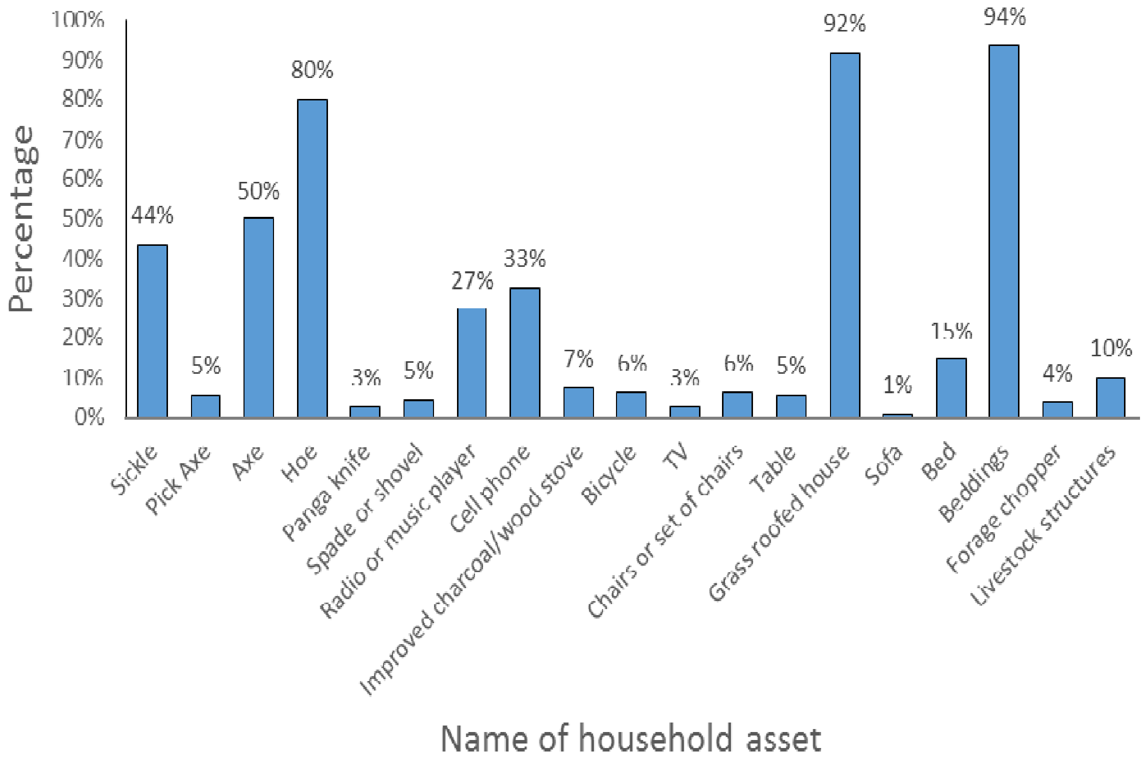

Figure 4.4.4: Relative frequencies of various assets possessed by households of the participants (N = 110)

On values of the assets, it was found that the mean value was USD 55.10 ± 62.80. More than half of the households (68%) had their assets valued at between USD 0.00 to 49.00, followed by those (21%) between USD 50.00 to 99.00 (*Figure 4.4.5*).

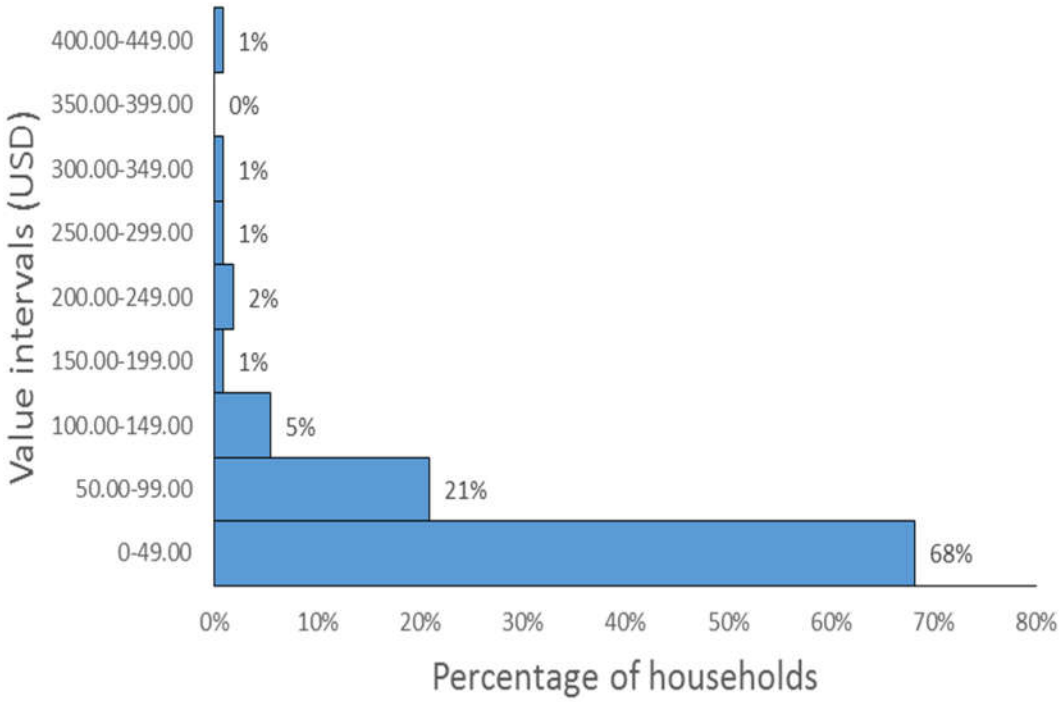

Figure 4.4.5: Relative frequency distribution of household assets values (N = 110)

On loan access, 21% of the women said they had borrowed cash in the previous 12 months. Out of the 21%, about 91% reported to have borrowed the cash from their friends and relatives, 4% from organisations, and 4% from local institutions, i.e. SACCOs (*Table 4.4.3*).

On perception of involvement and contribution towards tobacco labour, half of the women (50%) responded that they were highly involved. Close to half (44%) felt like they were moderately involved. Very few (6%) felt like their involvement was minimal (*Table 4.4.3*).

All of the women (100%) reported that they were not affiliated to any farmer-based organisations (FBOs). However, it was interesting to note that a majority (78%) indicated to have strong intentions to join any local FBOs (*Table 4.4.3*).

More than half of the women (54%) indicated that they had been trained in food security and nutrition matters. Of those who were trained, a majority (95%) had only been trained in dietary diversification and very few (2% and 3%) in food processing and agribusiness respectively. Government departments were responsible for most of the training conducted

(92%), while a few (8%) were conducted by NGOs. Almost half (47%) of the women said that they had received the training in the previous 12 months from the interview date (*Table 4.4.3*).

The participants were also asked to rate themselves on their ability to speak in public regarding community development agendas. Only a few (19%) rated themselves to be very comfortable. About 40% said they did not at all feel comfortable, while 41% said they could speak but with great difficulty (*Table 4.4.3*).

The women were asked to explain how decisions regarding wealth (decisions on selling of assets, tobacco and use of money), food security and nutrition matters were made in their households. Most of them (75%) reported that they were involved in the decision making process regarding wealth. Some (21%) reported that decisions regarding wealth were made by the males only. Likewise, most of the women (72%) said that they were involved in food security and nutrition decisions in the household, while a few (17%) said it was only the males who made the decisions (*Table 4.4.3*).

Table 4.4.3: Frequencies and relative frequencies of some households' socio-economic characteristics of the study participants (N = 110)

Name of variable	Frequency (n)	Relative frequency
Loan access		
No	86	79%
Yes	23	21%
	109	**100%**
Who provided loan		
NGO	1	4.35%
Informal lender	0	0%
Formal lender (Banks)	0	0%
Friends/relatives	21	91.30%
Group lending i.e. SACCOs*	1	4.35%
	23	**100%**
Perception on labour contribution		
Highly involved	55	50%
Moderately involved	48	44%
Less involved	7	6%
None	0	0%
	110	**100%**
Affiliation to FBOs		
No	110	100%
Yes	0	0%
	110	**100%**
Intention to join any FBOs**		
No	24	22%
Yes	86	78%
	110	**100%**
Training in food security and nutrition topics		
No	51	46%
Yes	59	54%
	110	**100%**

*SACCO is the Malawi Union of Savings and Credit Cooperatives **FBO is the Farmer Based Organisations

Continued

Table 4.4.3 continued: Frequencies and relative frequencies of some households' socio-economic characteristics of the study participants (N = 110)

Name of variable	Frequency (n)	Relative frequency
What were the topics		
Dietary diversification, sanitation& hygiene	56	95%
Storage & post-harvest losses	0	0%
Food processing	1	2%
Agribusiness training	2	3%
Financial management	0	0%
	59	**100%**
Who provided training		
Govt department	54	92%
NGO	5	8%
	59	**100%**
When did you receive training conducted		
This year	28	47%
Last year	14	24%
Two years ago	10	17%
More than three years ago	7	12%
	59	**100%**
Public speaking/representation		
No, not at all comfortable	44	40%
Yes, but with a little difficulty	45	41%
Yes, very comfortable	21	19%
	110	**100%**
Decision making (wealth)		
Male alone	23	21%
Female alone	4	4%
Male and female jointly	83	75%
	110	**100%**
Decision making (food and nutrition)		
Male alone	19	17%
Female alone	10	9%
Male and female jointly	79	72%
Someone else in the household	0	0%
No say since food is given by tenant owner	2	2%
	110	**100%**

4.5 DISCUSSION

4.5.1 Demographic factors

Eight out of every ten women of reproductive age (81%) sampled were below the age of 32 years. The mean age was 27.3 ± 6 years with a median of 25.5 years and a mode of 20 years. It can be suggested that the sampled population were largely composed of young adults. This trend is similar to the nationally representative data from the 2015/2016 Malawi DHS which reported that six in every ten people were below the age of 30 years. In fact the report indicated that basically Malawi is a young age-structured population (Government of Malawi & ICF Macro, 2016). On whether the age of women is associated with household food access and nutrition status varies a lot across myriad literature which the author came across. In some studies age of the respondent was found to have no bearing on, for example, household food access (Ben-Davies, Kinlaw, Estrada del Campo, Bentley & Siega-Riz, 2014), while in other studies age was found to correlate well with either food access or nutrition status (Hackett, Melgar-Quiñonez, Taylor & Uribe, 2010). In this study age was considered a demographic factor to be investigated for its influence on food access and nutrition status (*refer to chapters 5 to 9*). This is also inherent with the understanding that regardless of differences in the influence of age which may somehow be blamed on differences in study methodologies and study contexts, age is a well-known confounding factor capable of distorting the relationships between independent and dependent variables in many studies, and needs to be considered anyway (Bruemmer, Harris, Gleason, Boushey, Sheean, Archer & Van Horn, 2009).

The mean household size was about five members. This is a rather realistic reflection of Malawian household sizes as observed in various other demographic surveys (Sosola, Ajayi, Sileshi, Akinnifesi, Beedy & Kwavale, 2010; USAID, 2013; Government of Malawi & ICF Macro, 2016). Almost one in every two households (49%) in the study had between five to seven members. This could be regarded as a higher number of members per household considering that these households were in the rural areas and most of their economic and wealth statuses were extremely low (*refer to Figures 4.4.3 to 4.4.5 in section 4.4.2*). Also, eight in every ten households were composed of young adults who could somehow be overwhelmed by managing these large households, while being highly involved in tobacco labour. It should be noted that half of the women said they were highly involved in tobacco labour. High involvement in labour activities could lead to the women having limited time to care for their families and consequential disempowerment (Alkire *et al.*, 2013). Various other studies in different contexts, for example in Columbia, USA and Iran reported that food insecurity (accessibility) could be linked to the increased number of household members (Zerafati_Shoae, Omidvar, Ghazi-Tabatabaie, Houshiar_Rad, Fallah & Mehrabi, 2007; Weigel, Armijos, Hall, Ramirez & Orozco, 2007; Hackett *et al.*, 2010). In this study the influence of household size on food accessibility and nutrition status was investigated. (*Refer to chapters 5 to 9*.)

Almost all of the women (95%) who were interviewed were married and living with their spouses on the farms and or the villages surrounding the farms. Although the results of this study are similar to the 2015-2016 Malawi DHS report that also indicated that more women (62%) were married (Government of Malawi & ICF Macro, 2016), the percentage difference is relatively large. This difference could be justified by examining the nature of tenant work that these particular women were involved in. Mostly, preference to recruit a tenant on the farms is given to married men who will bring their wives and children to the farms so that farm owners could benefit from the additional costless labour provided by these other household members (ILO, 2011). Hence the possibility of a higher proportion of married women (95%) who lived with their spouses. Females' marital status has been linked to food insecurity (inaccessibility) and malnutrition status in a previous study (Hackett *et al.*, 2010). However, no linkages between marital status and food security (accessibility) and nutrition status have also been reported in a previous study (Ben-Davies *et al.*, 2014). In this study marital status of the women was investigated to assess its contextual influence on food accessibility and nutrition status. (*Refer to chapters 5 to 9*.)

It may be fair to say that generally the tenant women were illiterate. Close to one-fifth (17%) had never gone to school, a figure which is higher than the national figures (12%). Although a higher proportion of the tenants (73%) had attended primary education as compared to the national figures (62%), it looks like not many (10%) did attend secondary education as compared to the national figures (23%) (Government of Malawi & ICF Macro, 2016). Furthermore, when a follow-up question was asked to the women to indicate whether they were in possession of a certificate as evidence of completion of the level of education which they had attained, none said they had a certificate. This suggests that although they did attend some education, none of them probably completed the level of education they claimed to attend. The level of education of individuals have for long been understood to have a bearing on food security (accessibility) and nutrition status. Studies conducted in Bangladesh in 1994 and in Samoa and Bolivia in 2002 found that mothers' nutrition status, i.e. BMI were significantly correlated with the years of schooling (Baqui, Arifeen, Amin & Black, 1994; Bindon & Vitzthum, 2002). Another study which was done in 42 countries using DHS data found that, based on the mean, the upper level of education decreased child health suffering (Boyle, Racine, Georgiades, Snelling, Hong, Omariba, Hurley & Rao-Melacini, 2006). Another study that was conducted in Malawi, Tanzania and Zimbabwe in 2015, using DHS data, suggested that higher levels of maternal education reduced the odds of child stunting, underweight and wasting, especially in Malawi (Makoka & Masibo, 2015). The contextual influence of women's education on food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9.*)

For under-five children living in these households, the mean age was 28.8 ± 15 months with the median age of 27 months and the mode of 48 months. Most of the children (52%) were males. Most (63%) belonged to the age group between 24 to 59 months, while 37% belonged to the age group between zero to 23 months. The influence of the child's age and sex on food accessibility and nutrition status has been reported before. In one study, the child's age and sex were significant predictors of nutrition status where, for example, males had a worse nutrition status than females, and the 20 to 23 months age group was found to be the most vulnerable to malnutrition (Adeladza, 2009). Age and sex are also listed as common confounding factors that need to be considered in studies (Langseth, 1996; Bruemmer *et al.*, 2009). In this study age and sex of the children were investigated to find their contextual influence on food accessibility and nutrition status. (*Refer to chapters 5 to 9.*)

Through experience and observation, in terms of the service delivery structure in Malawi, most of health and nutrition related messages targeting the under-five children are delivered at the under-five clinics. For this reason, the women were asked if they visited the under-five clinics with their children and the frequency of the visits. The aim of this question was to enquire whether those who visited the under-five clinics had better food security and or nutrition status. Almost all (99%) of the women said they visited the under-five clinics with their children. However, there were still some (4%) who could not say how often they visited the under-five clinics. The contextual influence of visitation and knowledge on frequency of visitation to the under-five clinics on food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

4.5.2 Economic factors

When the women were asked to estimate their annual income, it was found that the households were earning a mean of USD 209.94 ± 129.69. Close to half of the households (45%) were getting between USD 100.00 to 199.00 annually. When the annual incomes were converted to daily wages, it was observed that almost nine in every ten women (87%) could not receive a mandated minimum wage of USD 0.97 per day or MK 687.70 per day (WageIndicator.org, 2016) taking the exchange rate at USD 1 = MK 674.00. So it could be fair to say that the annual incomes were very small as far as the minimum wage per day in Malawi is concerned.

The annual incomes were also converted to reflect the proportion of women living below the poverty line. It was observed that most households (92%) were earning less than USD 1.14 per day which is considered to be the national poverty line (USAID, 2013). This situation in the study is concerning because other demographic surveys that were conducted in rural Malawi, for example the Feed the Future Zone of Influence baseline survey, reported a lower proportion of the households (about 55.8%) that were living below the national poverty line of USD 1.14 per day (USAID, 2013). None of the interviewed women were above the current World Bank poverty line threshold of USD 1.90 per day (Ferreira, Chen, Dabalen, Dikhanov, Hamadeh, Jolliffe, Narayan, Prydz, Revenga & Sangraula, 2016). This shows how disadvantaged the women and their children were in the tobacco labour industry and confirms the argument that tenants are among the poor of the poorest in Malawi (Torres, 2000). Household economic status has also been investigated previously to determine its influence on food security (accessibility) and nutrition status. A study that was done in 1994 in Bangladesh demonstrated a positive correlational relationship between the mother's BMI and household economic status (Baqui *et al.*, 1994). In another study in Colombia, food insecure households were significantly characterised by lower incomes (Hackett *et al.*, 2010). The contextual relationship between household's income and food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

The study also investigated the possession of various household assets and their estimated values. It was revealed that none of the households possessed valuable farm production assets such as ox-carts, ploughs, sprayers, water pumps, trailers, iron roofed houses, milk churns and motorbikes. Greater than or equal to 50% of the households possessed either axes, hoes, grass roofed houses, beddings or combinations of these. The houses in which the women and children were living were not in good condition. Almost all of them (92%) were living in temporary grass roofed houses. Less than 50% of the households possessed bicycles, cell phones, TVs, radios, sickles, axes, improved charcoals stove, machete, shovel, chairs, tables, sofa set, forage choppers, livestock structures or combinations of these assets.

The values of the possessed assets were low. The mean value was so small at USD 55.10 ± 62.80. Nine in every ten households (89%) had their assets valued at less than USD 99.00. From this it can be concluded that mostly the possessed assets were not of tangible value. This scenario is actually concerning as some authors argue that the possession of assets could be good for constrained households because in times of food shortages the assets may be sold or exchanged for food as a coping mechanism (Harrigan, 2008; Hendriks, 2015). Using DHS data from 42 countries, household wealth has been demonstrated to have a strong positive association with children's health (Boyle *et al.*, 2006). In another study, lack of ownership of material assets demonstrated a significant association with increased food insecurity (Nagata *et al.*, 2015). The contextual effect of household wealth on food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

The households' economic status in this study was worsened with the women's inability to access loans. Only around one fifth of the women (21%) said they had borrowed cash in the previous 12 months. It was observed that the source of these loans were largely informal lending arrangements, as 91% of those who said they had borrowed cash, did so from their friends and relatives. This may confirm that women's access to input resources, such as a loan is a constraint in as far as women's empowerment for household food security and nutrition status is concerned. The women's inability to access loans could be caused by lack of collateral and financial skills, as well as institutional and cultural biases against women (FAO *et al.*, 2010). The findings in an Ethiopian study on credit programmes suggested that females who had access to credit services had better nutrition status and general well-being as opposed to control groups (Doocy, Teferra, Norell & Burnham, 2005). Another study in Ghana demonstrated that women's empowerment in credit decisions was positively and significantly correlated with women's dietary diversity (Malapit & Quisumbing, 2015). The contextual influence of access to loans on food accessibility and nutrition status in this study was investigated. (*Refer to chapters 5 to 9.*)

4.5.3 Social factors

On women's perception of tobacco labour involvement, one in every two women (50%) reported that they were highly involved in tobacco labour, while a good proportion (44%) felt that they were moderately involved. Very few (6%) felt that their contribution towards tobacco labour was minimal. These results are not different from other studies that reported that women's involvement in tobacco labour almost equal that of men despite that women also take up other tiresome responsibilities to care for their families (Torres, 2000; ILO, 2011). In fact, Alkire *et al.* (2013) reported that women's time constraint has extended negative effects to the health of the children and other members of the household. The contextual influence on whether the differences in tobacco labour contribution/involvement have a bearing on household food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9.*)

It can be claimed that FBOs in the rural areas may act as powerhouses for empowerment of women in many aspects. Women empowerment in agriculture is essentially instrumental in increasing agricultural productivity, achieving food security and reducing hunger (FAO, 2011). In Bangladesh weak leadership, as well as non-affiliation to local groups, contributed most to women's disempowerment (Alkire *et al.*, 2013). Therefore, it was very concerning to observe that all of the women of reproductive age in this study were not affiliated to any FBO. The majority of them (78%) indicated that they had strong intentions to join any local

FBO. However, the fact that none of the women belonged to any FBO, although a majority showed intentions to join some, still raised concerns. This scenario could be caused by several factors. The first explanation could be migration because most of the tenants are immigrants from other villages and districts (ILO, 2011). They may not consider themselves as residents in the areas where they are working to an extent of taking part in other socio-agricultural activities that deviate from their core tobacco work. The second explanation could be that the tenant women could be facing some sort of stereotyping by local farmers that they are immigrants and may not be accommodated into the local FBOs. The third explanation could be that the women worked in their domestic and farm spheres such that they lacked extra time for other socio-agricultural activities. The contextual influence of FBO affiliation on household food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

The women of reproductive age were asked to recall if they had ever received specific training in food security and nutrition topics. Slightly more than half of the participants (54%) indicated that they had ever received training. Government departments were responsible for most of the training (92%), while very few training (8%) was conducted by the NGOs. This shows the crucial role taken by the government in community services delivery, and also provides a window for other players to supplement the government's efforts. An observation of the type of training that the women received revealed that many (95%) were only trained in dietary diversification, and the rest either in food processing (2%) or agribusiness (3%). This reveals a potential gap in food security knowledge by the women. As already pointed out, mostly health and nutrition training is offered at the under-five clinics and the high attendance rate (99%) to these clinics could explain why most women received dietary diversification training (nutrition) and not training on food security. Nutrition training has been significantly linked to improved feeding practices and children's nutrition status in Uganda (Kabahenda, Mullis, Erhardt, Northrop-Clewes & Nickols, 2011). Nutrition training interventions delivered through local health services enhanced the caregivers' knowledge and practices of complementary feeding and ultimately improved children's growth in China (Zhang, Shi, Chen, Wang & Wang, 2013). Nutrition education given to a low income population in Indiana (USA) improved the food security status (Eicher-Miller, Mason, Abbott, McCabe & Boushey, 2009). The contextual influence of training in food security and nutrition topics on household food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

Public representation by women in developmental agendas in their respective communities is regarded as an instrumental domain in women empowerment. Women who are able to speak and represent themselves freely in public could be regarded as empowered. This was demonstrated in Guatemala that disempowered women were unlikely to hold leadership positions and representation in the community, and were likely to make uninformed decisions about their households' food security and nutrition related matters (Alkire *et al.*, 2013).

In this study the women were asked to rate themselves on their ability to speak in public about community development agendas. About eight in every ten women (81%) said they either did not at all feel comfortable or they could speak in public but with great difficulty. Only very few (19%) felt they were very comfortable to speak in public. By looking at the other demographic and socio-economic factors in this study (e.g. the literacy levels, income levels, wealthy levels and loan access), it strongly suggests that these women were way far from being empowered, and this could explain their failure to represent themselves, as well as their communities on the developmental agendas. The contextual influence of public speaking and representation on household food accessibility and nutrition status was investigated in this study. (*Refer to chapters 5 to 9*.)

Women partaking in the decision making process in households regarding household wealth, food security and nutrition matters hold similar sentiments like public representation. Women who are fully involved in households' decisions are more likely to be better off than their counterparts. A study that was done in Malawi, Zambia and Zimbabwe, using DHS data, demonstrated that women who do not take part in household decisions may be at an accelerated risk of suffering from food insecurity; this was so especially in Malawi (Hindin, 2006). Another study in Zimbabwe also found that women who did not take part in household decisions were significantly more likely to have a lower BMI and chronic energy deficiency (Hindin, 2000).

In the current study the women were asked to describe how decisions regarding household wealth were made in the households. Seven in every ten women (75%) responded that they were involved in the decision making process. However, a fair proportion (21%) said that it was only the males who made decisions. Likewise, seven in every ten women (72%) said that they were involved in food security and nutrition decisions in the household, while a few (17%) said that those decisions were made by the males only.

These results indicate that the tenant women were at large involved in the decision making process regarding wealth, food security and nutrition matters which is quite different from expectations, because mostly in societies where households are male-dominated, final decisions are not made jointly with females (Hindin, 2006). This could also suggest that these women were empowered. However, by looking at the other demographic and socio-economic factors, this notion could be challenged as unrealistic. The possible explanation for this scenario is that, through observations mostly in rural areas of Malawi, disadvantaged women, such as these tenants are likely not even going to be in a position of realising the dynamics of intra-household decision making. The author even feels that the women could be unaware of the importance and impact of decision making because it is culturally acceptable for males to make most decisions, especially in the patrilineal marriage tradition (Mbweza, Norr & McElmurry, 2008). The contextual influence of women's participation in household decision making on food accessibility and nutrition status was investigated. (*Refer to chapters 5 to 9*.)

4.6 STRENGTH AND LIMITATIONS

4.6.1 Strength

- This could be the only study in Malawi focusing on the tobacco tenant households in which programmatic characteristics, such as those used in the Women Empowerment in Agriculture Index (WEAI) were included to determine their contextual influence on food accessibility and nutrition status.

4.6.2 Limitations

- The study assumed that the interviewed women of reproductive age would be able to provide all necessary household information. However, experience during data collection proved otherwise as the women struggled to give some important household information, such as annual income and value of goods.

- Not all demographic and socio-economic characteristics were included in this study. Other relevant characteristics, such as access to inputs were omitted, because selection of the included characteristics were subjective to the researcher's discretion based on the reviewed literature.

4.7 CONCLUSION

The state of demographic and socio-economic characteristics of the tobacco tenant households was poor. Largely characterised by high illiteracy, lower incomes and wealth, relatively large household sizes, inability to access loans, high involvement in tobacco labour, non-affiliation to farmer groups, non-representation in leadership positions and inability to speak in public. The status of women showed positive results where most women were married, had good attendance of under-five clinics, most received training in food security and nutrition topics, and were involved in household decision making. However, the positive outcomes could not outdo the general poor living conditions of the study participants.

4.8 RECOMMENDATIONS

- To improve the general poor demographic and socio-economic status of the households, holistic and interdisciplinary approaches to address demographic and socio-economic factors need to be employed. Such approaches could include investment in adult education, credit facilities, cooperative development and provision of health services.
- Fully fledged research studies with the packaged five domain factors of women empowerment, including production, resources, income, leadership and time in the tobacco tenancy farming need to done in Malawi to establish the real picture of women empowerment.

CHAPTER 5

HOUSEHOLD FOOD INSECURITRY ACCESS SCALE

5.1 INTRODUCTION

This chapter presents findings on the use of the Household Food Insecurity Access Scale (HFIAS) measurement tool. The tool was administered to women of reproductive age in Mzimba North district in the northern region of Malawi. The tool was administered in January and February 2016 (i.e. the hunger season).

The chapter is presented in the following sections: introduction, objectives, description of the HFIAS tool, data analysis, results, discussion, strength and limitation, conclusion and recommendation.

5.2 OBJECTIVES

5.2.1 To assess and describe the severity of the experience of food insecurity access in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the validated HFIAS developed by Coates *et al.* (2007). (*Refer to Appendix 10 for the HFIAS questionnaire.*)

5.2.2 To determine and report the relationships between the HFIAS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

5.3 DESCRIPTION OF THE HOUSEHOLD FOOD INSECURITRY ACCESS SCALE QUESTIONNAIRE

The HFIAS questionnaire has nine pairs of questions. A pair consists of an "occurrence" question (e.g. "Did you worry that your household would not have enough food?"), and a follow-up question to determine "how-often-the-occurrence" of a concerned condition took place (e.g. "How often did this happen?"). The occurrence questions are sequentially lined to represent an increasing level of severity of food insecurity access (Coates *et al.*, 2007). Of the nine occurrence questions, some probe about the respondents' perceptions of food vulnerability or stress (e.g. "Did you worry that your household would not have enough food?"), and others ask about the respondents behavioural responses to insecurity (e.g. "Did you or any household member have to eat fewer meals in a day because there was not enough food?") (Coates *et al.*, 2007).

In fact, according to Coates *et al.* (2007) the nine HFIAS occurrence questions relate to three different domains of food insecurity access. The first domain digs deeper to understand the anxiety and uncertainty perceived by a household due to the situation of food supply (e.g. "Did you worry that your household would not have enough food?"). The second domain emphasises on understanding the respondents' behavioural response due to consumption of insufficient quality food, including insufficient food varieties and preferences (e.g. "Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?", "Did you or any household member have to eat a limited variety of foods due to a lack of resources?", and "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?"). The last domain seeks to understand the behavioural responses of the respondents as a result of insufficient food intake (e.g. "Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?", "Did you or any household member have to eat fewer meals in a day because there was not enough food?", "Was there ever no food to eat of any kind in your household because of a lack of resources to get food?", "Did you or any household member go to sleep at night hungry because there was not enough food?", and "Did you or any household member go a whole day and night without eating anything because there was not enough food?") (Coates *et al.*, 2007).

Each "how-often-the-occurrence" question is designed to contain two parts. The first part is the stem that has the timeframe for the recall period of the previous month. The second is the body of the question that refers to a specific attitude and the two response options (0 = NO and 1 = YES). There is also a "skip code" next to each "NO" response option. This code instructs the researcher to skip the related "how often the occurrence" follow-up question whenever the participant answers "NO" to an "occurrence question" (Coates *et al.*, 2007).

Each HFIAS "how-often-the-occurrence" question asks the participant how often the condition reported in the corresponding occurrence question happened in the previous month. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often) (Coates *et al.*, 2007).

5.4 DATA ANALYSIS

The data analyses were threefold, namely univariate, bivariate and multivariate. Data quality and management were ensured at all levels from the study conception to analysis. (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.*)

5.4.1 Univariate analysis

This statistical analysis was performed to provide descriptive assessment of a single variable derived from the HFIAS data to address "objective 5.2.1" (i.e. to assess and describe the severity of the experience of household food insecurity access). The responses from the HFIAS questionnaire were entered and analysed using Microsoft Excel version 2013.

To understand the descriptive characteristics of households' food insecurity (access) in the surveyed population, the HFIAS guide was used (Coates *et al.*, 2007). Informed by the guide, the following indicators were generated: the HFIAS-related conditions, the HFIAS-related domains, the HFIAS score and the HFIAS prevalence.

5.4.1.1 Calculation of the HFIAS-related conditions

To identify the HFIAS-related conditions, the percentage of households that responded "YES" to each of the nine occurrence questions, regardless of the frequency of the experience, was calculated. Thus, the HFIAS-related conditions measured the percentage of households that experienced a particular condition at any level of severity. Each indicator was further disaggregated to examine the frequency of experience of that particular condition across the surveyed households (Coates *et al.*, 2007).

5.4.1.2 Calculation of the HFIAS-related domains

To identify the HFIAS-related domains, the percentage of households that responded “YES” to each of the nine occurrence questions, regardless of the frequency of the experience, was calculated. The percentages were then summarised depending on the prevalence of households experiencing one or more behaviours in each of the three domains reflected in the HFIAS guide (the anxiety and uncertainty, insufficient quality and insufficient food intake) (Coates *et al.*, 2007). For the domains with more than one behaviour, a mean percentage was calculated.

5.4.1.3 Calculation of the HFIAS score

To calculate the HFIAS score indicator for all the households, firstly the HFIAS score was calculated for each household by summing the codes for each of the nine frequency-of-occurrence questions. Then the mean HFIAS score for all the households was calculated through dividing the sum of HFIAS scores in the sample by the number of HFIAS scores (i.e. households) in the sample (Coates *et al.*, 2007).

The maximum possible score for a household was 27 whereby the household responses to all the nine “how-often-the-occurrence” questions was “often”, coded with the response code of “three”. The minimum score was “zero” whereby the household responded “NO” to all the occurrence questions, and or the “how-often-the-occurrence” questions were skipped by the researcher, and subsequently coded as “zero” by the data analyst. The higher the score, the more food insecurity (access) the household experienced and vice versa (Coates *et al.*, 2007).

5.4.1.4 Calculation of the HFIAS prevalence

To identify the HFIAS prevalence, first, a HFIA category **variable** was calculated for each household by assigning a code for the food insecurity (access) category in which it falls. The four food security categories were created sequentially to ensure that households were classified according to their most severe response. The possible HFIAS categories for each household were 1 = Food secure, 2 = Mildly food insecure access, 3 = Moderately food insecure access, and 4 = Severely food insecure access. Then the prevalence at different levels of household food insecurity (access) was calculated by dividing the number of households with a particular HFIA category by the total number of households with the HFIA category. The answer was then multiplied by 100 to get the percentage (Coates *et al.*, 2007).

5.4.2 Bivariate analysis

This statistical analysis was performed to determine linear relationships between two variables to address "objective 5.2.2" (i.e. to determine and report the correlational relationships between the HFIAS scores and the respective associating demographic or socio-economic factor).

The univariate data output from Microsoft Excel version 2013 was exported to Stata Statistics and Data Analysis computer package version 14.0 for the bivariate analysis. Before the analysis, some variables were discarded based on violations of the earlier stated statistical assumptions (*refer to section 3.6.2 on assumptions*). For example, variables such as main occupation, visitation to the under-five clinics, frequency of visitation to under-five clinics, affiliation to farmer-based organisations and intention to join farmer-based organisations were dropped because they seemed to be constant across the sample, hence did not provide much information.

The remaining variables were then organised as either categorical or numerical (*Table 5.4.1*). The dependent and independent variables were identified. Testing for the linear relationships was done between the dependent variable and each of the independent variables separately, using linear regression analysis at the 95% confidence interval and 0.05 level of significance.

Table 5.4.1: Type of data used in the HFIAS bivariate analysis

Numerical	Categorical (nominal)	Categorical (ordinal)
• HFIAS scores • Age of the mothers • Household size • Household annual income (USD) • Household assets values/wealth (USD)	• Marital status • Training in food security and nutrition topics • Loan access • Involvement in decision making process regarding wealth • Involvement in decision making process regarding food security and nutrition matters	• Tobacco labour contribution • Public speaking and representation in community development agendas • Literacy levels

5.4.2.1 Dependent variable

The numerical HFIAS scores were selected to be the dependent variable among several other calculated HFIAS indicators, e.g. the HFIAS prevalence and the HFIAS-related conditions and domains. The HFIAS scores were selected in consultation with the statistician in respect to the preferred statistical testing for correlational relationships (linear regression analysis) to be performed. The HFIAS score has also been used as a dependent variable by many other researchers (Frongillo & Nanama, 2006; De Cock, D'Haese, Vink, Van Rooyen, Staelens, Schönfeldt & D'Haese, 2013; Mango, Zamasiya, Makate, Nyikahadzoi & Siziba, 2014).

5.4.2.2 Independent variables

The rest of the variables apart from the HFIAS scores were considered to be the independent variables (*Table 5.4.1*). The independent variables were entered into the analysis as either numerical or categorical (*Table 5.4.1*). During the analysis, some variable categories for the categorical independent variables were combined to come up with new categories, and reference categories were either taken as default or in some instances customised to suit prevailing logical interpretation (*refer to Table 5.5.2 and Table 5.5.3 in the results section*).

5.4.3 Multivariate analysis

This statistical analysis was performed to provide assessment for more than two variables to further address "objective 5.2.2" (i.e. to determine and report the correlational relationships amongst the associating demographic and socio-economic factors, and identify the significant factors influencing the HFIAS scores).

After performing the bivariate tests for the correlational relationships using linear regression analysis, the independent variables that were observed to have statistical significance with the HFIAS scores (at least at 0.1 level of significance) were automatically considered to be fed into the final multivariable linear regression analysis model. The independent variables were then adjusted one by one through a trial and error method, while observing the level of significance of the variables until a final logical model was established.

5.5 RESULTS

5.5.1 Univariate results

5.5.1.1 Demographic and socio-economic indicators

A total of 110 households were randomly sampled. One woman of reproductive age was interviewed per each household. Therefore, the total sample size (N) was 110 women of reproductive age. The minimum age of these women was 18 years and the maximum was 45 years. The mean age was 27.3 ± 6 years. (*Refer to chapter 4 for the full description of the univariate results of the demographic and socio-economic factors*.)

5.5.1.2 HFIAS indicators

The results of the HFIAS yielded four indicators that were used to describe the characteristics of food insecurity (access) in the sampled households as follows: the HFIAS-related conditions, the HFIAS-related domains, the HFIAS score and the HFIAS prevalence.

5.5.1.2.1 HFIAS-related conditions

The HFIAS-related conditions describe distinct characteristics of the sampled households' behaviours and perceptions. More households (85%) reported that they ate a limited variety of foods due to lack of resources, followed by those households (76%) not able to eat the preferred kinds of foods, and those (75%) that reported to be worried that they would not have enough food. More than half of the households (58%) reported to have gone to sleep at night on an empty stomach, while close to half (45%) said that they had ever gone a whole day and night without eating anything because there was not enough food. More than half of the households (59%) also said that they ran out of food of any kind because of lack of resources (*Table 5.5.1*).

Table 5.5.1: Percentage of households experiencing a HFIAS-related condition at any time during the previous month (N = 110)

Condition	Frequency (n)	Percentage (%)
Worry that household would not have enough food	83	75
Not able to eat the kinds of foods preferred	84	76
Have to eat a limited variety of foods	93	85
Eating foods that members really did not want	78	71
Eating smaller meals than the members felt	77	70
Have to eat fewer meals in a day	78	71
No food to eat of any kind in the household	65	59
Go to sleep at night hungry	64	58
Go a whole day and night without eating anything	49	45

5.5.1.2.1.1 Frequency of HFIAS-related conditions

Out of the 85% who reported that they ate a limited variety of foods, 37% said that experience happened "often", while 34% said it happened "sometimes", and only 14% said it happened "rarely". Out of those households (75%) that said they were worried that they would not have enough food, 34% said that experience happened "often", while 26% said it happened "sometimes", and only 15% said it happened "rarely". For those (58%) that had gone to sleep at night on an empty stomach, 13% said that experience happened "often", while 19% said it happened "sometimes", and a larger proportion (26%) said it happened "rarely". For those (45%) that said that they had ever went a whole day and night without eating anything, 7% said that experience happened "often", 13% said it happened "sometimes", and a larger proportion (25%) said it happened "rarely". Finally, out of those households (59%) that said they had run out of food, 16% said that experience happened "often", while 26% said it happened "sometimes", and 16% said it happened "rarely" (*Figure 5.5.1*).

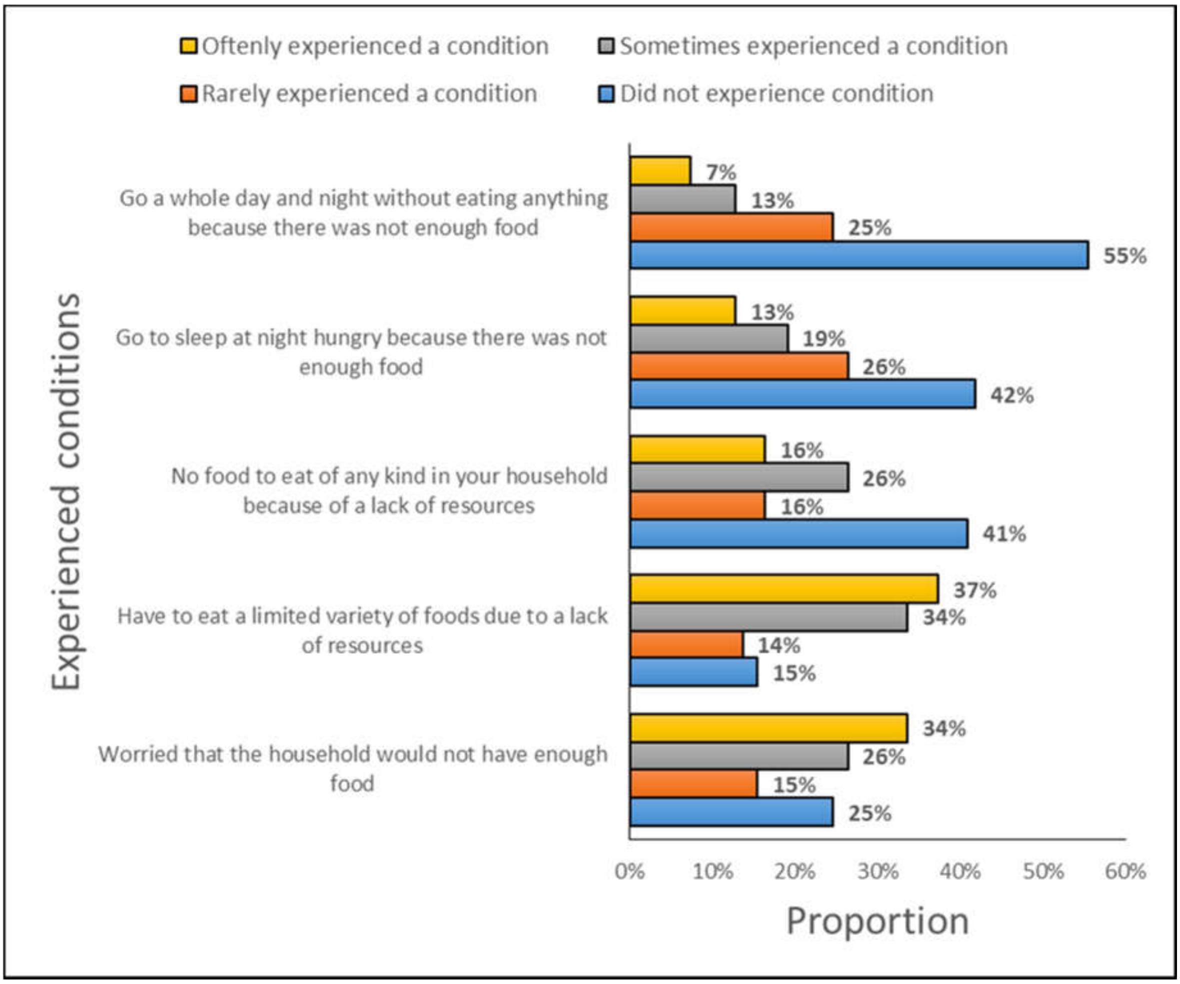

Figure 5.5.1: Occurrence and "how-often-the-occurrence" of selected HFIAS-related conditions (N = 110)

5.5.1.2.2 HFIAS-related domains

There are three HFIAS-related domains, namely anxiety and uncertainty, insufficient quality, and insufficient food intake and its physical consequences (Coates *et al.*, 2007). These domains describe summary information on the prevalence of households experiencing one or more behaviours in each of the said three domains. For the first domain, 75% of the households reported that they were anxious and uncertain about the accessibility of food. For the second domain, a mean of 77% had insufficient food quality, while a mean of 61% had insufficient food intake for the last domain (*Figure 5.5.2*).

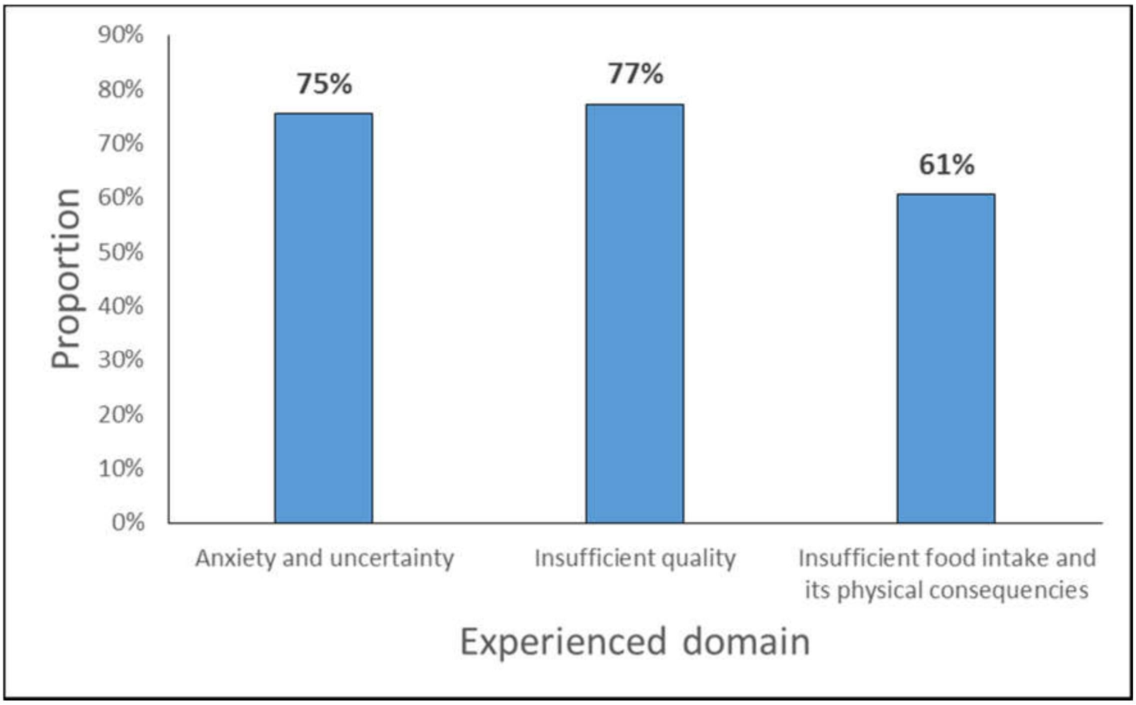

Figure 5.5.2: Proportion of households that experienced the HFIAS-related domains (N = 110)

5.5.1.2.3 HFIAS score

The HFIAS score indicator is a continuous measure of the extent of food insecurity (access) in the household in the predefined period of the previous four weeks (Coates *et al.*, 2007). The mean HFIAS score for the 110 households was 12.89 ± 7.89; the median and mode were 15 and 19 respectively, suggesting that more households were food insecure.

5.5.1.2.4 HFIAS prevalence

The HFIAS prevalence indicator groups households into four levels of household food insecurity (access): food secure, mild, moderately, or severely food insecure. Households are categorised as increasingly food insecure as they respond positively to more severe conditions and/or experience those conditions more frequently (Coates *et al.*, 2007).

The survey found that 7% of the households did not experience any of the food insecurity access conditions (food secure). Another 7% were worried about not having enough food (mildly food insecure). The other 11% were found to be moderately food insecure. The last category of the households (75%) were found to be severely food insecure (*Figure 5.5.3*). For the HFIAS prevalence, the sample size was 100 because data for ten households were declared redundant (i.e. the ten households fell in more than one category).

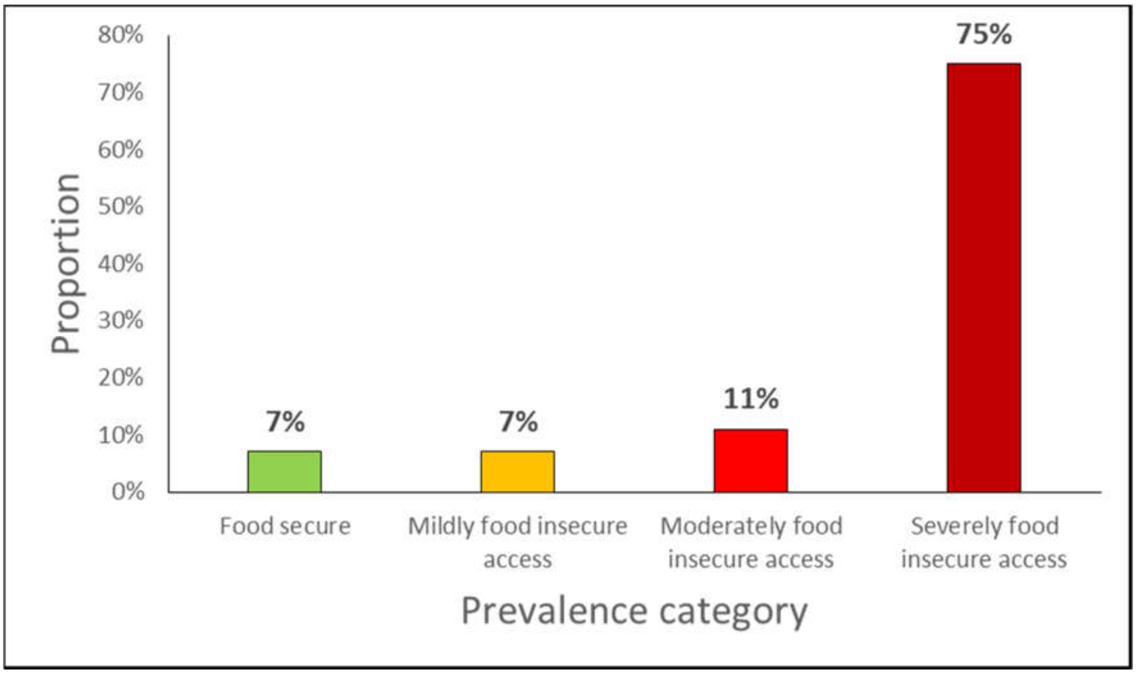

Figure 5.5.3: Prevalence of HFIAS per category (N = 100)

5.5.2 Bivariate results

The bivariate analysis found statistically significant relationships between the HFIAS *scores* and age of the mothers (P = 0.001), household size (P = 0.000), marital status (P = 0 .044), literacy level (P = 0.014) and lastly loan access (P = 0.002) (*Table 5.5.2*).

The analysis failed to provide evidence of statistically significant relationships between the HFIAS scores and training in food security and nutrition topics (P = 0.118), labour contribution (P = 0.320), annual income (P = 0.969), household assets values (P = 0.098), public speaking (P = 0.404), decision making regarding wealth (P = 0.188), decision making regarding food security and nutrition matters (P = 0.175) (*Table 5.5.2*).

Table 5.5.2: **Bivariate analysis between the HFIAS score and associating demographic and socio-economic factors (N = 110)**

	HFIAS scores (N = 110)				
Variable name	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Household size ^ (N = 110)	0.098	0.32	0.93, 2.19	1.59**	0.000
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.019	2.31	0.14, 9.26	4.70*	0.044
Age of the mothers ^ (N = 110)	0.052	0.08	0.13, 0.47	0.30**	0.001
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.058	1.38	-3.94, 1.51	-1.21	0.381
Secondary (n = 11)	0.058	2.05	1.06, 9.14	5.10	0.014
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.005	1.05	-3.14, 1.03	-1.05	0.320
Annual income ^ (N = 110)	0.000	0.00	-0.01, 0.01	0.00	0.969
Household assets values ^ (N = 110)	0.013	0.01	-0.00, 0.03	0.01	0.098
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.011	1.06	1.57, 0.11	1.66	0.118
No (n = 51) ǂ					

Continued

Table 5.5.2 continued: Bivariate analysis between the HFIAS score and associating demographic and socio-economic factors (N = 110)

	HFIAS scores (N = 110)				
Variable name	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.042	1.28	1.41, 6.45	3.93**	0.002
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.004	1.18	-3.31, 1.34	-0.99	0.404
Yes, very comfortable (n = 21)	0.004	1.48	-3.75, 2.07	-0.84	0.572
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.008	1.23	-0.80, 4.04	1.62	0.188
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.012	2.17	-4.24, 4.30	0.03	0.990
Male and female jointly + someone else in the household (n = 81)	0.012	1.41	-0.86, 4.71	1.92	0.175

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

5.5.3 Multivariate results

The following variables, namely age of the mothers (P = 0.001), household size (P = 0.000), marital status (P = 0 .044), literacy level (P = 0.014), loan access (P = 0.002), training in food security and nutrition topics (P = 0.118), household assets values (P = 0.098), decision making regarding wealth (P = 0.188) and decision making regarding food security and nutrition matters (P = 0.175) were entered into the final multivariable linear regression analysis model.

Adjustments were made through a trial and error method. Among all the independent variables considered, the final adjusted multivariable linear regression analysis model revealed that only loan access (P = 0.015) and household size (P = 0.000) were the statistically significant variables influencing the HFIAS scores (*Table 5.5.3*).

Table 5.5.3: Final multivariable linear regression analysis model between the HFIAS score and associating demographic and socio-economic factors (N = 110)

	HFIAS scores (N = 110)				
Variable names	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on multivariable linear regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.123	1.24	0.60, 5.49	3.04*	0.015
Yes (n = 23) ǂ					
Household size ^ (N = 110)	0.123	0.32	0.80, 2.07	1.44**	0.000

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

5.6 DISCUSSION

With regard to external validity, the researcher in this study acknowledges that the HFIAS tool has a constraint of not being cross-culturally comparable, since six out of the nine food insecurity conditions constituting the HFIAS questionnaire were proven to be inconsistent across cultures (Ballard *et al.*, 2011; Coates, 2013). Due to this reason, as well as the contextual differences in settings, adaptations of the questionnaires and methodologies of the studies, comparability of the results to other studies need to be taken with caution.

For the HFIAS-related conditions, a mean of 71% of the sampled households experienced each of the eight conditions (worrying about having inadequate food, not able to eat the preferred food, eating limited food, eating food households did not want, eating smaller meals, eating fewer meals in a day, having no food of any kind, and going to sleep at night on an empty stomach) out of the total nine food insecurity conditions included in the HFIAS questionnaire. The only condition which was not experienced by more than half of the households was having gone the whole day and night without eating any food. However, nearly half of the households (45%) reported to have experienced this condition. In a similar study that was done in Mudzi district in Zimbabwe, more than half of the households experienced only six out of the total nine food insecurity conditions included in the HFIAS questionnaire (Mango *et al.*, 2014). The percentage for the last three more severe food insecurity conditions were lower in Zimbabwe than in Malawi in the following manner: no food to eat of any kind (Zimbabwe 27%, Malawi 59%), going to sleep at night hungry (Zimbabwe 18%, Malawi 58%), and going the whole day and night without eating anything (Zimbabwe 24%, Malawi 45%) (Mango *et al.*, 2014). However, that study used a different study group (smallholder groundnut farmers) (Mango *et al.*, 2014), unlike the current study.

For the "how-often-the-occurrence" of the conditions, it was observed that less severe to relatively more severe conditions were likely to happen "often" and "sometimes" (e.g. "Worrying about having inadequate food", "Not able to eat the preferred food", "Eating limited food", "Eating food households did not want", "Eating smaller meals", and "Eating fewer meals in a day"). More severe conditions were likely to happen "rarely" (e.g. "No food to eat", "Going to bed hungry", and "Going the whole day and night without eating any food"). However, this scenario does not necessarily portray a better food security situation due to the fact that some households still experienced the more severe food insecurity conditions "often" and "sometimes" (*Figure 5.6.1*).

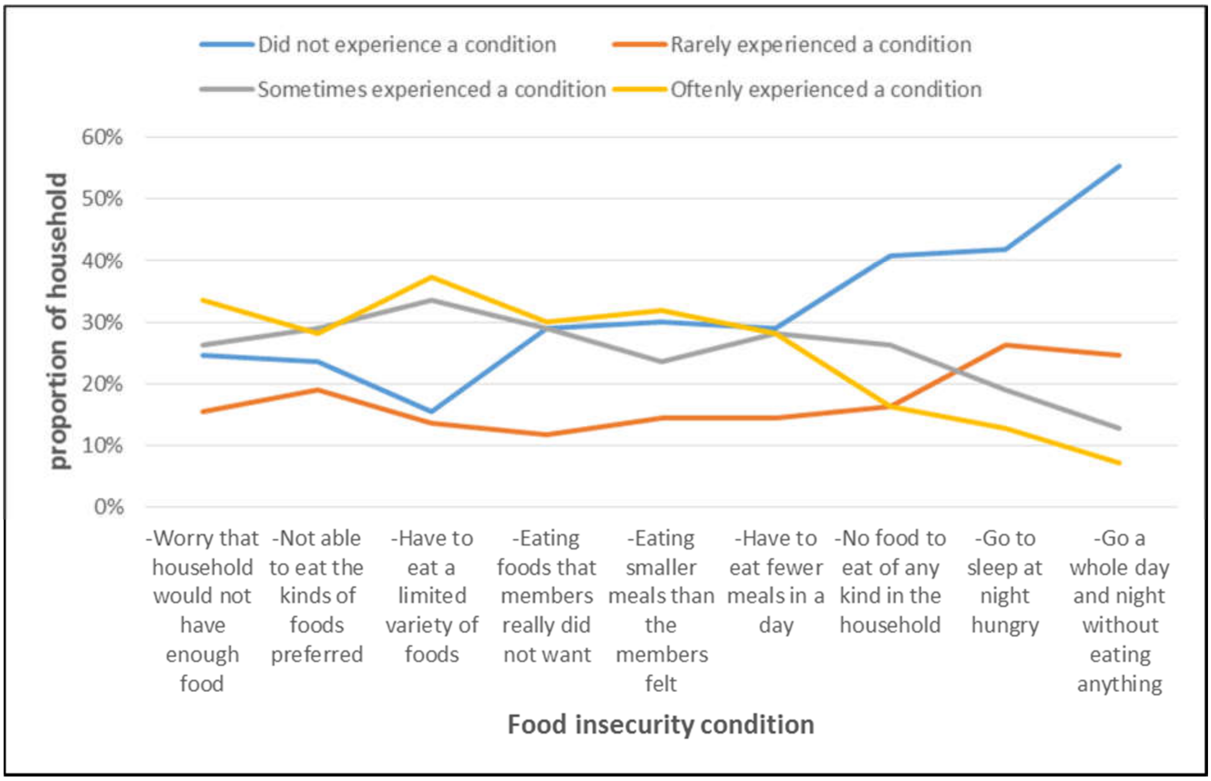

Figure 5.6.1: Trends and "how-often-the-occurrence" of the nine HFIAS-related conditions (N = 110)

The households were clustered into the three HFIAS-related domains, namely anxiety and uncertainty, insufficient quality and insufficient food intake and its physical consequences (Coates *et al.*, 2007). It was observed that a mean of 71% of the households experienced each of the stated domains. In extreme instances, about eight in every ten households (77%) reported to have insufficient food quality.

The HFIAS score indicator is a continuous measure of the extent of food insecurity (access) in the household in the predefined period of the previous four weeks. The highest possible value a household can score is 27 and the lowest is zero (Coates *et al.*, 2007). The study observed that the mean HFIAS score for the households (N = 110) was 12.89 ± 7.89; the median and mode were 15 and 19 respectively. The mean HFIAS score suggests that almost half of the households (48%) were food insecure. However, depending on the type of distribution of the data, the mean HFIAS score indicator's accuracy could be questioned (Ballard *et al.*, 2011). In this case, the median and mode are all higher than the mean HFIAS score, suggesting that the households that might be food insecure could as well be greater than half (*refer to Figure 5.5.3 for prevalence*). Comparatively a study conducted in rural Limpopo province in South Africa reported a lower mean HFIAS score at 10.05 (De Cock *et al.*, 2013), while another study in Southern Nepal reported a very low HFIAS score at 0.69 (Kular, Devakumar, Manandhar, Shrestha, Saville & Osrin, 2013). Another study that gathered data in eight countries (Pakistan, Tanzania, South Africa, Bangladesh, Nepal, Brazil, India and Peru) also used the HFIAS tool. The study reported varied mean HFIAS scores with a mean of mean HFIAS scores of 5.8. The lowest mean HFIAS score was reported in Tanzania (2.4) and the highest score was reported in Pakistan (8.3) (Psaki, Bhutta, Ahmed, Ahmed, Bessong, Islam, John, Kosek, Lima & Nesamvuni, 2012). All these studies reported lower mean HFIAS scores compared to the current study, suggesting that the smallholder tobacco households in Malawi were worse off as far as food insecurity (access) is concerned.

According to the categorisation of the HFIAS prevalence, 7% of the households were food secure, another 7% mildly food insecure, 11% moderately food insecure, and 75% were severely food insecure. The current study registered more severely food insecurity cases (75%) as compared to a study in rural Limpopo province that reported 53% of the households being severely food insecure (De Cock *et al.*, 2013). The eight countries study conducted in Pakistan, Tanzania, South Africa, Bangladesh, Nepal, Brazil, India and Peru also reported a lower mean for severely food insecurity prevalence at 24%; the highest being in Brazil (47%) and the lowest in Tanzania (10%) (Psaki *et al.*, 2012), again suggesting that the smallholder tobacco households in Malawi were worse off.

The 7% of the households that were observed to be food secure implied that they did not experience any of the nine food insecurity (access) conditions, or just experienced worry, but "rarely" (Coates *et al.*, 2007).

The 7% of the households that were categorised as having experienced mild food insecurity implied that they experienced one, all, or a combination of the following conditions: worry about not having enough food "sometimes" or "often", and or unable to eat preferred foods, and or ate a monotonous diet not desired, and or ate some foods considered undesirable, but only "rarely". Actually those were the households that neither compromised on quantity nor experienced any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating) (Coates *et al.*, 2007).

The 11% of the households that were moderately food insecure implied that they were compromising on food quality more frequently. Those households were experiencing the following conditions: eating a monotonous diet or undesirable foods "sometimes" or "often", and or had started to reduce on quantity by reducing the size of meals or number of meals, "rarely" or "sometimes". These households did not experience any of the three most severe conditions (Coates *et al.*, 2007).

Lastly, almost eight in every ten household (75%) were categorised to be severely food insecure. Those household were experiencing all, one or a combination of the following conditions: reduction on meal size or number of meals "often", and or experienced any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night hungry) regardless of the frequency. In fact, if a household experienced one of the three severe conditions even once in the previous four weeks, it was considered to be a more severely food insecure case (Coates *et al.*, 2007).

The independent variables that showed significance at least at 0.1 level of significance were fed and adjusted into the final multivariable linear regression analysis model. Some independent variables lost their significance and the final model that was established indicated that only loan access (P = 0.015) and household size (P = 0.000) were statistically significantly correlated to the HFIAS scores.

For the household size variable, the results suggested that for every one member increase in the household size, the HFIAS scores were also increasing by the factor of 1.44. Note that the higher the HFIAS score, the more food insecure the household was (Coates *et al.*, 2007). The results from the current study are consistent with the results of a study that was done in Mudzi district in Zimbabwe, that reported that household size was among the factors that increased the HFIAS scores (Mango *et al.*, 2014). The size of the household was also reported to significantly affect the HFIAS in a study that was conducted in rural Limpopo province in South Africa (De Cock *et al.*, 2013). However, differences in terms of the contexts and methodologies with the current study need to be acknowledged. For instance, in the Limpopo province study, a sample of rural households was selected regardless of occupation (De Cock *et al.*, 2013), while in the Mudzi district study, smallholder groundnut farmers were sampled (Mango *et al.*, 2014).

For the loan access variable, the results suggested that comparatively, for the households that did not access loans, their HFIAS scores increased by the factor of 3.04. These results are consistent with a case-control study that was done in Cambodia. In that study, households that were enrolled in village savings and loan programmes experienced less severe food insecurity (mean HFIAS of 9.9) as compared to controls that were not in the programme (mean HFIAS score of 10.8) at the p-value of 0.04 (Tuot, Thin, Shimizu, Suong, Sron, Chhoun, Pal, Ngin & Yi, 2016). Note that the higher the HFIAS score, the more food insecurity access the household experienced (Coates *et al.*, 2007). Another study conducted in Lira district in northern Uganda, between March and July 2011, investigated the impact of social capital, including access to credit. The study also reported a strong positive relationship between social capital, including access to credit with the HFIAS score indicator (Malual, 2014).

The researcher observed that whether the respective demographic and socio-economic factors would be significantly correlated with the HFIAS indicators varies considerably across the literature. Some demographic and socio-economic factors that the current study could not provide evidence of statistically significant correlational relationship with the HFIAS indicators had been found to be significant elsewhere. Examples of such factors include education level, household income and household wealth (Knueppel, Demment & Kaiser, 2010; Mohammadi, Omidvar, Houshiar-Rad, Khoshfetrat, Abdollahi & Mehrabi, 2012; De Cock *et al.*, 2013; Malual, 2014; Mango *et al.*, 2014; Naja, Hwalla, Fossian, Zebian & Nasreddine, 2015). This could be explained partly due to the differences in contexts, settings, methodologies, modifications of the original HFIAS questionnaire, and of course the adoption and translation processes involved in the due processes of implementation of the HFIAS tool (Coates *et al.*, 2007). (*Refer to section 3.5 for the process of questionnaire translation*.)

5.7 STRENGTH AND LIMITATION

5.7.1 Strength

- Capturing a wide range of behavioural experiences of food insecurity (access) which the tobacco tenant households experienced was quite revealing. This is where one gets to practically appreciate the complex nature of the experience of food insecurity ranging from the feeling of worry and anxiety about food access to the experience of having to have insufficient food quality and inadequate food intake.

5.7.2 Limitation

- The HFIAS questionnaire has closely related questions. This posed a challenge during the translation process from English to the Chewa and Tumbuka languages. In fact, more time was spent on translating the HFIAS questionnaire than on any of the other questionnaires used in this study.

5.8 CONCLUSION

The results suggested that generally most tobacco tenant households in the Mzimba north district in Malawi experienced severe food insecurity as defined by the HFIAS tool. More than half of the households were severely food insecure. Regarding the food insecurity domains, more than half of the households experienced each of the three domains, i.e. were worried and anxious about food access, they felt that they had access to insufficient food quality, and that they had inadequate food intake.

From the multivariable analysis, loan access and household size were found to be the influential factors of food insecurity (HFIAS). Keeping all things equal, this could mean that policies and programmes aimed at addressing the problem of food insecurity (HFIAS) for the women working as tobacco tenants and their children must be multisectoral.

5.9 RECOMMENDATION

- Government and research institutions must work together to formally translate the HFIAS questionnaire into all the eleven Malawian local languages for public use to enhance uniformity and accelerate research in food insecurity in Malawi.

CHAPTER 6

HOUSEHOLD HUNGER SCALE

6.1 INTRODUCTION

This chapter presents findings on the use of the Household Hunger Scale (HHS) measurement tool. The tool was administered to women of reproductive age in Mzimba North district in the northern region of Malawi. The tool was administered in January and February 2016 (i.e. the hunger season).

The HHS tool is a sub-set of the HFIAS tool. Just like its parent (HFIAS), the HHS is an experience-based method for measuring food insecurity (access) with an emphasis on assessing the severity of hunger. The tool asks participants directly about what had happened during the previous month in terms of the experience of hunger. This method is based on the assumption that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and numerically quantified through a survey, and put into a summarised scale (Cafiero *et al.*, 2014).

The chapter is presented in the following sections: introduction, objectives, description of the HHS tool, data analysis, results, discussion, strength and limitation, conclusion and recommendation.

6.2 OBJECTIVES

6.2.1 To assess and describe the severity of hunger in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the validated Household Hunger Scale developed by Ballard *et al.* (2011). (*Refer to Appendix 10, last three questions of the HFIAS questionnaire*.)

6.2.2 To determine and report relationships between the HHS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and under-five children (0 to 59 months old) on smallholder farms.

6.3 DESCRIPTION OF THE HOUSEHOLD HUNGER SCALE QUESTIONNAIRE

The Food and Nutrition Technical Assistance Project (FANTA) collaborated with the FAO Food Security Information for Action Programme and Tufts University in 2008 to validate the cross-cultural comparability of the HFIAS. The result of that validation research was the discovery that only the last three questions out of the nine in the HFIAS questionnaire are valid for cross-cultural comparability (Ballard *et al.*, 2011). These last three questions of the HFIAS are what constitute the HHS, hence the referencing of the HHS as the sub-set of the HFIAS.

As opposed to the HFIAS that focuses on describing food insecurity (access) in the three domains, namely anxiety and uncertainty, insufficient quality and insufficient food intake (Coates *et al.*, 2007), the HHS focuses on the most severe food insecurity access occurrence characterised by lack of food and real hunger (Ballard *et al.*, 2011).

The HHS indicator has three pairs of questions and the design and outline is the same as in the HFIAS. A pair consists of an "occurrence" question (e.g. "Did you or any household go to sleep at night hungry because there was no enough food?"), and a follow-up question to determine "how-often-the-occurrence" of a concerned condition took place (e.g. "How often did this happen?") (Coates *et al.*, 2007). The questions seek to understand the behavioural responses of the respondents as a result of lack of food and real hunger (e.g. "Was there ever no food to eat of any kind in your household because of a lack of resources to get food?", "Did you or any household member go to sleep at night hungry because there was not enough food?", and "Did you or any household member go a whole day and night without eating anything because there was not enough food?") (Coates *et al.*, 2007; Ballard *et al.*, 2011).

Each "how-often-the-occurrence" question is designed to contain two parts. The first part is the stem that has the timeframe for the recall period of the previous four weeks. The second is the body of the question that refers to a specific attitude and the two response options (0 = NO and 1 = YES). There is also a "skip code" next to each "NO" response option. This code instructs the field investigator to skip the related "how-often-the-occurrence" follow-up question whenever the respondent answers "NO" to an occurrence question (*Table 6.3.1*) (Coates *et al.*, 2007; Ballard *et al.*, 2011).

Each of the HHS "how-often-the-occurrence" question asks the respondent how often the condition reported in the corresponding occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often) (*Table 6.3.1*) (Coates *et al.*, 2007; Ballard *et al.*, 2011).

Table 6.3.1: An example of structure of the HHS questionnaire

	Occurrence question
Body	In the previous four weeks, did you or any household member go to sleep at night hungry because there was no enough food?
Response options	0 = NO (Skip to …) 1 = YES
	How-often-the-occurrence question
Body	How often did this happen?
Response options	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)

6.4 DATA ANALYSIS

The data analyses were threefold, namely univariate, bivariate and multivariate. Data quality and management were ensured at all levels from the study conception to analysis. (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.*)

6.4.1 Univariate analysis

This statistical analysis was performed to provide descriptive statistics of a single variable derived from the HHS data to address "objective 6.2.1" (i.e. to assess and describe the severity of the prevalence of household hunger). The responses from the HHS questionnaire were entered and analysed using Microsoft Excel version 2013.

For the understanding of the characteristics of households' severity of hunger in the surveyed population, the HHS guide was used (Ballard *et al.*, 2011). The following indicators were generated: the HHS-related Conditions, the categorical HHS and the median HHS.

6.4.1.1 Calculation of the HHS-related conditions

To assess the HHS-related conditions, a similar procedure as used to calculate the HFIAS-related conditions in the HFIAS guide (Coates *et al.*, 2007) was employed. The percentage of households that responded "YES" to each of the three questions, regardless of the "how-often-the-occurrence" of the experience, was calculated. Thus, the HHS conditions measured the percentage of households experiencing a particular condition at any level of severity. Each food insecurity condition was further disaggregated to examine its frequency across the surveyed households.

6.4.1.2 Calculation of the categorical HHS indicator

The first step in coming up with the categorical HHS indicator was to collapse the responses for each "how-often-the-occurrence" from three frequency variables ("rarely", "sometimes", "often") into two newly created frequency variables ("rarely" or "sometimes" and "often"). The next step was to add another frequency variable for households that replied "No" to each corresponding "occurrence" question so that all households should have code values of either "0", "1" or "2" for each of the three newly created variables (Ballard *et al.*, 2011).

The three newly created variables were then summed for each household to calculate the HHS score. Each household had a HHS score between zero and six. These HHS scores were then used to generate the categorical HHS indicators. The three categorical indicators and their corresponding cut-off scores were "little to no hunger" (0-1), "moderate hunger" (2-3) and "severe hunger" (4-6) (Ballard *et al.*, 2011).

6.4.1.3 Calculation of the median HHS indicator

The median value is the value that falls at the 50th percentile or at the middle of the score distribution for the households. The median was calculated by arranging all the HHS score values in the sample in ascending or descending order. The value that fell in the middle of the range was identified as the median HHS indicator (Ballard *et al.*, 2011).

6.4.2 Bivariate analysis

This statistical analysis was performed to determine the linear relationships between two variables to address "objective 6.2.2" (i.e. to determine and report the correlational relationships between the HHS scores and the respective associating demographic or socio-economic factor).

The univariate data output from Microsoft Excel version 2013 was exported to Stata Statistics and Data Analysis computer package version 14.0 for bivariate analysis. Before the analysis, the variables that violated some of the statistical assumptions that were made were removed (*refer to section 3.6.2 on assumptions*). Examples of variables that were dropped because they seemed to be constant across the sample and or they did not provide much information in the analysis included main occupation, visitation to under-five clinics, frequency of visitation to under-five clinics, affiliation to farmer-based organisations and intention to join farmer-based organisations.

The other variables were then organised as either categorical or numerical (*Table 6.4.1*). The dependent and independent variables were identified. Testing for the relationships was done between the dependent variable and each of the independent variables separately using linear regression analysis at the 95% confidence interval and 0.05 level of significance.

Table 6.4.1: Type of data used in the HHS bivariate analysis

Numerical	Categorical (nominal)	Categorical (ordinal)
• HHS scores • Age of the mothers • Household size • Household annual income (USD) • Household assets values/wealth (USD)	• Marital status • Training in food security and nutrition topics • Loan access • Involvement in decision making process regarding wealth • Involvement in decision making process regarding food security and nutrition matters	• Tobacco labour contribution • Public speaking and representation in community development agendas • Literacy levels

6.4.2.1 Dependent variable

The numerical HHS score was chosen to be the dependent variable among several other calculated HHS indicators, i.e. the HHS-related conditions and the categorical HHS. The HHS score was chosen in consultation with the statistician in respect to the preferred statistical testing (linear regression analysis) to be performed.

6.4.2.2 Independent variables

The rest of the variables, apart from the HHS score, were considered to be the independent variables (*Table 6.4.1*). The independent variables were either numerical or categorical (*Table 6.4.1*). During data analysis, some reference categories were customised depending on logical interpretation of the results. (*Refer to Table 6.5.2 and Table 6.5.3 in the results section*.)

6.4.3 Multivariate analysis

This statistical analysis was performed to provide assessment for more than two variables to further address "objective 6.2.2" (i.e. to determine and report the correlational relationships amongst the associating demographic and socio-economic factors, and identify the significant factors influencing the HHS scores).

The bivariate tests for the relationships using linear regression analysis were performed. The independent variables that were observed to have statistical significant correlational relationship with the HHS at least at 0.1 level of significance were automatically considered to be fed into the final multivariable linear regression analysis model. The independent variables were then adjusted one by one through a trial and error method, while observing the level of significance of the variables until a final logical model was established.

6.5 RESULTS

6.5.1 Univariate results

6.5.1.1 Demographic and socio-economic indicators

A total of 110 households were randomly sampled. One woman of reproductive age was interviewed per each household. Therefore, the total sample size (N) was 110 women of reproductive age. The minimum age of these women was 18 years and the maximum was 45 years with a mean age of 27.3 ± 6 years. (*Refer to chapter 4 for the full descriptive results of the demographic and socio-economic factors.)*

6.5.1.2 HHS indicators

The results from the HHS tool yielded three indicators that were used to describe the characteristics of real hunger in the sampled households, namely the HHS-related conditions, the categorical HHS indicator and the median HHS indicator.

6.5.1.2.1 HHS-related conditions

The HHS-related conditions describe the distinct characteristics of the sampled households' food deprivation and actual hunger. More than half of the households (59%) said that they had run out of food of any kind in the household because of lack of resources, followed by those households (58%) that reported to have gone to sleep at night on an empty stomach. Close to half of the households (45%) said that they had ever gone a whole day and night without eating anything because there was not enough food (*Table 6.5.1*).

Table 6.5.1: Proportion of households that experienced a form of hunger (N = 110)

HHS-related Conditions (N = 110)	Frequency (n)	Frequency percentage
No food to eat of any kind in the household	65	59%
Go to sleep at night hungry	64	58%
Go a whole day and night without eating anything	49	45%

6.5.1.2.1.1 Frequency of HHS-related conditions

For the "how-often-the-occurrence" of the conditions, out of those households (59%) that said they had run out of food, 16% said that experience happened "often", while 43% said it happened "sometimes" or "rarely". For those (58%) that had gone to sleep at night on an empty stomach, 13% said that experience happened "often", while 45% said it happened "sometimes" or "rarely". For those (45%) that said that they had ever gone a whole day and night without eating anything, 8% said that experience happened "often", while 37% said that experience happened "sometimes" or "rarely" (*Figure 6.5.1*).

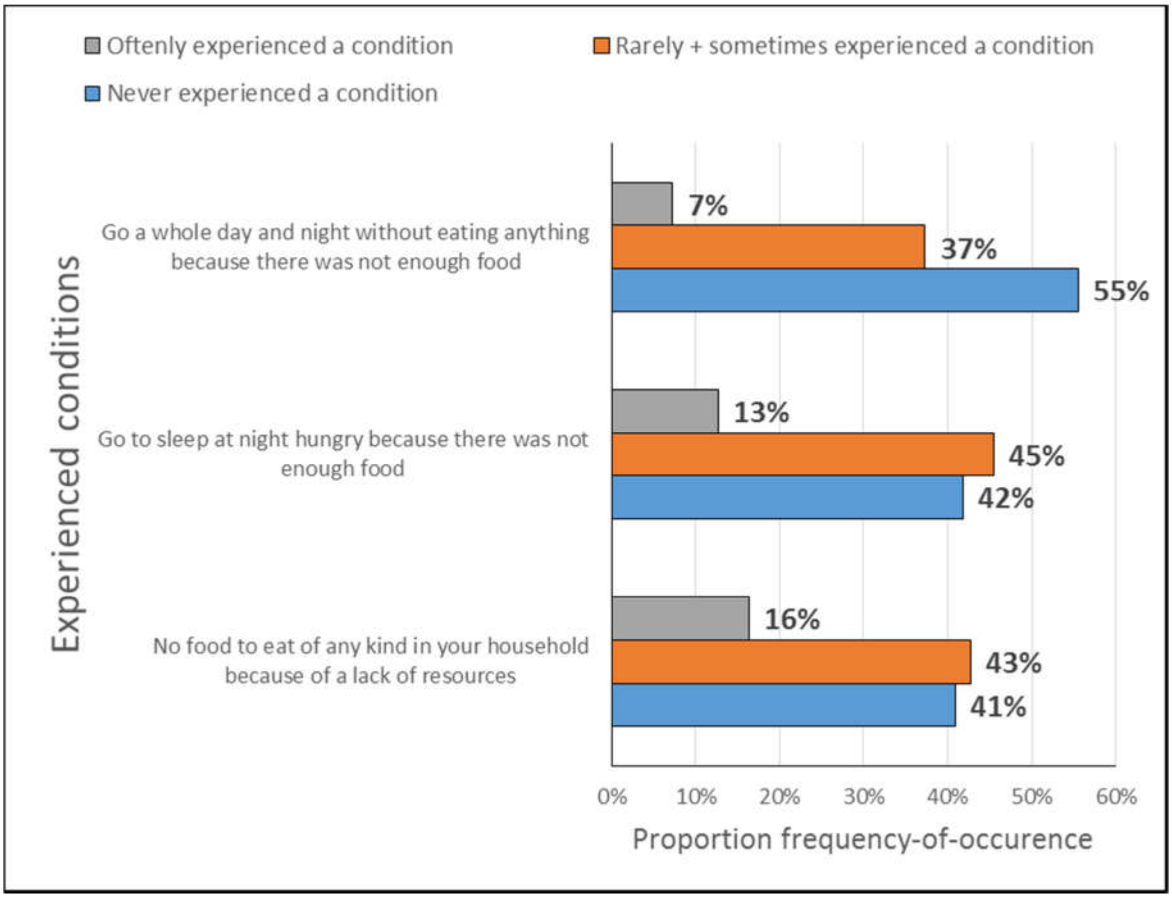

Figure 6.5.1: Proportion of households that experienced the HHS-related conditions (N = 110)

6.5.1.2.2 Categorical HHS indicator

More than half of the households (55%) were found to be hungry. Specifically, 36% were moderately hungry, while 19% were severely hungry. The rest of the households were found to have little or no hunger (*Figure 6.5.2*).

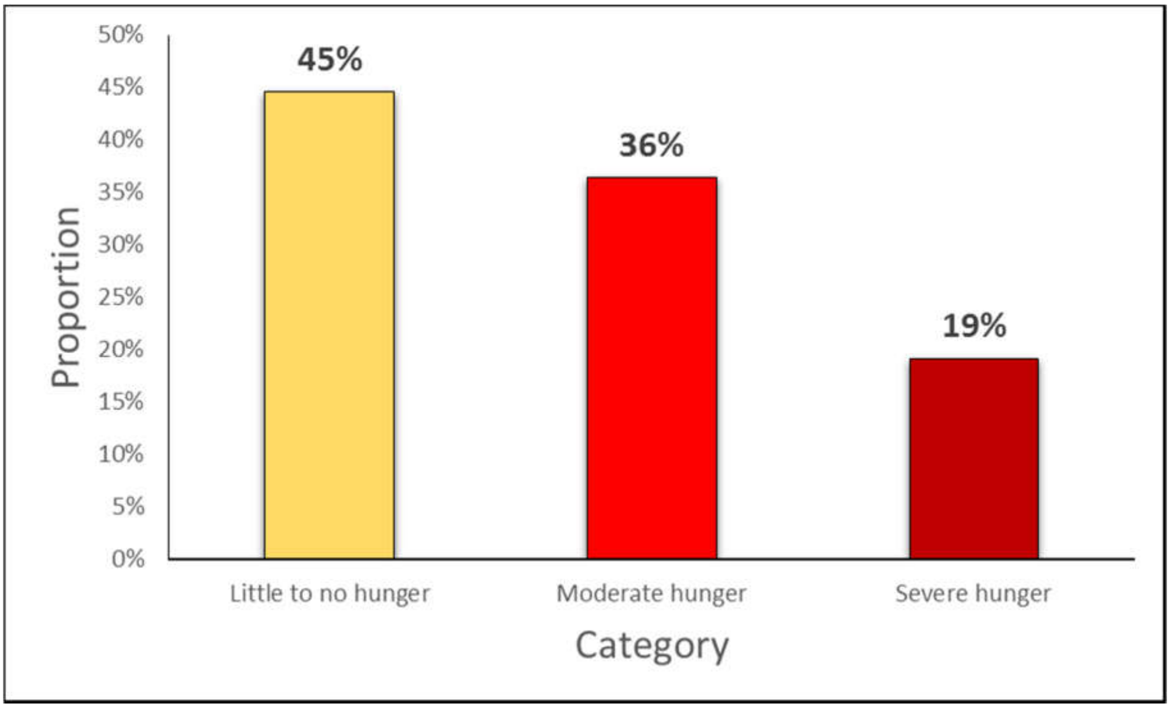

Figure 6.5.2: Prevalence of lack of food and hunger per HHS category (N = 110)

6.5.1.2.3 Median HHS indicator

The mean HHS score was 1.98 ± 1.80 with a median value of two and a mode of zero (N = 110). The median HHS indicator could be considered low.

6.5.2 Bivariate results

The bivariate analysis revealed statistically significant correlational relationships between the HHS scores and household size (P = 0.000), marital status (P = 0.018), age of the mothers (P = 0.033), literacy levels (P = 0.005), training in food security and nutrition topics (P = 0.015), loan access (P = 0.054), decisions regarding wealth (P = 0.044), decisions regarding food security and nutrition matters (P = 0.047) (*Table 6.5.2*).

The analysis could not provide evidence of statistically significant correlational relationship between the HHS scores and the other variables [labour contribution (P = 0.368), annual income (P = 0.783), household assets values (P = 0.591) and public speaking (P = 0.865)] (*Table 6.5.2*).

Table 6.5.2: Bivariate analysis between the HHS score and associating demographic and socio-economic factors (N = 110)

	HHS scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Household size ^ (N = 110)	0.070	0.07	0.15, 0.45	0.30**	0.000
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.025	0.53	0.22, 2.29	1.25*	0.018
Age of the mothers ^ (N = 110)	0.021	0.02	0.00, 0.08	0.04*	0.033
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.044	0.32	-0.48, 0.78	0.15	0.636
Secondary (n = 11)	0.044	0.47	0.42, 2.28	1.35**	0.005
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.004	0.24	-0.69, 0.26	-0.22	0.368
Annual income ^ (N = 110)	0.000	0.00	-0.00, 0.00	-0.00	0.783
Household assets values ^ (N = 110)	0.001	0.00	-0.00, 0.00	0.00	0.591
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59) ǂ					
No (n = 51)	0.027	0.24	0.12, 1.06	0.59*	0.015

Continued

Table 6.5.2 continued: Bivariate analysis between the HHS score and associating demographic and socio-economic factors (N = 110)

	HHS scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.017	0.30	-0.01, 1.15	0.57*	0.054
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.005	0.27	-0.58, 0.48	-0.05	0.865
Yes, very comfortable (n = 21)	0.005	0.34	-1.02, 0.31	-0.35	0.295
Decisions regarding wealth made in the household^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.019	0.28	0.02, 1.11	0.56*	0.044
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.054	0.48	-1.63, 0.27	-0.68	0.162
Male and female jointly + someone else in the household (n = 81)	0.054	0.32	0.01, 1.25	0.63	0.047

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

6.5.3 Multivariate results

The following independent variables, namely household size (P = 0.000), marital status (P = 0.018), age of the mothers (P = 0.033), literacy levels (P = 0.005), training in food security and nutrition topics (P = 0.015), loan access (P = 0.054), decisions regarding wealth (P = 0.044), and decisions regarding food security and nutrition matters (P = 0.047) were entered into the final multivariable linear regression analysis model.

After adjustments of independent variables based on a trial and error method, statistically significant relationships were observed between the HHS scores and training in food security and nutrition topics (P = 0.046), marital status (P = 0.045), as well as household size (P = 0.000) (*Table 6.5.3*).

Therefore, among all the independent variables considered, the final adjusted multivariable linear regression analysis model revealed that only training in food security and nutrition topics, marital status and household size were the statistically significant variables influencing the HHS scores.

Table 6.5.3: Final multivariable linear regression analysis model between the HHS score and associating demographic and socio-economic factors (N = 110)

	HHS scores (N = 110)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on multivariable linear regression analysis**
Household size ^ (N = 110)	0.07	0.13, 0.42	0.27**	0.000
Marital status^^ (N = 110)				
Married living with spouse (n = 104) ǂ				
Married spouse away + widowed (n = 6)	0.51	0.25, 2.03	1.03*	0.045
Training in food security and nutrition topics ^^ (N = 110)				
Yes (n = 59) ǂ				
No (n = 51)	0.23	0.01, 0.92	0.47*	0.046

Unadjusted $R^2 = 0.106$, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

6.6 DISCUSSION

The HHS tool, unlike the HFIAS, was validated to be cross-culturally comparable (Ballard *et al.*, 2011; Coates, 2013). Due to this reason, the HHS results compare well with results from other studies. However, the contextual differences in settings, adaptations of the questionnaires and methodologies of the studies still need to be cautioned.

The HHS-related conditions described the distinct characteristics of the sampled households' food deprivation and actual hunger. Almost six out of every ten households (59%) reported to have ran out of food of any kind in the household because of lack of resources. Similarly, almost six out of every ten households (58%) reported to have gone to sleep at night on an empty stomach. Close to five in every ten households (45%) also reported that they had ever gone a whole day and night without eating anything because there was not enough food. The levels of food insecurity (hunger) in the current study were higher than in a study that was conducted in rural households with children less than two years in the Sidama Zone in Southern Ethiopia. The study was conducted between December 2010 to January 2011, and it was reported that 44% of the households had run out of food, 32% reported had gone to sleep at night on an empty stomach, and 29% had ever gone a whole day and night without eating anything (Regassa & Stoecker, 2012). This suggests that the smallholder tobacco tenant households in Malawi were worse off.

For the "how-often-the-occurrence" of the conditions, it can be observed that the proportion of households that reported to have ran out of food "often" was lower (8%) than those (16%) that reported to have gone the whole day and night without eating anything "often". This trend is similar to the proportion of households that reported to have ran out of food "rarely" and "sometimes" which was lower (37%) than those (43%) that reported to have gone the whole day and night without eating anything. The proportion of households that reported not to have ran out of food at all was larger (55%) than those (41%) that reported to have gone the whole day and night without eating anything. This depicts that there was an increase in proportional frequency of households suffering from food insecurity as we moved from less severe to more severe hunger conditions across the continuum of severity (*Figure 6.6.1*).

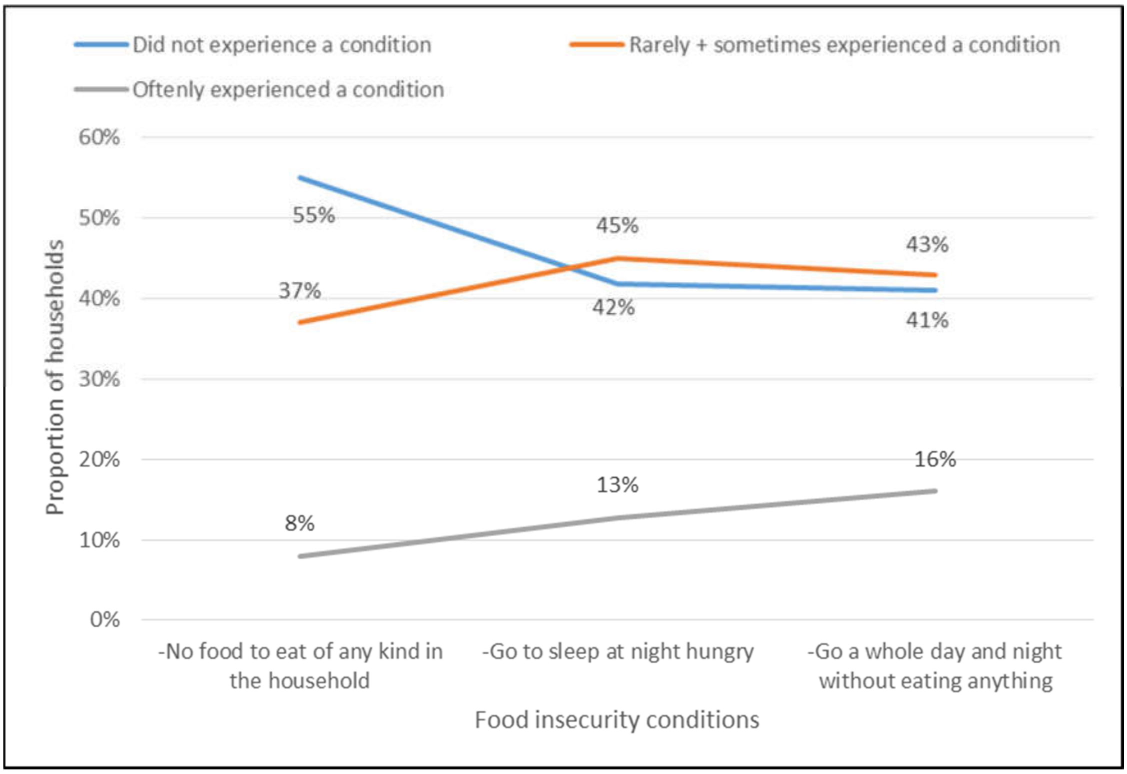

Figure 6.6.1: Trends and "how-often-the-occurrence" of the three HHS-related conditions (N = 110)

In terms of the severity of hunger, almost six in every ten households (55%) were found to be hungry. Specifically, close to four out of every ten (36%) were moderately hungry, while about one-fifth (19%) were severely hungry. Compared with the study that was conducted in Ethiopia, more households (65%) had no or little hunger, less (29%) were moderately hungry, while very few (6%) were severely hungry (Regassa & Stoecker, 2012). Compared to another study that was conducted in the rural households of OR Tambo district in the Eastern Cape (South Africa) in October 2013 (summer) and July 2014 (winter), more households (80% summer, 99% winter) had no or little hunger, few (20% summer, 1 % winter) were moderately hungry, while none were severely hungry (Hendriks *et al.*, 2016). Compared to the Feed the Future Zone of Influence baseline report, few rural smallholder households (38%) either experienced moderate and or severe hunger. These findings were derived from a baseline study that was done in November to December of 2012 (also a hunger season) within Malawi in seven districts of the central and southern regions (USAID, 2013). This also supports the claim that the tobacco tenant households in the northern region of Malawi were worse off as far food insecurity (hunger) is concerned.

After running a multivariable linear regression analysis model, statistically significant relationships were observed between the HHS scores and training in food security and nutrition topics (P = 0.046), marital status (P = 0.045), as well as household size (P = 0.000). Therefore, among all the independent variables considered, the final adjusted multivariable linear regression analysis model revealed that only training in food security and nutrition topics, marital status and household size were significant influencing the HHS scores.

For the household size variable, the results suggested that for any additional household member in the household, the HHS scores increased by the factor of 0.27. This could imply that hunger was more likely to be experienced by the households with more household members. These results are consistent with the studies in Zimbabwe (Mango *et al.*, 2014), as well as in South Africa (De Cock *et al.*, 2013) that reported that households with more members were likely to be food insecure. However, the studies by De Cock *et al.* (2013) and Mango *et al.* (2014) used the HFIAS and not the HHS. Besides, the contextual and methodological differences between these two studies with the current study need also to be acknowledged. For instance, in the Limpopo province study, a sample of rural households was selected regardless of occupation (De Cock *et al.*, 2013), while in the Mudzi district study, smallholder groundnut farmers were sampled (Mango *et al.*, 2014).

For the marital status variable, the results suggested that as compared to the households where both spouses were present, there was an increase in the HHS scores by the factor of 1.03 in the households where only female spouses were present and or widowed households. The results are consistent with the findings of the Malawi Feed the Future Zone of Influence baseline survey. That survey also used the HHS tool and reported that more female headed households (46%) were moderately and or severely food insecure than their male counterparts (41%) (USAID, 2013). The marital status variable indicated a puzzling higher increase in the HHS scores than any other variable. Caution needs to be applied since the "n" for the category where only female spouses were present was very small. This could have a possible effect on the results.

For the training in food security and nutrition topics variable, the results suggested that compared to the households that received training in food security and nutrition topics, there was an increase in the HHS scores by the factor of 0.47 in the households that did not receive any training. The impact of nutrition education, for example on food insecurity, has been investigated previously. In a randomised controlled trial in the USA, significant improvement in food security was observed for cases that were in a community nutrition education programme (Dollahite, Pijai, Scott-Pierce, Parker & Trochim, 2014). In another study in the USA, food insecurity scores decreased significantly in households that received training (Dollahite, Olson & Scott-Pierce, 2003). Generally, food insecurity among educated and or trained women is likely to diminish because educated women have a higher chance of allocating a larger proportion of their household food budget to food groups that are nutritionally rich in micronutrients (Smith & Haddad, 2000; Smith, 2003; Block, 2004), probably because they are fully knowledgeable of nutrition and health benefits of such foods (Smith, 2004; Taruvinga, Muchenje & Mushunje, 2013). However, the differences in the contexts and methodologies between the USA and the current studies need to be acknowledged. For instance, in one of the USA studies, the design was a randomised controlled trial (Dollahite *et al.*, 2014), while the current study was a cross-sectional descriptive correlational study. Furthermore, the USA is a developed country, while Malawi is a developing country.

6.7 STRENGTH AND LIMITATION

6.7.1 Strength

- The HHS has been validated for cross-cultural use. Therefore, data generated from this study is valid for cross-cultural comparability (Ballard *et al.*, 2011) worldwide.

6.7.2 Limitation

- Critics argue that the feeling of hunger is barely universal. Therefore, there is an existing fear that food insecurity as captured from an individual's perspective of hunger might somehow be insensitive and subjective to misreporting and misinterpretation (Hendriks *et al.*, 2016), hence difficult to measure.

6.8 CONCLUSION

The results suggested that more than half of the tobacco tenant households in Mzimba north district, Malawi experienced hunger as defined by the HHS method. More than one-fifth of the households experienced severe hunger.

From the multivariable analysis, household size, marital status and training in food security and nutrition topics were found to be the influential factors of hunger (HHS). Keeping all things equal, this could mean that policies and programmes aimed at addressing the problem of hunger (HHS) must be multisectoral and inclusive to address the problem of food insecurity in the short-term, as well as in the long term by addressing the determinants.

6.9 RECOMMENDATION

- On the basis of this HHS findings, it is clear that the tobacco tenants experienced food deprivation and real hunger. This calls for government and other stakeholders to implement periodic targeted interventions, such as cash or food transfer programmes to alleviate the situation of the tobacco tenants during the hunger season

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CHAPTER 7

MONTHS OF ADEQUATE HOUSEHOLD FOOD PROVISIONING

7.1 INTRODUCTION

This chapter presents findings of the Months of Adequate Household Food Provisioning (MAHFP) measurement tool. The tool was administered to women of reproductive age involved in tobacco tenant farming in Mzimba North district in the northern region of Malawi. The tool was administered in January and February 2016 (i.e. the hunger season).

To understand the MAHFP of the households, this chapter is arranged into the following sections: introduction, objectives, description of the MAHFP tool, data analysis, results, discussion, strength and limitations, conclusion and recommendations.

7.2 OBJECTIVES

7.2.1 To assess and describe the annual prevalence of hunger in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the MAHFP tool developed by Bilinsky and Swindale (2007). (*Refer to Appendix 9 for the MAHFP questionnaire.*)

7.2.2 To determine and report the relationships between the MAHFP scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

7.3 DESCRIPTION OF THE MONTHS OF ADEQUATE HOUSEHOLD FOOD PROVISIONING QUESTIONNAIRE

The MAHFP, developed by Bilinsky and Swindale (2007), aims to measure annual food access. The MAHFP tool is widely used by the Food and Nutrition Technical Assistance II Projects (FANTA-2) (Bilinsky & Swindale, 2007), as well as by Africare in almost all of its food security projects (Africare, 2007).

The purpose of the MAHFP questionnaire is to identify the months in which the households has limited access to food regardless of the source of the food, i.e. production, purchase, barter or food aid (Bilinsky & Swindale, 2007). It is with the understanding that the households' resources will vary over the course of the year, hence their ability to access food would be decided by a number of hindering factors. These factors include inadequate crop production due to poor soil or lack of labour and loss or decrease in income sources, such as employment, social obligations or natural disasters (Bilinsky & Swindale, 2007).

The MAHFP questionnaire is a simple tool composed of two questions. The first question is asked to identify which households were able or were not able to access food in all the previous 12 months (e.g. "Were there months, in the previous 12 months, in which you did not have enough food to meet your family's needs?"). For the households which were unable to access food in one or more months in the previous 12 months, a second question follows for the households to identify which months they did not have access to sufficient food (e.g. "If yes, which were the months in the previous 12 months during which you did not have enough food to meet your family's needs?"). Techniques, such as probing, are used to make sure that the household respondent has thought about the entire previous 12 months (Bilinsky & Swindale, 2007).

7.4 DATA ANALYSIS

The data analyses were threefold, namely the univariate, bivariate and multivariate. Data quality and management were ensured at all levels from the study conception to analysis. . (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.*)

7.4.1 Univariate analysis

This type of analysis was performed to provide descriptive assessment of a single variable derived from the MAHFP data to address "objective 7.2.1" (i.e. to assess and describe the annual prevalence of hunger). The responses from the MAHFP questionnaire were entered and analysed using Microsoft Excel version 2013.

The first step in the tabulation process of the responses from the women of reproductive age, involved finding the months in which each of the households had adequate food. This was calculated by subtracting the total number of months that the household was unable to meet their food needs from 12 months (Bilinsky & Swindale, 2007).

$$\mathbf{MAHFP} = \ \mathbf{12}\ \boldsymbol{months}$$
$$\boldsymbol{sum\ of\ month\ of\ inadequate\ household\ food\ provisioning}\ (\boldsymbol{January} + \boldsymbol{December} + \boldsymbol{November} + \boldsymbol{October} + \boldsymbol{September} + \boldsymbol{August} + \boldsymbol{July} + \boldsymbol{June} + \boldsymbol{May} + \boldsymbol{April} + \boldsymbol{March} + \boldsymbol{February})$$

The second step was to calculate the mean MAHFP for all the households in the sample as indicated in the formula below. The denominator included all households interviewed, even those that did not experience any months of inadequate food (Bilinsky & Swindale, 2007).

$$\textbf{Mean MAHFP} = \frac{\boldsymbol{Sum\ of\ the\ MAHFPs\ for\ all\ households\ in\ the\ sample}}{\boldsymbol{Total\ number\ of\ households}}$$

In the last step, the households were then categorised into three categories. The first one being the most food secure, i.e. those that accessed adequate food during all the previous 12 months. The second one being the moderately food secure, i.e. those that experienced inadequate food for one to three months. The third category being the least food secure households, i.e. those that were unable to access food for equal to or greater than four months. There is no universally agreed cut-off points for the categorisation of the MAHFP scores (Hendriks *et al.*, 2016). Hence, the categorisation employed in this regard was the researcher's choice, as well as being informed by other studies that used similar categorisation techniques (Leah *et al.*, 2013; Harris-Fry *et al.*, 2015).

7.4.2 Bivariate analysis

This statistical analysis was performed to determine linear relationships between two variables to address "objective 7.2.2" (i.e. to determine and report the correlational relationships between the MAHFP scores variable and the respective associating demographic or socio-economic factor).

The univariate data output from Microsoft Excel version 13 was exported to Stata Statistics and Data Analysis computer package version 14.0 for bivariate analysis. Before the analysis, the variables that violated some statistical assumptions stated at the conception stage of the study were discarded from the analysis (*refer to section 3.6.2 on assumptions*). Examples of variables that were dropped because they seemed to be constant across the sample included main occupation, visitation to under-five clinics, frequency of visitation to under-five clinics, affiliation to farmer-based organisations and intention to join farmer-based organisations.

The other variables were then organised as either categorical or numerical (*Table 7.4.1*). The dependent and independent variables were identified. Testing for the correlational relationships was done between the dependent variable and each of the independent variables separately, using linear regression analysis at the 95% confidence interval and 0.05 level of significance.

Table 7.4.1: Type of data used in the MAHFP bivariate analysis

Numerical	**Categorical (nominal)**	**Categorical (ordinal)**
• MAHFP scores • Age of mothers • Household size • Household annual income (USD) • Household assets values/wealth (USD)	• Marital status • Training in food security and nutrition topics • Loan access • Involvement in decision making process regarding wealth • Involvement in decision making process regarding food security and nutrition matters	• Tobacco labour contribution • Public speaking and representation in community development agendas • Literacy levels

7.4.2.1 Dependent variable

The numerical MAHFP score was chosen to be the dependent variable (*Table 7.4.1*). The MAHFP score was chosen in consultation with the statistician in respect to the preferred statistical testing (linear regression analysis) to be performed. The lowest possible value of the MAHFP score is zero and the highest is 12. A higher score depicts a more food secure situation (Leah *et al.*, 2013).

7.4.2.2 Independent variables

The rest of the variables, apart from the MAHFP score, were considered to be the independent variables (*Table 7.4.1*). The independent variables were either organised as numerical or categorical (*Table 7.4.1*). During the analysis, the reference categories were customised depending on logical interpretation of the results. (*Refer to Table 7.5.1 and Table 7.5.2 in the results section for the names of the categories, as well as the reference categories*.)

7.4.3 Multivariate analysis

This statistical analysis was performed to provide assessment of more than two variables to further address "objective 7.2.2" (i.e. to determine and report the correlational relationships among the associating demographic and socio-economic factors, and identify the significant factors influencing the MAHFP scores).

After performing the bivariate tests for the correlational relationships using linear regression analysis, the independent variables which were observed to have statistical significant correlational relationship with the MAHFP scores (at 0.05 or at least at 0.1 level of significance) were automatically considered to be fed into the final multivariable linear regression analysis model. The independent variables were then adjusted one by one through a trial and error method, while observing the level of significance of the variables until a final logical model was established.

7.5 RESULTS

7.5.1 Univariate results

7.5.1.1 Demographic and socio-economic indicators

A total of 110 households were randomly sampled. One woman of reproductive age was interviewed per each household. Therefore, the total sample size (N) was 110 women of reproductive age. The minimum age of these women was 18 years and the maximum was 45 years. Their mean age was 27.3 ± 6 years. (*Refer to* c*hapter 4 for the full descriptive results of the demographic and socio-economic factors*.)

7.5.1.2 MAHFP indicators

The mean MAHFP score was 8.45 ± 2.42 with a median of 9.0 and a mode of 10.0 (N = 110). The worst months in which more than half of the households reported to have inadequate access to food were January (64%) and February (70%). The best months in which more than 90% of the households reported to have access to adequate food were May (95%), June (95%) and July (92%) (*Figure 7.5.1*).

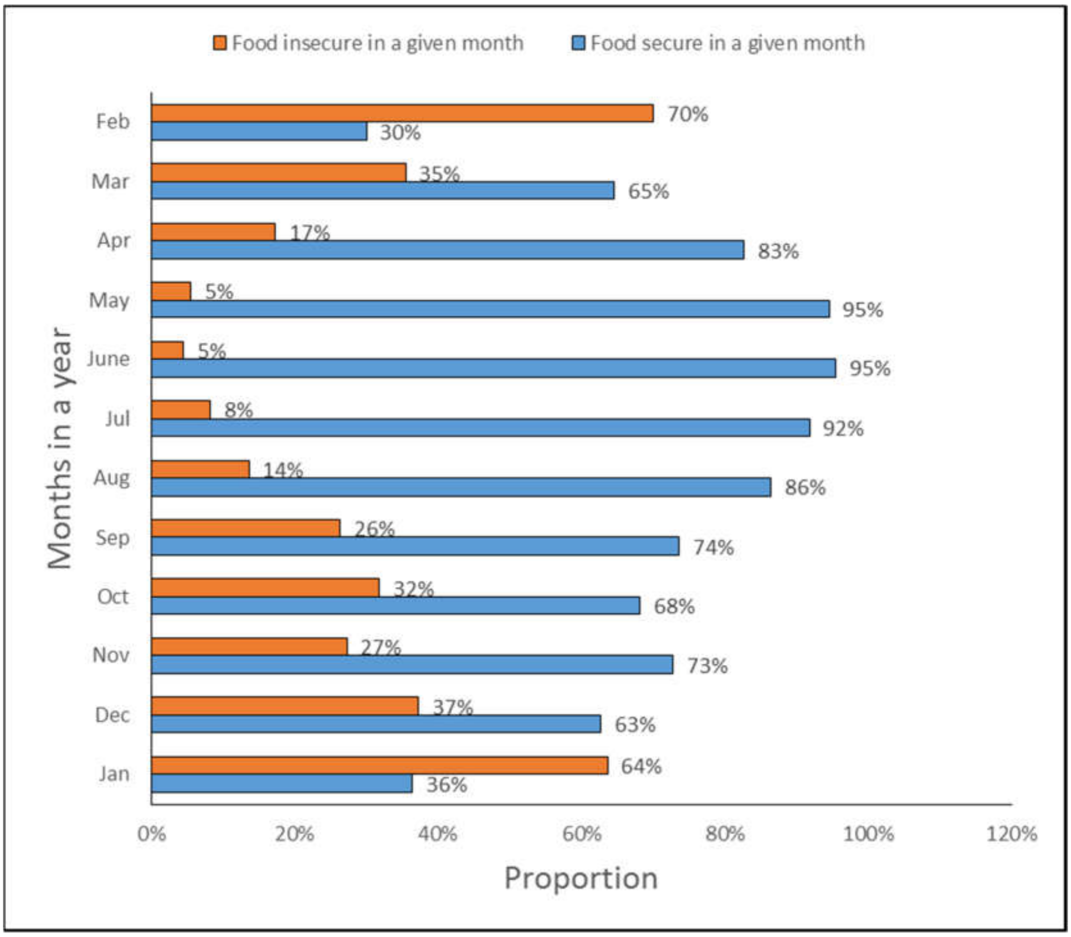


Figure 7.5.1: Months in which households had adequate and inadequate food (N = 110)

Most of the households (44%) reported to have inadequate access to food for one to three months in the previous 12 months (n = 48). Others (41%) reported to have inadequate access to food for equal to or greater than four months in the previous 12 months (n = 45). A few households (15%) reported not to have struggled to access food. The latter actually reported to have access to adequate food in all the previous 12 months (n = 17) (*Figure 7.5.2*).

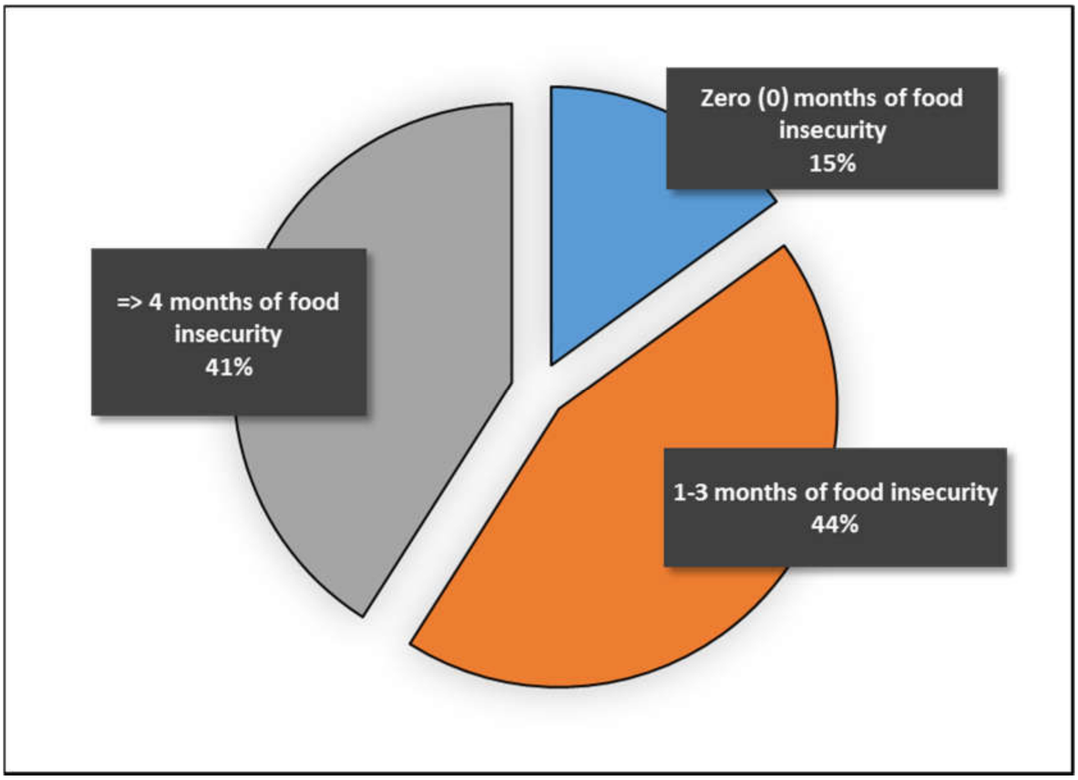


Figure 7.5.2: Categories of months of inadequate household food provisioning (N = 110)

7.5.2 Bivariate results

The bivariate analysis found statistically significant relationships between the MAHFP scores and household size (P = 0.012), age of the mother (P = 0.052), labour contribution (P = 0.029), loan access (P = 0.045), decisions regarding wealth (P = 0.052) and decisions regarding food security and nutrition matters (P = 0.055) (*Table 7.5.1*).

The analysis did not provide evidence of statistically significant correlational relationships between the MAHFP scores and the other variables [training in food security and nutrition topics (P = 0.150), annual income (P = 0.105), literacy levels (P = 0.125), marital status (P = 0.264), household assets values (P = 0.328) and public speaking (P = 0.977)] (*Table 7.5.1*).

Table 7.5.1: Bivariate analysis between the MAHFP scores and associating demographic and socio-economic factors (N = 110)

	MAHFP scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Household size ^ (N = 110)	0.046	2.37	-0.61, -0.04	-0.22**	0.012
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.006	0.72	-2.21, 0.61	-0.80	0.264
Age of mother ^ (N = 110)	0.024	2.40	-0.14, 0.01	-0.16*	0.052
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.016	0.43	-0.19, 1.52	0.67	0.124
Secondary (n = 11)	0.016	0.64	-1.28, 1.25	-0.01	0.982
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n= 55) ǂ					
Less + moderately involved (n = 55)	0.022	0.32	0.07, 1.34	0.71*	0.029
Annual income ^ (N = 110)	**0.005**	2.41	-0.00, 0.01	0.12	0.105
Household assets values ^ (N = 110)	**0.002**	2.43	-0.01, 0.01	-0.04	0.328
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.010	0.33	-1.11, 0.17	-0.47	0.150
No (n = 51) ǂ					

Continued

Table 7.5.1 continued: Bivariate analysis between the MAHFP scores and associating demographic and socio-economic factors (N = 110)

	MAHFP scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Loan access ^^ (N = 110)					
Yes (n = 87)	0.018	0.40	-1.58, -0.02	-0.80*	0.045
No (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.004	0.36	-1.04, 0.39	-0.33	0.367
Yes, very comfortable (n = 21)	0.004	0.45	-0.91, 0.88	-0.01	0.977
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.017	0.38	-0.01, 1.47	0.73*	0.052
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.025	0.66	-0.03, 2.58	1.27*	0.055
Male and female jointly + someone else in the household (n = 81)	0.025	0.43	-0.92, 0.78	-0.07	0.872

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

7.5.3 Multivariate results

The following independent variables, namely household size (P = 0.012), age of the mothers (P = 0.052), labour contribution (P = 0.029), loan access (P = 0.045), decisions regarding wealth (P = 0.052), decisions regarding food security and nutrition matters (P = 0.055), training in food security and nutrition topics (P = 0.150), annual income (P = 0.105) and literacy levels (P = 0.125) were entered into the final multivariable linear regression analysis model.

The variables were adjustments through a trial and error method, while observing the level of significance of the variables. The researcher observed statistically significant relationships between the MAHFP scores and labour contribution (P = 0.038), annual income (P = 0.008), as well as household size (P = 0.001). Loan access was considered important but was not significant (P = 0.072) (*Table 7.5.2*).

Therefore, among all the independent variables considered, the final adjusted multivariable linear regression analysis model revealed that only labour contribution, annual income and household size were the statistically significant variables influencing the MAHFP scores.

Table 7.5.2: Final multivariable linear regression analysis model between the MAHFP score and associating demographic and socio-economic factors (N = 110)

	MAHFP scores (N = 110)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on multivariable linear regression analysis**
Household size ^ (N = 110)	0.10	-1.56, -0.16	-0.36**	0.001
Labour contribution into two categories ^^ (N = 110)				
Highly involved (n = 55) ǂ				
Less + moderately involved (n = 55)	0.31	0.04, 1.27	0.65*	0.038
Loan access ^^ (N = 109)				
No (n = 86)	0.39	-1.46, 0.06	-0.70	0.072
Yes (n = 23) ǂ				
Annual income ^ (N = 110)	0.00	0.00, 0.01	0.0036**	0.008

Unadjusted R^2 = 0.108, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

7.6 DISCUSSION

The mean MAHFP score was 8.45 ± 2.42. This represents that, based on the mean, the households could only have access to adequate food for around eight months out of the previous 12 months. January and February were found to be the worst months in which more than half of the households (64% and 70% respectively) reported to have inadequate food access. Up to nine in every ten households (90%) reported to have adequate food in May, June and July. The results are consistent with the Malawian seasonal calendar of events for a typical year. The lean season in which many households are expected to run out of food starts from November to March (FEWS NET, 2013). Comparatively, the women of reproductive age in this study could be considered worse off since a study that was conducted in rural Bangladesh reported that more than half of the women of reproductive age had access to adequate food in all the previous 12 months (Harris-Fry *et al.*, 2015).

In most instances, food is available during and after the harvest time, however hunger starts to loom just four months down the line (FEWS NET, 2013). Post-harvest losses, pest and disease infestations, poor food processing, preservation and storage facilities could be among the reasons for the food insecurity (Godfray *et al.*, 2010).

Food security is achieved 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, 1996). Note the phrase "***at all times***" in the definition. In the current study roughly an overwhelming nine out of every ten households (85%) did not have access to adequate food "***at all times***" in the previous 12 months. Specifically, 44% reported to have inadequate access to food for one to three months, while 41% reported that they were unable to access food for equal to or more than four months. A small-scale agriculture households study in Ecuador, Bolivia and Peru that also used a MAHFP tool to assess food security reported a large proportion of households (41%) that did have access to adequate food over the previous 12 months (Leah *et al.*, 2013). Comparatively, this consolidates the finding that the tobacco tenant households in Malawi were worse off in performance as far as annual food accessibility is concerned.

Using the final multivariable linear regression analysis model, statistically significant relationships were observed between the MAHFP scores (dependent variable) and the following independent variables, namely the labour contribution (P = 0.038), annual income (P = 0.008), as well as household size (P = 0.001). The loan access variable was statistically non-significant although it was left in the final model (P = 0.072).

For the household size variable, the results suggested that for any additional household member in the household, the MAHFP scores decreased by the factor of 0.36. The lower MAHFP score depicts a food insecure situation (Leah *et al.*, 2013). A 2011 study in rural Bangladesh that also used the MAHFP tool, and a similar study group (women of reproductive age), reported that larger households among other factors significantly increase the risk of food insecurity (Harris-Fry *et al.*, 2015). The results are also consistent with other studies in Zimbabwe (Mango *et al.*, 2014), as well as in South Africa (De Cock *et al.*, 2013). However, the Mango *et al.* (2014) study used the HFIAS which captures a different aspect of food access, unlike the MAHFP.

For the annual income variable, the results suggested that for any additional US dollar to the household, the MAHFP scores increased by the factor of 0.0036. Although the coefficient increase is very small; nearing to zero, the relationship itself is positive (P = 0.008). Positive correlational relationships between income and food security have been reported previously. A study in the Limpopo province, South Africa reported that household income is one of the major significant determinants of food security (annual access) (De Cock *et al.*, 2013).

For the labour contribution variable, the results suggested that as compared to the women who were highly involved in tobacco labour, there was an increase in the MAHFP scores by the factor of 0.65 in the women who were less and or moderately involved. The women's high involvement in tobacco labour could be an indication of an additional income to the household. However, this could be argued against because in most instances labour contribution from female spouses and children is almost free (ILO, 2011). Satisfaction with labour involvement and time availability for leisure activities are among the five domains of women empowerment. Time burden was among the main domains contributing to women disempowerment in Uganda (Alkire *et al.*, 2013). Women who were found highly empowered in a study in Bangladesh showed great contribution towards household food security through increased income, participation in the decision making process, improving their health and nutrition knowledge, control over capital and participating in social and political activities (Kabir *et al.*, 2014).

For the loan access variable, the results suggested that as compared to the women who accessed loans, there was a decrease in the MAHFP scores by the factor of 0.70 in the women who did not have access to loans. As already pointed out, the loan access variable was statistically non-significant although it was left in the final model. In the literature, access to loans has been reported to have a bearing on food insecurity status. A case-control study that was done in Cambodia reported that households that were enrolled in village savings and loan programmes experienced less severe food insecurity as compared to controls that had more severe food insecurity experiences by having limited choices in the types of food consumed, and eating smaller portions of food (Tuot *et al.*, 2016). Another study conducted in northern Uganda between March and July 2011, investigated the impact of social capital, including access to credit. The study revealed a strong positive relationship between social capital, including access to credit with the food security (HFIAS) indicator (Malual, 2014).

7.7 STRENGTH AND LIMITATIONS

7.7.1 Strength

- The use of the MAHFP tool in the study unlocked opportunities to have a glance into the understanding of the annual food access occurrence. With a known weakness of having done the study in one season only, the findings of the MAHFP was a strong piece of the puzzle to understand the food accessibility across the year.

7.7.2 Limitations

- The MAHFP tool can be considered to have compromised validity and reliability, especially due to recall bias as study participants needed to think through a lengthy 12 months period. Collection of agriculture data in which respondents are required to recall through lengthy periods is a cause of quality concern (Beegle *et al.*, 2012).

- There are fears that some study participants were at times exaggerating their levels of months of inadequate food provisioning hoping to qualify for hand-outs or aid of some kind. Existence of such practices was expectations during probing and cross-examination of data with spouses.

7.8 CONCLUSION

Household food insecurity, as defined by the MAHFP measurement tool, is a concern for the tobacco tenant households in Mzimba district, Malawi. Households faced food shortages for a mean of four months, with January and February being the worst months.

Farther analytical methods employed in the study revealed that annual income, household size and labour contribution/involvement were the significant influential factors of food insecurity (MAHFP). Putting all things equal, new and existing policies that relate to improvements of these associating factors need to be considered in policy design and implementation processes.

7.9 RECOMMENDATIONS

- There is need to formulate participatory and multisectoral policies and interventions encompassing the various determinants of food insecurity. These policies should aim at addressing comprehensive determinants of food insecurity by bringing together synergies from various sectors such health, trade, social, agriculture and nutrition.
- Food security policies and interventions aimed at ensuring adequate food provisioning all year round are urgently needed, for instance food security policies and interventions aimed at boosting effective post-harvest handling, food processing, preservation, and storage of food from both plant and animal products.

CHAPTER 8

INDIVIDUAL DIETARY DIVERSITY OF WOMEN AND CHILDREN

8.1 INTRODUCTION

This chapter presents findings of the Individual Dietary Diversity scale (IDDS) tool. The tool was administered to the women of reproductive age, as well as their under-five children in Mzimba North district in the northern region of Malawi. The tool was administered in January and February 2016 (i.e. the hunger season).

The IDDS is a qualitative measure of food security that yields numerical values to describe household access to a variety of foods, and is also a proxy for describing nutrient adequacy of the diet of individuals (Kennedy *et al.*, 2011).

The chapter is organised in the following sections: introduction, objectives, description of the IDDS tool, data analysis, results, discussion, strength and limitations, conclusion and recommendations.

8.2 OBJECTIVES

8.2.1 To assess and describe the IDDS of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (24 to 59 months old) on smallholder farms by using the validated IDDS questionnaire developed by Kennedy *et al.* (2011). (*Refer to Appendices 11 and 12.*)

8.2.2 To determine and report the relationships between the IDDS scores for the tobacco tenant women of reproductive age (15 to 49 years old) and the IDDS scores for their under-five children (0 to 59 months old) on smallholder farms.

8.2.3 To determine and report the relationships between the IDDS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

8.3 DESCRIPTION OF THE INDIVIDUAL DIETARY DIVERSITY SCALE QUESTIONNAIRE

The IDDS tool provides an approach for measuring an individual's dietary diversity as a proxy measure of food security access. The tool consists of a simple qualitative count of food groups that an individual had accessed and consumed inside and outside the home over the previous 24 hours period. The tool was validated for several age and sex groups as a proxy measure for macro- and micronutrient adequacy of the diet (Kennedy *et al.*, 2011).

The first question on the IDDS questionnaire asks respondents to describe the foods (meals and snacks) that they ate or drank in the previous 24 hours during the day and night, whether at home or outside the home. The respondents are allowed to freely recall what they had consumed as breakfast, lunch, dinner, or any snacks (Kennedy *et al.*, 2011).

The respondents are asked to list the ingredients when composite or mixed dishes are mentioned. Probing questions are asked for any food groups that were not mentioned after the recall process (Kennedy *et al.*, 2011).

The IDDS questionnaire considers 16 food groups. After data collection, the 16 food groups are collapsed by combining some food groups to form nine food groups, including staples, dark green leafy vegetables, other vitamin A rich fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes and seeds, and dairy and dairy products (Kennedy *et al.*, 2011).

8.4 DATA ANALYSIS

The data analyses were threefold, namely univariate, bivariate and multivariate. Data quality and management were ensured at all levels from the study conception to analysis of the results. (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.*)

8.4.1 Univariate analysis

This analysis was performed to provide descriptive statistics of a single variable derived from the IDDS tool to address "objective 8.2.1" (i.e. to assess and describe the dietary diversity of women of reproductive age and their under-five children). The responses from the IDDS questionnaire were entered and analysed using Microsoft Excel version 2013. Various indicators were generated as suggested in the IDDS guide (Kennedy *et al.*, 2011). Examples of such indicators include the IDDS scores, the IDDS categories and the IDDS conditions.

8.4.1.1 Creation of IDDS scores

The IDDS score was calculated by summing up all food groups consumed by the sampled women of reproductive age, as well as the under-five children. The following steps as suggested by Kennedy *et al.* (2011) were followed:

- Creation of newly formed food group variables for those food groups that needed to be aggregated. This was necessary because during data collection, a total of 16 foods would be listed but to come up with nine food groups as used in the IDDS guide, some food groups needed to be combined. For example, "starchy staples" was a newly formed variable created by combining the answers to "Cereals" and "White roots and tubers" (*see Appendices 11 and 12*).
- Creation of a new variable termed Women Dietary Diversity Score (WDDS) for women and Children Dietary Diversity Score (CDDS) for children.
- Computing values for the DDS score variable by summing all the nine food groups included in the IDDS scale.
- A mean score was then calculated for all the sampled women, as well as for the under-five children using the formula below.

Mean IDDS Score:

$$= \frac{\boldsymbol{Sum\ of\ food\ groups\ consumed\ by\ all\ women/children}}{\boldsymbol{Total\ number\ of\ the\ respondents\ (sample)}}$$

8.4.1.2 IDDS conditions, i.e. proportion of women of reproductive age/under-five children consuming a certain type of food group

Several indicators were calculated based on specific nutrients in the food groups of interest, such as vitamin A and haem-iron rich food groups. The following are the examples given by Kennedy *et al.* (2011):

- Percentage of women/children consuming plant foods rich in vitamin A (vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits).
- Percentage of women/children consuming vitamin A rich animal source foods (organ meat, eggs or dairy and dairy products).
- Percentage of women/children consuming either a plant or animal source of vitamin A (vitamin A rich vegetables and tubers or dark green leafy vegetables or vitamin A rich fruits or organ meat, or eggs, or dairy and dairy products).

The indicators above were calculated by summing the number of women or children who consumed **ANY** of the food groups listed in the questionnaire and then dividing by the total sample size of the study as illustrated in the formula below.

Percentage women/children consuming a food group of interest:

$$= \frac{\boldsymbol{Number\ of\ individuals\ who\ consumed\ a\ particular\ food\ group}}{\boldsymbol{Total\ number\ of\ the\ respondents\ (sample)}}\ \boldsymbol{X\ 100}$$

8.4.1.3 IDDS categories

Dietary patterns were calculated by dividing the women's or children's IDDS scores into categories and determining which food groups were consumed by each category. The tertile categorisation was used and it allowed households to fall into the low tertile (≤ three food groups), the medium tertile (four and five food groups) and or the high tertile (≥ six food groups). Categorisation was done according to the researcher's discretion, informed by the IDDS guide (Kennedy *et al.*, 2011) since there is no universally agreed cut-offs for the categorisation of the IDDS scores (Kennedy *et al.*, 2011; Cafiero *et al.*, 2014; Hendriks *et al.*, 2016).

8.4.2 Bivariate analysis

This statistical analysis was performed to determine the linear relationships between two variables to address "objective 8.2.2" (i.e. to determine and report the correlational relationships between the IDDS scores for the women and the IDDS scores for the children). Furthermore, also to address "objective 8.2.3" (i.e. to determine and report the correlational relationships between the IDDS scores for women and the respective associating demographic or socio-economic factors).

The univariate data output from Microsoft Excel version 13 was exported to Stata Statistics and Data Analysis computer package version 14.0 for bivariate analysis. Before the analysis, the variables that violated some statistical assumptions stated at the conception of the study were discarded (*refer to section 3.6.2 on assumptions*). Examples of variables that were dropped because they seemed to be constant across the sample included main occupation, visitation to the under-five clinics, frequency of visitation to the under-five clinics, affiliation to farmer-based organisations and intention to join farmer-based organisations.

The other variables were organised as either categorical or numerical (*Table 8.4.1*). The dependent and independent variables were identified at this stage. Testing for the relationships was done between the dependent variable and each of the independent variables separately using linear regression analysis at the 95% confidence interval and 0.05 level of significance.

Table 8.4.1: Type of data used in the IDDS bivariate analysis

Numerical	Categorical (nominal)	Categorical (ordinal)
• IDDS scores for the mothers (WDDS) • IDDS scores for the children (CDDS) • Age of the mothers • Household size • Household annual income (USD) • Household assets values/wealth (USD)	• Marital status • Training in food security and nutrition topics • Loan access • Involvement in decision making process regarding wealth • Involvement in decision making process regarding food security and nutrition matters	• Tobacco labour contribution • Public speaking and representation in community development agendas • Literacy levels

8.4.2.1 Dependent variable

The numerical IDDS score was chosen to be the dependent variable (*Table 8.4.1*). This dependent variable was chosen in consultation with the statistician in respect to the preferred statistical testing (linear regression analysis) to be performed. Some studies have also used the DD score as the dependent variable (Bernal & Lorenzana, 2003; Arimond & Ruel, 2004).

8.4.2.2 Independent variables

The rest of the variables apart from the IDDS score were considered to be the independent variables (*Table 8.4.1*). The independent variables were either numerical or categorical (*Table 8.4.1*). During analysis, reference categories were customised depending on logical interpretation. (*Refer to Table 8.5.3 and Table 8.5.4 in the results sections for the names and reference categories*.)

To address "objective 8.2.2", the IDDS scores for the women (WDDS) were considered to be the dependent variable, while the IDDS scores for the children (CDDS) were considered to be the independent variable.

8.4.3 Multivariate analysis

This statistical analysis was performed to provide assessment of more than two variables to further address "objective 8.2.3" (i.e. to determine and report the correlational relationships amongst the associating demographic and socio-economic factors, and identify the significant factors influencing the IDDS scores).

After performing the bivariate tests for the relationships using linear regression analysis, the independent variables (demographic and socio-economic) that were observed to have statistical significant correlational relationship with the IDDS scores (at least at 0.1 level of significance) were automatically considered to be fed into the final multivariable linear regression analysis model. The independent variables were then adjusted and eliminated one by one through a trial and error method, while observing the level of significance of the variables until a final logical model was established.

8.5 RESULTS

8.5.1 Univariate results

8.5.1.1 Demographic and socio-economic indicators

The total sample size of the women of reproductive age who were interviewed was 110, with ages between 18 to 45 years. The mean age of the women was 27.3 ± 6 years (*refer to chapter 4 for the full univariate results of the demographic and socio-economic factors*).

The total sample of the under-five children whose mothers were interviewed about their IDDS was 88, with ages between 24 to 59 months. The mean age of these children was 38.1 ± 10.3 months (*refer to chapter 4 for the full univariate results of the demographic and socio-economic factors*).

8.5.1.2 IDDS scores for the women of reproductive age and under-five children

The mean IDDS score for the women (WDDS) was low at 2.5 ± 0.8 food groups with a mode and median of two food groups respectively. The mean IDDS score for the children (CDDS) was also low at 2.5 ± 0.9 with a median and mode of two food groups respectively.

8.5.1.3 IDDS conditions, i.e. proportion of women of reproductive age/under-five children consuming a certain type of food group

Staples was the most consumed food group (99% women, 98% children), followed by dark-green leafy vegetables (80% women, 77% children). Consumption of legumes was the lowest (9% women, 9% children), followed by meat (10% women, 11% children) and vitamin A fruits and vegetables (13% women, 16% children). Both the women and children did not consume organ meat, eggs and or dairy and dairy products (*Figure 8.5.1*).

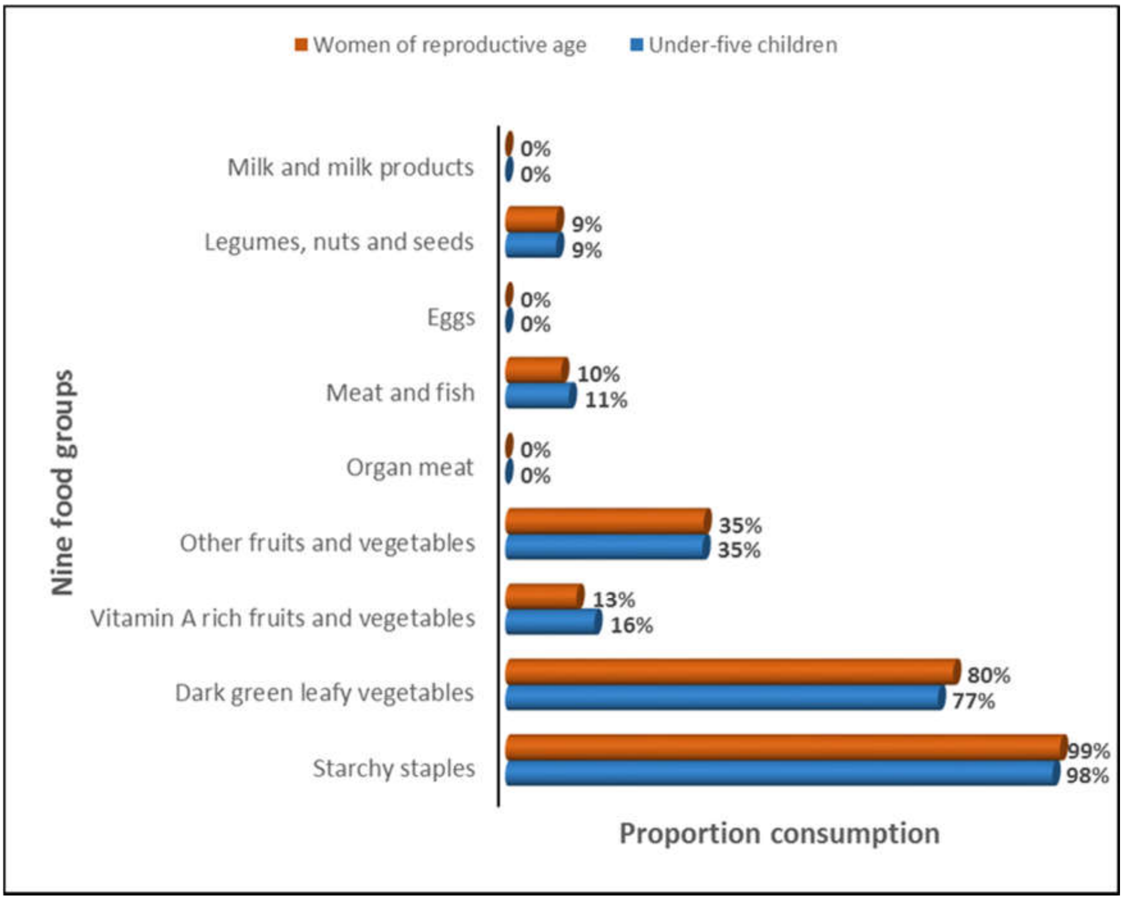


Figure 8.5.1: Consumption of the nine food groups by the women (N = 110) and children (N = 88)

The study also reported on the proportions of women of reproductive age who consumed food groups that are good sources of micronutrients (haem-iron and vitamin A). None of the women and children consumed vitamin A rich animal source foods, such as organ meat, eggs or dairy and dairy products. However, the majority (93% women, 95% children) consumed plant foods rich in vitamin A, such as vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits. Only a few (10% women, 11% children) consumed foods that are good sources of haem-iron, such as organ meat, flesh meat, or fish (*Figure 8.5.2*). Although fats and oils are not micronutrients, it is of importance to report their proportion consumption, since they play a crucial role in the absorption of vitamin A (Kennedy *et al.*, 2011). It was revealed that only a few (16% women, 16% children) reported to have consumed fats and oils (*data not shown*).

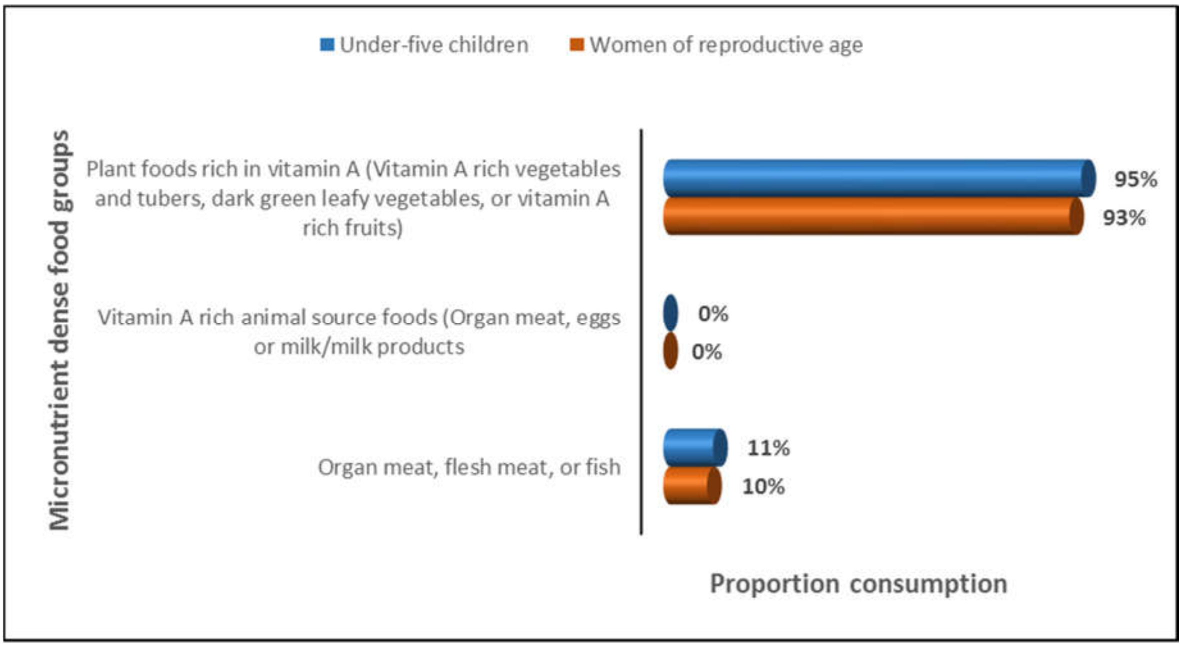


Figure 8.5.2: Consumption of micronutrient dense food groups by the women (N = 110) and children (N = 88)

8.5.1.4 IDDS categories for the women of reproductive age and under-five children

When the IDDS scores were categorised into tertiles, the majority (91% women, 91% children) reported only to have consumed less than or equal to three food groups. A few (9% women, 9% children) consumed four to six food groups, while none of the women and children consumed more than or equal to seven food groups (*Figure 8.5.3*).

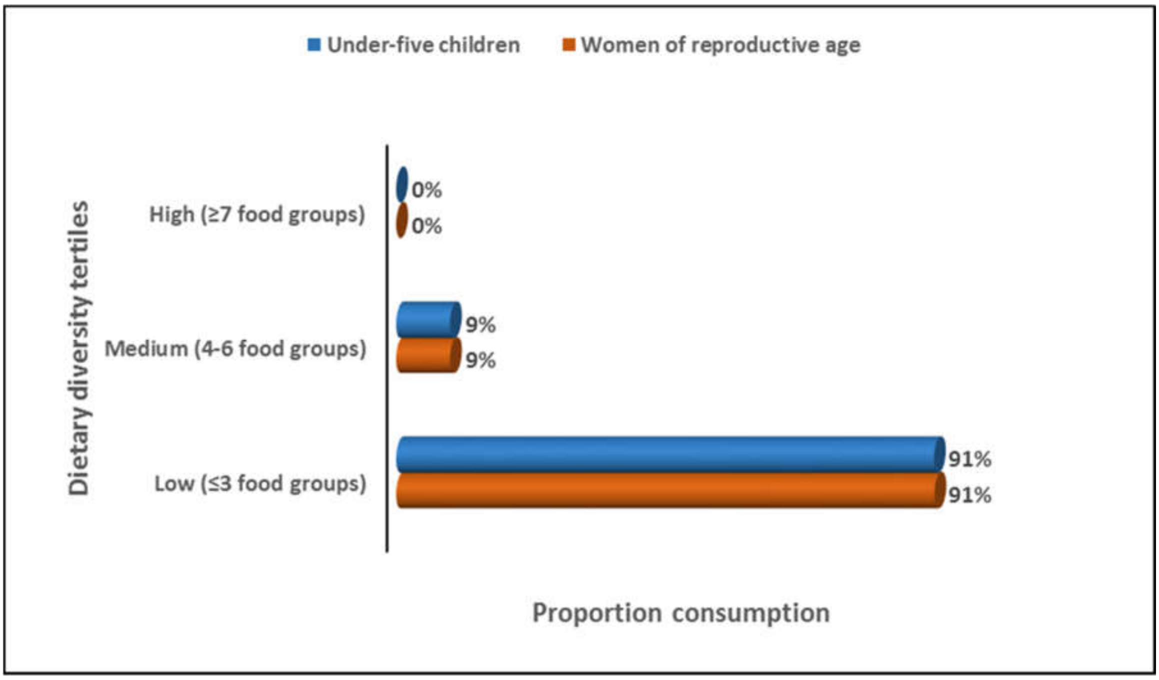


Figure 8.5.3: IDDS score tertiles and proportion consumption by the women (N = 110) and children (N = 88)

The food groups that were consumed by more than or equal to 50% of the women in the lower IDDS score tertile (n = 100) were starchy staples and dark green leafy vegetables. Those consumed by more than or equal to 50% of the women in the medium IDDS score tertile were staples, dark green leafy vegetable and vitamin A fruits and vegetables (n = 10). None of the women were in the highest IDDS score tertile (*Table 8.5.1*).

Table 8.5.1: Food groups consumed by equal to or more than 50% of the women by IDDS score tertile (N = 110)

Low: ≤ food groups (n = 100)	**Medium: 4-6 food groups (n = 10)**	**High: ≥ 7 food groups (n = 0)**
Starchy staples	Starchy staples	-
Dark green leafy vegetables	Dark green leafy vegetables	-
-	Vitamin A rich fruits and vegetables	-

The food groups that were consumed by more than or equal to 50% of the children in the lower IDDS score tertile were starchy staples and dark green leafy vegetables (n = 80). Those consumed by more than or equal to 50% of the children in the medium IDDS score tertile were staples, dark green leafy vegetable, vitamin A rich fruits and vegetables, other fruits and vegetables, and meat and fish (n = 8). None of the children were in the highest IDDS score tertile (*Table 8.5.2*).

Table 8.5.2: Food groups consumed by equal to or more than 50% of the under-five children by IDDS score tertile (N = 88)

Low: ≤3 food groups (n = 80)	**Medium: 4-6 food groups (n = 8)**	**High: ≥ 7 food groups (n = 0)**
Starchy staples	Starchy staples	-
Dark green leafy vegetables	Dark green leafy vegetables	-
-	Vitamin A rich fruits and vegetables	-
-	Other fruits and vegetables	-
-	meat and fish	-

8.5.2 Bivariate results

The bivariate analysis found that the IDDS scores for the mothers/women had a significant correlational relationship with the IDDS scores for the children (P = 0.000). Furthermore, it was observed that there were statistically significant relationships between the IDDS scores for the mothers and labour contribution (P = 0.001), annual income (P = 0.000), decisions regarding food security and nutrition matters (P = 0.028) (*Table 8.5.3*).

The analysis could not provide enough evidence of statistically significant correlational relationships between the IDDS scores for the mothers and the other variables [marital status (P = 0.184), age of mothers (P = 0.061), household size (P = 0.272), literacy levels (P = 0.924), household assets values (P = 671), training in food security and nutrition topics (P =

0.904), loan access (P = 0.268), public speaking (P = 0.220) and decisions regarding wealth (P = 323)] (*Table 8.5.3*).

It is worth noting that there was a highly significant correlational relationship between the IDDS scores for the mothers and that of the children, suggesting that mothers and children consumed similar food groups. The sample size for the children was smaller (N = 88), as compared to that of the women (N = 110). These two notions justified why only the IDDS scores for women of reproductive age (WDDS) were considered for further analysis (*see Table 8.5.3 and Table 8.5.4 on bivariate and multivariate analysis*).

Table 8.5.3: Bivariate analysis between the IDDS scores and associating demographic and socio-economic factors (N = 110)

	IDDS scores for mothers (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
IDDS scores for children ^ (N = 88)	0.757	0.43	0.75, 0.96	0.05**	0.000
Household size ^ (N = 110)	0.006	0.03	-0.10, 0.03	-0.04	0.272
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.008	0.24	-0.78, 0.15	-0.31	0.184
Age of mothers ^ (N = 110)	0.016	0.01	-0.03, 0.00	-0.02	0.061
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.007	0.14	-0.27, 0.30	0.01	0.924
Secondary n = 11)	0.007	0.21	-0.62, 0.22	-0.20	0.348
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.047	0.10	0.14, 0.55	0.35**	0.001
Annual income ^ (N = 110)	0.058	0.00	-0.00, 0.00	0.00**	0.000
Household assets values ^ (N = 110)	0.001	0.00	-0.00, 0.00	0.00	0.671
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.000	0.11	-0.23, 0.20	-0.01	0.904
No (n = 51) ǂ					

Continued

Table 8.5.3 continued: Bivariate analysis between the IDDS scores and associating demographic and socio-economic factors (N = 110)

Variables	Unadjusted R^2	Std Error	95% CI	Coefficient	P-value based on linear regression analysis
	IDDS scores for mothers (N = 110)				
Loan access ^^ (N = 109)					
No (n = 89)	0.006	0.13	-0.41, 0.11	-0.15	0.268
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.007	0.12	-0.09, 0.38	0.15	0.220
Yes, very comfortable (n = 21)	0.007	0.15	-0.20, 0.38	0.09	0.548
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.005	0.12	-0.12, 0.37	0.12	0.323
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.022	0.22	0.05, 0.91	0.48	0.028
Male and female jointly + someone else in the household (n = 81)	0.022	0.14	-0.14, 0.42	0.14	0.323

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

8.5.3 Multivariate results

The following independent variables, namely labour contribution (P = 0.001), annual income (P = 0.000), decisions regarding food security and nutrition matters (P = 0.028), marital status (P = 0.184) and the age of mothers (P = 0.061) were entered into the final multivariable linear regression analysis model.

A trial and error method was used to adjust the variables. The researcher observed statistically significant relationships between the IDDS scores for women and labour contribution (P = 0.001), decisions regarding food security and nutrition matters (P = 0.004), age of the mothers (P = 0.033) and annual income (P = 0.000) (*Table 8.5.4*).

Therefore, among all the independent variables considered, the final adjusted multivariable linear regression analysis model revealed that only labour contribution, decisions regarding food security and nutrition matters, age of the mothers and annual income were the statistically significant variables influencing the IDDS scores for the women.

Table 8.5.4: Final multivariable linear regression analysis model between the IDDS scores and associating demographic and socio-economic factors (N = 110)

	IDD scores for women (N = 110)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on multivariable linear regression analysis**
Labour contribution into two categories ^^ (N = 110)				
Highly involved (n = 55) ǂ				
Less + moderately involved (n = 55)	0.10	0.13, 0.53	0.33**	0.001
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)				
Male alone (n = 19) ǂ				
Female alone (n = 10)	0.21	0.19, 1.00	0.59**	0.004
Male and female jointly + someone else in the household (n = 81)	0.14	-0.17, 0.37	0.10	0.452
Age of mothers ^ (N = 110)	0.01	-0.03, -0.00	-0.02*	0.033
Annual income ^ (N = 110)	0.00	0.00, 0.00	0.00**	0.000

Unadjusted R^2 = 0.151, * Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

8.6 DISCUSSION

The women of reproductive age and under-five children are among vulnerable groups susceptible to suffer from the ills of food insecurity, including micronutrient deficiencies resulting from poor dietary diversity (Arimond *et al.*, 2010). The current study investigated the dietary diversity status at individual level in these two vulnerable groups. Out of the nine food groups, the mean consumption was 2.5 ± 0.8 food groups for the women and 2.5 ± 0.9 food groups for the children. A Feed the Future Initiative baseline survey in the central and southern regions of Malawi reported a higher mean food group consumption score for the women of reproductive age of 3.4 food groups (USAID, 2013). This may suggest seriously low dietary diversity in the current study.

The diet of the women and children was basically monotonous depending majorly on staples (99% women, 98% children) and dark-green leafy vegetables (80% women, 77% children), consistent with the trends reported by the Feed the Future baseline survey report (USAID, 2013). There were a few reported cases of consumption of legumes (9% women, 9% children) and meat (10% women, 11% children), as well as vitamin A rich fruits and vegetables (13% women, 16% children) which can be claimed to be unsatisfactory. Further to the researcher's dismay, literally none of the women and children consumed organ meat, eggs and or dairy foods and products during the reported consumption period. In agreement with these results, lack of dietary diversity was outlined as a challenge for rural communities in developing countries. Mostly, the diet in developing countries was reported to mainly constitute starchy staples with no or inadequate animal products (Arimond & Ruel, 2004).

In the face of accelerated nutrient demands of women of reproductive age and under-five children who are entangled in a web of HIV/AIDS and infections, the consumption of micronutrient dense foods provide a spontaneous and relatively easy way to address these needs (Arimond *et al.*, 2010). Worryingly, the consumption of vitamin A rich animal source food groups was so rare with literally none reporting to have consumed foods, such as organ meat, eggs or dairy and dairy products. However, the consumption of the vitamin A plant rich source food group was not an issue as a majority (93% women, 95% children) reported to have consumed food groups, such as vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits. Although fats and oils are not micronutrients, it is of importance to report their proportion consumption, since they play a crucial role in the absorption of vitamin A (Kennedy *et al.*, 2011). It was revealed that only a few (16% women, 16% children) reported to have consumed fats and oils.

A handful (10% women, 11% children) reported to have consumed foods that were good sources of haem-iron, such as organ meat, flesh meat, or fish. Mostly monotonous diets that are largely composed of plant-based diets cannot meet the body's requirements of iron, thus leading to nutrition iron deficiency (Zimmermann & Hurrell, 2007). Iron-deficiency anaemia is identified as a public health concern in Malawi, with more than six in every ten children (64%) and more than three in every ten women (32%) suffering from some form of anaemia in the rural areas (Government of Malawi & ICF Macro, 2016). Regardless of cause, iron deficiency is considered among the leading causes of death worldwide (Zimmermann & Hurrell, 2007).

In this study the IDDS scores were categorised in tertiles informed by the IDDS guide (Kennedy *et al.*, 2011), since there is no universally agreed cut-offs for the categorisation (Kennedy *et al.*, 2011; Cafiero *et al.*, 2014; Hendriks *et al.*, 2016). A majority (91% women, 91% children) reported to have consumed only less than or equal to three food groups. A few (9% women, 9% children) consumed four to six food groups, while none consumed more than or equal to seven food groups. Based on the Malawian dietary guidelines, each individual must eat foods from each of the six food groups (i.e. staples; animal foods; legumes and nuts; fruits; vegetables; and fats and oils) every day (Government of Malawi, 2014). In respect to this, the women and children in this study consumed way below the recommendations, adding evidence to the claim that dietary diversity was seriously low in this study group.

Bivariate analysis found that the IDDS scores for the women had a significant correlational relationship with the IDDS scores for the children ($P = 0.000$). This could mean that the children were being fed family foods without consideration of giving them special nutritious and diversified foods according to their age. Children need special nutrition attention in order for them to grow into productive and healthy adults (Arimond & Ruel, 2004; UNICEF, 2005).

The IDDS scores for the women and children were not significantly different. Considering that the sample size for the women was bigger than that of the children (110 against 88), only the IDDS scores for the women were fed into the final multivariable linear regression analysis as dependent variable.

Using the final multivariable linear regression analysis model, statistically significant relationships were observed between the IDDS scores for women (dependent variable) and the following independent variables, namely labour contribution (P = 0.001), decisions regarding food security and nutrition matters (P = 0.004), age of the mothers (P = 0.033) and annual income (P = 0.000).

For the annual income variable, the results suggested that an increase in one US dollar to the household resulted in a 0.001 factor increase in the IDDS scores for the women, indicating a positive correlational relationship (P = 0.000). Globally, many authors have also reported a positive association between income and dietary diversity. For instance, Gehlhar and Coyle (2001) and Mayén, Marques-Vidal, Paccaud, Bovet and Stringhini (2014) demonstrated that an increase in income usually results in an increase in diversified food expenditures in both developing and developed countries. A South African study suggested a higher probability of the high income groups to move from a medium dietary diversity status to a high dietary diversity status (Taruvinga *et al.*, 2013). In Germany, purchase and consumption of a variety of foods were also reported to significantly correlate to an increase in income (Thiele & Weiss, 2003).

For the age of the mothers variable, the results suggested that an increase in the age of the mothers by one year resulted in a decrease in the IDDS scores for the mothers by the factor of 0.02, suggesting a negative relationship (P = 0.033). These results are consistent with a study that was conducted in Mali, that reported a negative relationship between individual dietary diversity and age (Torheim, Ouattara, Diarra, Thiam, Barikmo, Hatløy & Oshaug, 2004). However, contrasting results were observed in a study in South Africa that reported a positive relationship between age and dietary diversity, although it was not a statistically significant relationship (Taruvinga *et al.*, 2013). Contrary results were also noted in a study in Germany that reported that age increase (greater than 46 years old) caused a statistically significant increase in consumption and purchase of a variety of foods (Thiele & Weiss, 2003). Therefore, age can be speculated to have a complex relationship with dietary diversity.

For the labour contribution variable, the results suggested that the IDDS scores for the women, who felt they were less and or moderately involved in tobacco labour, increased by the factor of 0.33, as compared to those who felt they were highly involved in tobacco labour (P = 0.001). This shows that having free time was a beneficial decisive factor to contribute to the women's consumption of diversified foods. As already pointed out, women's high involvement in tobacco labour could not necessarily depict an additional income to the household because in most instances, labour contribution from female spouses and children is almost free (ILO, 2011). Satisfaction with labour involvement and time availability for leisure activities are considered among the five domains of women empowerment (Alkire *et al.*, 2013). Time burden was among the main domains contributing to women disempowerment in Uganda (Alkire *et al.*, 2013). Women, who were found to be highly empowered in a study in Bangladesh, showed great contribution to the household food security, because they were involved in activities that increased their income and increased their participation in decision making process. Furthermore, they were involved in activities that build-up their health and nutrition knowledge, control over capital, and participation in social and political agendas (Kabir *et al.*, 2014). In central and southern Malawi, where women were highly involved in domestic and agricultural activities, workload was found to be the second highest contributor to women disempowerment (USAID, 2013).

For the decisions regarding the food security and nutrition matters variable, the results suggested that there was an increase in the IDDS scores by the factor of 0.59 when females alone made decisions regarding food security and nutrition matters in the household compared to when the decisions were made by the men alone (P = 0.004). This could imply that when the women are the ones making decisions regarding food security and nutrition matters, the individuals are likely to consume diversified diets. These results are consistent with a study in Germany that reported that single male compared to female households consumed a significantly smaller number of different food products (Thiele & Weiss, 2003). A body of evidence from Africa, Asia and Latin America suggests that when women are empowered to make economic decisions, there is a spill over effect on food security benefits, not only to themselves, but also to the rest of household members (Quisumbing, Brown, Feldstein, Haddad & Peña, 1995; Ibnouf, 2009).

8.7 STRENGTH AND LIMITATIONS

8.7.1 Strength

- The IDDS questionnaire's adaptation and piloting processes that were done prior to the data collection, assisted the researcher to incorporate local foods as opposed to those listed in the IDDS guide. This helped to speed up the data collection and analysis processes, besides providing a more realistic and valid picture of the diet for the tenants.

8.7.2 Limitations

- Reflection of dietary patterns for the tobacco tenant farmers was limited since only one 24 hours recall period was used in the study.
- Data on actual portion sizes of foods consumed were not collected. As such, it was impossible to report on actual amount of nutrients obtained from the foods consumed.
- There are differences in number of food groups used in the IDDS and those promoted in Malawi as a country. The IDDS uses nine food groups, while in Malawi six food groups are promoted. This could be a possible source of controversy regarding to what qualifies to be an optimum number of food groups for a diverse diet.
- There is fear that some women were at times deliberately under reporting the meals they consumed thinking that by doing so they would qualify for hand-outs or aid of some kind. This was observed during probing and cross-checking of information with spouses, where a woman would change what they reported earlier on.

8.8 CONCLUSION

Dietary diversity is seriously low and poor in the women of reproductive age involved in smallholder tobacco farming and their under-five children in the North Mzimba district in the northern region of Malawi. The diet was basically monotonous, almost entirely constituting starchy staples. Other vitamin A fruits and vegetables, ordinary vegetables, legumes, seeds and nuts, flesh meats and fish were consumed by a few individuals only. None of the individuals consumed organ meat, eggs and or dairy and dairy products. However, the opposite was true for the dark green leafy vegetables, as more than half of the individuals reported to have consumed them, which is a positive aspect that needs to be strengthened.

The age of the mothers, contribution and involvement in tobacco labour, annual income and decisions made regarding food security and nutrition matters were significant factors influencing the dietary diversity. This revelation of the associating factors of the IDDS is a good entry point for policy formulation and or planning of interventions aimed at improving the dietary diversification of the tenant women and their under-five children on the tobacco farms.

8.9 RECOMMENDATIONS

- Food consumption methods (e.g. semi-quantitative food frequency questionnaires) that incorporate portion sizes to estimate the real nutrient adequacy of the diet of tobacco tenant farmers need to be considered in future research.
- Research designs that could follow the tobacco tenant farmers for a lengthy period, covering different seasons of the year to establish more realistic dietary patterns, need to be considered in future research.
- Women should be recognised for their involvement in informal labour settings and remunerated accordingly for their involvement to improve the dietary diversity of households.

CHAPTER 9

NUTRITION STATUS INDICATORS OF WOMEN AND CHILDREN

9.1 INTRODUCTION

This chapter presents findings of the anthropometric measurements to describe the nutrition status of the women of reproductive age and their under-five children. The anthropometric data were collected from the women of reproductive age and their under-five children in January and February 2016 during the face-to-face interviews in Mzimba North district in the northern region of Malawi.

The chapter is organised in the following sections: introduction, objectives, data analysis, results, discussion, strength and limitations, conclusion and recommendations.

9.2 OBJECTIVES

9.2.1 To assess and describe the nutrition status of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by use of anthropometric measurements to calculate body mass index (BMI), weight-for-age (underweight), weight-for-height (wasting), height-for-age (stunting) and BMI-for-age (wasting) indices.

9.2.2 To determine and report the relationships between nutrition status indicators and associating factors (demographic, socio-economic, HFIAS scores, HHS scores, MAHFP scores and IDDS scores) of the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

9.3 DATA ANALYSIS

The data analyses were threefold, namely univariate, bivariate and multivariate. Data quality and management were ensured at all levels from the study conception to analysis. (*Refer to section 3.5 on data collection, data quality and management, as well as validity and reliability of the measurement tools.*)

9.3.1 Univariate analysis

This statistical analysis was performed to provide descriptive statistics of a single variable derived from the anthropometric data for the women (BMI) and children (height-for-age, weight-for-height, weight-for-age and BMI-for-age) to address "objective 9.2.1" (i.e. to assess and describe the nutrition status of the women of reproductive age and their under-five children).

9.3.1.1 Nutrition status of women of reproductive age

The nutrition status of the women of reproductive age was analysed by entering the weight and height variables in Microsoft Excel version 2013. The BMI indicator was calculated. The BMI was used to measure underweight and obesity. The BMI is defined as weight in kilograms divided by height in metres squared (kg/m^2) (Geissler & Powers, 2011). The WHO cut-off points were used. A cut-off point of $18.5kg/m^2$ is used to define underweight or acute undernutrition, and a BMI of $25.0kg/m^2$ or more usually indicates overweight or obesity. Specifically, less than $16.0kg/m^2$ is severe underweight, $16.0kg/m^2$ to $18.4kg/m^2$ is moderate underweight, $18.5kg/m^2$ to $24.9kg/m^2$ is normal nutrition status and $25.0kg/m^2$ to $29.9kg/m^2$ is overweight (Government of Malawi, 2014).

$$\boldsymbol{The\ body\ mass\ index, BMI} = \frac{\boldsymbol{Weight\ (kg)}}{\boldsymbol{Heigh\ (m)^2}}$$

9.3.1.2 Nutrition status of under-five children

Weight and height measurements of the under-five children were primary variables during data analysis. Other important variables included age and sex. The data were entered and analysed using the WHO Anthro software version 3.2.2. Anthropometric indices, namely height-for-age, weight-for-height, weight-for-age and BMI-for-age were derived. These indices provide different information about growth and body composition, which is used to assess nutrition status (Geissler & Powers, 2011). The WHO growth standards using Z-score standard deviations were used to describe the nutrition status of the under-five children (WHO, 2008).

The ***height/length-for-age*** index is an indicator of linear growth retardation and cumulative growth deficits. The under-five children whose height-for-age Z-score is below minus two standard deviations (-2 SD) are considered short for their age or stunted, and are chronically malnourished. The under-five children who are below minus three standard deviations (-3 SD) are considered severely stunted. Stunting reflects failure to receive adequate nutrition over a long period and is also affected by recurrent and chronic illness. Therefore, the height-for-age represents the long-term effects of malnutrition in a population, and is not sensitive to recent, short-term changes in dietary intake (WHO, 2008).

The ***weight-for-height/length*** index measures body mass in relation to body height or length and describes current nutrition status. The under-five children whose Z-scores are below minus two standard deviations (-2 SD) are considered thin, or wasted, and are acutely malnourished. The wasting represents the failure to receive adequate nutrition in the period immediately preceding the survey. It may result from inadequate food intake or a recent episode of illness causing loss of weight and the onset of malnutrition. The children whose weight-for-height is below minus three standard deviations (-3 SD) are considered severely wasted (WHO, 2008). Those whose Z-scores are more than one, two and three standard deviations (+1, +2 and +3 SD) are considered at risk of overweight, overweight and obese respectively (WHO, 2008).

The ***weight-for-age*** is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Under-five children whose weight-for-age is below minus two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Under-five children whose weight-for-age is below minus three standard deviations (-3 SD) from the median of the reference population are considered severely underweight (WHO, 2008).

The ***BMI-for-age*** index is an indicator that is especially important when screening for children's overweight and obesity status. The BMI-for-age index is not very much different from the weight-for-length/height index. In many instances these two indices tend to display similar results and they also use similar cut-off points (WHO, 2008).

9.3.2 Bivariate analysis

This statistical analysis was performed to determine the linear relationships between two variables to address “objective 9.2.2” (i.e. to determine and report the correlational relationships between the nutrition status indicator and the respective associating demographic and socio-economic factors, HFIAS scores, HHS scores, MAHFP scores or IDDS scores).

The univariate data outputs from Microsoft Excel version 13 (for demographic, socio-economic, HFIAS, HHS, MAHFP, IDDS for women and BMI for women), and Z-scores for children from the WHO Anthro software version 3.2.2 were exported to Stata Statistics and Data Analysis computer package version 14.0 for bivariate analysis. Before the analysis, the variables that violated some statistical assumptions made were removed (*refer to section 3.6.2 on assumptions*). Examples of variables that were dropped because they seemed to be constant across the sample included main occupation, visitation to the under-five clinics, frequency of visitation to the under-five clinics, affiliation to farmer-based organisations and intention to join farmer-based organisations.

The remaining variables were then organised as either categorical or numerical (*Table 9.3.1*). The dependent and independent variables were also identified. The variables were continually reorganised depending on the type of dependent variable and the logical interpretation of the relationships. Two sets of tests were conducted as follows:

- Testing for the relationships between the dependent variable (BMI for women) and each of the independent variables separately using linear regression analysis at the 95% confidence interval and 0.05 level of significance.
- Testing for the relationships between the dependent variable (Z-scores for children) and each of the independent variables separately using random-effects Generalised Least Squares (GLS) regression analysis at the 95% confidence interval and 0.05 level of significance. The random-effects Generalised Least Squares (GLS) regression analysis considered the household as a group variable to cater for household dependency where a mother had more than one child per household (Hsiao, 2014).

Table 9.3.1: Type of data used in the nutrition status bivariate analyses

Numerical	Categorical (nominal)	Categorical (ordinal)
• BMI for women • Z-scores for children • HFIAS scores • HHS scores • MAHFP scores • IDDS scores for women • Age of women of reproductive age • Age of children • Household size • Household annual income (USD) • Household assets values/wealth (USD)	• Marital status • Sex of under-five children • Training in food security and nutrition topics • Loan access • Involvement in decision making process regarding wealth • Involvement in decision making process regarding food security and nutrition matters	• Tobacco labour contribution • Public speaking and representation in community development agendas • Literacy levels

9.3.2.1 Dependent variables

There were two types of dependent variables as follows:

- The numerical BMI scores for the women. The BMI score was chosen in consultation with the statistician in respect to the selected statistical testing (linear regression analysis) to be performed.
- The numerical Z-scores for children. The Z-scores were chosen in consultation with the statistician in respect to the selected statistical testing (random-effects GLS regression analysis) to be performed. Many studies have also used Z-scores as dependent variables (Hong & Mishra, 2006; Baig-Ansari, Rahbar, Bhutta & Badruddin, 2006).

9.3.2.2 Independent variables

The rest of the variables, apart from the BMI scores for the women and Z-scores for children, were considered to be the independent variables (*Table 9.3.1*). The independent variables were either numerical or categorical (*Table 9.3.1*). (*Refer to Tables 9.4.5 to 9.4.16 in the results section for the names and reference categories*.)

9.3.3 Multivariate analysis

This statistical analysis was performed to provide assessment of more than two variables to further address "objective 9.2.2" (i.e. to determine and report the correlational relationships amongst the demographic and socio-economic factors, HFIAS scores, HHS scores, MAHFP scores, IDDS scores, and identify the significant factors influencing the BMI for the women or Z-scores for the children).

After performing the bivariate tests for the relationships using linear regression analysis (for BMI scores for women), and random-effects GLS regression analysis (for Z-scores for children), the independent variables that were observed to have statistical significant correlational relationship with the BMI scores for women or Z-scores for children (at least at 0.1 level of significance) were automatically considered to be fed into the final multivariable regression analysis model [i.e. linear, random-effects Generalised Least Squares (GLS), and or Instrumental Variables (IV)]. The independent variables were then adjusted one by one through a trial and error method, while observing the level of significance of the variables until a final logical model was established.

The general multivariable regression analysis model that formed the basis for analysis in the study was specified as outlined by Wooldridge (2013) (*Figure 9.3.1*).

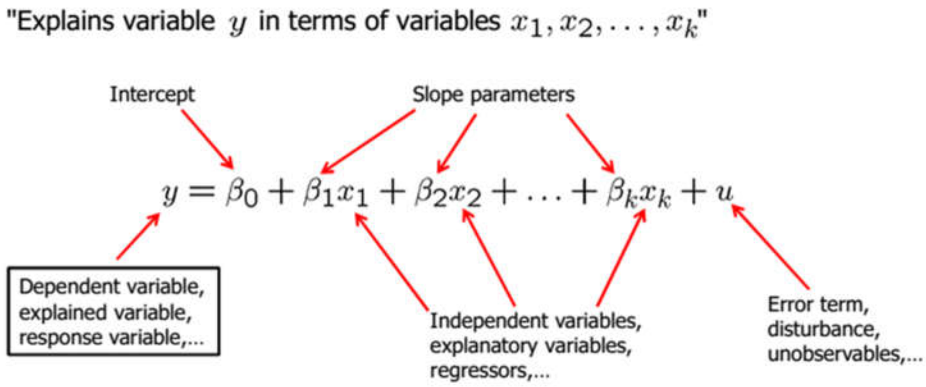


Figure 9.3.1: The general regression analysis model (Wooldridge, 2013)

9.4 RESULTS

9.4.1 Univariate results

9.4.1.1 Demographic, socio-economic, HFIAS, HHS, MAHFP and IDDS indicators

For the univariate analysis results of the associating factors, including the demographic, socio-economic, HFIAS, HHS, MAHFP and IDDS indicators (*refer to chapters' 4 to 8*).

9.4.1.2 Nutrition status indicators

9.4.1.2.1 BMI for the women of reproductive age

The anthropometric measurements (weight and height) for the women were used to calculate the BMI. The mean weight was 51kg ± 6.8, while the mean height was 157cm ± 5.7 (*Table 9.4.1*). The study revealed that 21% of the women of reproductive age were malnourished (N = 110), out of which 15% were underweight and 6% were overweight. None of the women were obese (*Figure 9.4.1*).

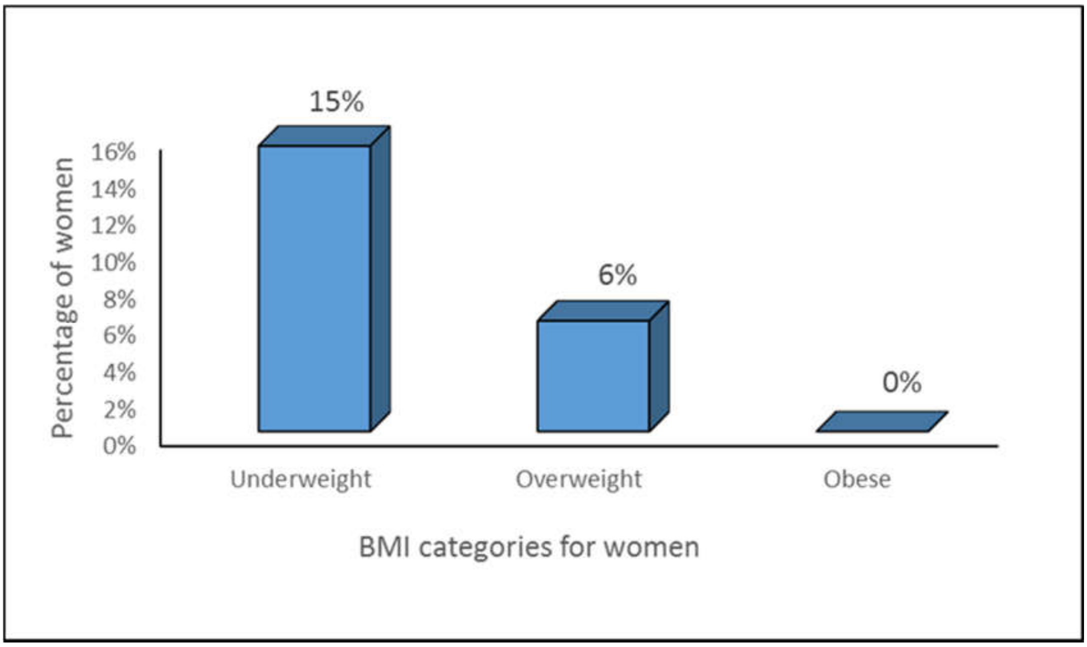


Figure 9.4.1: Proportion of women of reproductive age by BMI category (N = 110)

Table 9.4.1: Summary statistics for weight and height measurements of women (N = 110)

Statistical calculation	Weight (kg)	Height (cm)
Mean	51.4	157.3
Median	50.7	157.8
Mode	49.0	152.0
Standard deviation	6.8	5.7
Minimum	37.5	140.3
Maximum	72.0	170.3

9.4.1.2.2 Z-score indices for the under-five children

Note that the sample size of the under-five children (N) was 139. However, the sample size for specific nutrition status indices varied due to missing age, height and weight values.

For the under-five children (N = 139), anthropometric measurements (weight and height) were used and four nutrition status indicators, namely weight-for-height/length, length/height-for-age, weight-for-age and BMI-for-age were derived.

For the weight-for-length/height index, 23% of the under-five children (N = 131) were malnourished (i.e. 12% severely wasted, 8% wasted, and 2% overweight, 1% obese). For the length/height-for-age index, 31.3% of the under-five children (N = 131) were stunted, i.e. 11.5% severely stunted and 19.8% stunted. For the weight-for-age index, 34% of the under-five children (N = 133) were underweight, i.e. 12% severely underweight and 22% underweight. For the BMI-for-age index, 22.5% of the under-five children (N = 129) were malnourished (i.e. 9.3% severely wasted, 7.8% wasted, and 5.4% overweight, 0% obese) (*Table 9.4.2*).

Out of the 139 under-five children, 52% were males. For the weight-for-length/height index, 34.9% of the male under-five children (n = 66) were malnourished (i.e. 18.2% severely wasted, 10.6% wasted, and 4.6% overweight, 1.5% obese). For the length/height-for-age index, 34.4% of the male under-five children (n = 64) were stunted, i.e. 14.1% severely stunted and 20.3% stunted. For the weight-for-age index, 44.8% of the male under-five children (n = 67) were underweight, i.e. 17.9% severely underweight and 26.9% underweight. For the BMI-for-age index, 32.3% of the male under-five children (n = 65) were malnourished (i.e. 13.8% severely wasted, 10.8% wasted, and 7.7% overweight, 0% obese) (*Table 9.4.3*).

Out of the 139 under-five children, 48% were females. For the weight-for-length/height index, 10.8% of the female under-five children (n = 65) were malnourished (i.e. 6.2% severely wasted, 4.6% wasted, and 0% overweight, 0% obese). For the length/height-for-age index, 28.4% of the female under-five children (n = 67) were stunted, i.e. 9% severely stunted and 19.4% stunted. For the weight-for-age index, 22.7% of the female under-five children (n = 66) were underweight, i.e. 6.1% severely underweight and 16.6% underweight. For the BMI-for-age index, 12.5% of the female under-five children (n = 64) were malnourished (i.e. 4.7% severely wasted, 4.7% wasted, and 3.1% overweight, 0% obese) (*Table 9.4.4*).

The detailed tabular descriptions of the anthropometric indicators showing confidence intervals, means and standard deviations are provided in the appendices section. (*Refer to Appendix 14 for the anthropometric indicators combining male and female under-five children, Appendix 15 for the male under-five children alone, and Appendix 16 for the female under-five children alone*.)

Table 9.4.2: Frequency distribution of anthropometric indicators of the under-five children with sexes combined (N = 139)

Set 1: Sexes combined					
Index / Z-score	(< -3SD)	(< -2SD)	(> +1SD)	(> +2SD)	(> +3SD)
Weight-for-length/height (N = 131)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	12.2	7.6	8.8	2.3	0.8
Length/height-for-age (N = 131)	Severely stunted	Stunted	-	-	-
(%)	11.5	19.8	-	-	-
Weight-for-age (N = 133)	Severely underweight	Underweight	-	-	-
(%)	12.0	21.8	-	-	-
BMI-for-age (N = 129)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	9.3	7.8	9.3	5.4	0

Table 9.4.3: Frequency distribution of anthropometric indicators of the male under-five children (n = 72)

Set 2: Males					
Index \ Z-score	(< -3SD)	(< -2SD)	(> +1SD)	(> +2SD)	(> +3SD)
Weight-for-length/height (n = 66)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	18.2	10.6	6.0	4.6	1.5
Length/height-for-age (n = 64)	Severely stunted	Stunted	-	-	-
(%)	14.1	20.3	-	-	-
Weight-for-age (n = 67)	Severely underweight	Underweight	-	-	-
(%)	17.9	26.9	-	-	-
BMI-for-age (n = 65)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	13.8	10.8	7.7	7.7	0

Table 9.4.4: Frequency distribution of anthropometric indicators of the female under-five children (n = 67)

Set 3: Females					
Index \ Z-score	(< -3SD)	(< -2SD)	(> +1SD)	(> +2SD)	(> +3SD)
Weight-for-length/height (n = 65)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	6.2	4.6	12.3	0	0
Length/height-for-age (n = 67)	Severely stunted	Stunted	-	-	-
(%)	9.0	19.4	-	-	-
Weight-for-age (n = 66)	Severely underweight	Underweight	-	-	-
(%)	6.1	16.6	-	-	-
BMI-for-age (n = 64)	Severely wasted	Wasted	Risk of overweight	Overweight	Obese
(%)	4.7	4.7	11.0	3.1	0

9.4.2 Bivariate results

9.4.2.1 BMI for the women

Bivariate analysis found that the BMI scores for the women had a significant correlational relationship with the age of the mothers (P = 0.004), literacy levels (P = 0.018) and loan access (P = 0.000) (*Table 9.4.5*).

The analysis failed to prove existence of statistical significant correlational relationships between the BMI scores for the women and the other variables [household size (P = 0.100), decisions regarding food security and nutrition matters (P = 0.100), marital status (P = 0.437), labour contribution (P = 0.997), annual income (P = 0.644), household assets values (P = 0.623), training in food security and nutrition topics (P = 0.679), public speaking (P = 0.778) and decisions regarding wealth (P = 0.713)] (*Table 9.4.5*).

Table 9.4.5: Bivariate analysis between the BMI scores and associating factors (N = 110)

	BMI scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Household size ^ (N = 110)	0.012	0.10	-0.03, 0.35	0.16	0.100
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.003	0.67	-1.85, 0.80	-0.52	0.437
Age of mothers ^ (N = 110)	0.038	0.02	0.02, 0.12	0.07**	0.004
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.051	0.40	-0.49, 1.08	0.30	0.461
Secondary (n = 11)	0.051	0.59	-2.59, -0.25	-1.42**	0.018
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.000	0.31	-0.60, 0.60	0.00	0.997
Annual income ^ (N = 110)	0.001	0.16	-0.40, 0.25	-0.08	0.644
Household assets values ^ (N = 110)	0.001	0.23	-0.56, 0.33	-0.11	0.623
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.000	0.31	-0.48, 0.73	0.13	0.679
No (n = 51) ǂ					

Continued

Table 9.4.5 continued: Bivariate analysis between the BMI scores and associating factors (N = 110)

	BMI scores (N = 110)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on linear regression analysis**
Loan access ^^ (N = 109)					
No (n = 86) ǂ					
Yes (n = 23)	0.058	0.37	0.62, 2.06	1.34**	0.000
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.001	0.34	-0.77, 0.57	-0.10	0.776
Yes, very comfortable (n = 21)	0.001	0.43	-0.72, 0.96	0.12	0.778
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.000	0.36	-0.57, 0.83	0.13	0.713
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.015	0.62	-0.20, 2.26	1.03	0.100
Male and female jointly + someone else in the household (n = 81)	0.015	0.41	-0.69, 0.92	0.12	0.775

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.2.2 Length/height-for-age for children

Bivariate analysis found that the height-for-age Z-scores for the under-five children had statistically significant correlational relationship with the age of the mothers (P = 0.019), sex of the children (P = 0.002), as well as the HFIAS categories (P = 0.006) (*Table 9.4.6*).

The analysis failed to provide evidence of statistically significant correlational relationships between the height-for age Z-scores for the children and the other variables [annual income categories (P = 0.102), household assets values (P = 0.078), marital status (P = 0.184), age of children (P = 0.965), HHS scores (P = 0.475), MAHFP scores (P = 0.571), IDDS scores (P = 297), household size (P = 0.921), BMI categories of mothers (P = 0.872), labour contribution (P = 0.648), training in food security and nutrition topics (P = 0.231), loan access (P = 0.956), public speaking (P = 0.919), decisions regarding wealth (P = 0.703), decisions regarding food security and nutrition matters (P = 0.786) and literacy levels (P = 0.296)] (*Table 9.4.6*).

Table 9.4.6: Bivariate analysis between the height-for-age Z-scores and associating factors (N = 110)

	Height-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Age of children ^ (N = 139)	0.000	0.10	-0.02, 0.02	0.00	0.965
HHS scores ^ (N = 110)	0.004	0.09	-0.23, 0.11	-0.06	0.475
MAHFP scores ^ (N = 110)	0.003	0.07	-0.17, 0.09	-0.04	0.571
IDDS scores for mothers ^ (N = 110)	0.009	0.20	-0.61, 0.19	-0.21	0.297
Household size ^ (N=110)	0.000	0.10	-0.21, 0.19	-0.01	0.921
BMI of mothers in two categories ^^ (N = 110)					
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.000	0.40	-0.72, 0.85	0.07	0.872
Normal (18.5 to 24.9) (n = 88) ǂ					
Age of mother in two categories ^^ (N = 110)					
Less than or equal to 30 years (n = 78) ǂ					
Greater than 30 years (n = 32)	0.040	0.34	-1.44, -0.13	-0.78**	0.019
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.002	0.31	-0.47, 0.76	0.14	0.648
Sex of children ^^ (N = 138)					
Females (n = 67) ǂ					
Males (n = 72)	0.039	0.29	-1.49, -0.34	-0.92**	0.002
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.110	0.31	-0.98, 0.24	-0.37	0.231
No (n = 51) ǂ					

Continued

Table 9.4.6 continued: Bivariate analysis between the height-for-age Z-scores and associating factors (N = 110)

	Height-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.000	0.40	-0.81, 0.77	-0.02	0.956
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.003	0.35	-0.90, 0.47	-0.21	0.541
Yes, very comfortable (n = 21)	0.003	0.44	-0.90, 0.81	-0.04	0.919
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.001	0.36	-0.57, 0.85	0.14	0.703
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.009	0.64	-1.91, 0.59	-0.66	0.300
Male and female jointly + someone else in the household (n = 81)	0.009	0.40	-0.90, 0.68	-0.11	0.786
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.013	0.70	-2.30, 0.44	-0.93	0.184

Continued

Table 9.4.6 continued: Bivariate analysis between the height-for-age Z-scores and associating factors (N = 110)

	Height-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.013	0.42	-0.95, 0.70	-0.13	0.765
Secondary (n = 11)	0.013	0.60	-0.62, 1.74	0.55	0.356
Annual income into four categories ^^ (N = 110)					
Less than USD 100 (n = 13) ǂ					
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.022	0.50	-1.51, 0.46	-0.52	0.296
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.022	0,55	-1.71, 0.46	-0.63	0.258
Greater than USD 300 (n = 21)	0.022	0.56	-2.01, 0.18	-0.91	0.102
Household assets values in three categories ^^ (N = 110)					
Less than USD 50 (n = 77) ǂ					
Greater than or equal to USD 50, but < USD 100 (n = 21)	0.032	0.40	-0.08, 1.50	0.71	0.078
Greater than or equal to USD 100 (n = 12)	0.032	0.49	-0.28, 1.64	0.67	0.166
HFIAS in three categories ^^ (N = 100)					
Food secure + mildly food insecure access (n = 14) ǂ					
Moderately food insecure access (n = 11)	0.066	0.65	-3.06, -0.52	-1.79**	0.006
Severe food insecure access (n = 75)	0.066	0.46	-1.37, -0.41	-0.48	0.291

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.2.3 Weight-for-age for children

Bivariate analysis found that the weight-for-age Z-scores for the under-five children had a statistically significant correlational relationship with the household assets values (P = 0.028), age categories of the mothers (P = 0.004), sex of the children (P = 0.045), age categories of the children (P = 0.002) and annual income categories (P = 0.048) (*Table 9.4.7*).

The analysis failed to provide evidence of statistically significant correlational relationships between the weight-for-age Z-scores and the other variables [HHS scores (P = 0.069), MAHFP scores (P = 0.120), BMI categories for the women (P = 0.126), HFIAS scores (P = 0.489), IDDS scores for the women (P = 0.907), household size (P = 0.344), labour contribution (P = 0.923), training in food security and nutrition topics (P = 0.583), loan access (P = 0.335), public speaking (P = 0.646), decisions regarding wealth (P = 0.712), decisions regarding food security and nutrition matters (P = 0.246), marital status (P = 0.949) and literacy levels (P = 0.341)] (*Table 9.4.7*).

Table 9.4.7: **Bivariate analysis between the weight-for-age Z-scores and associating factors (N = 110)**

Variables	Weight-for-age Z-scores (N = 135)				
	Unadjusted R^2	Std Error	95% CI	Coefficient	P-value based on random-effects GLS regression analysis
Household assets values ^ (N = 110)	0.034	0.00	0.00, 0.00	0.00*	0.028
HFIAS scores ^ (N = 110)	0.004	0.16	-0.04, 0.02	-0.01	0.489
HHS scores ^ (N = 110)	0.024	0.07	-0.27, 0.01	-0.13	0.069
MAHFP scores ^ (N = 110)	0.018	0.05	-0.02, 0.19	0.09	0.120
IDDS scores for mothers ^ (N = 110)	0.000	0.17	-0.35, 0.31	-0.02	0.907
Household size ^ (N = 110)	0.007	0.08	-0.24, 0.08	-0.08	0.344
BMI of mothers in two categories ^^ (N = 110)					
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.017	0.34	-1.17, 0.14	-0.51	0.126
Normal (18.5 to 24.9) (n = 88) ǂ					
Age of mother in two categories ^^ (N = 110)					
Less than or equal to 30 years (n = 78) ǂ					
Greater than 30 years (n = 32)	0.058	0.28	-1.35, -0.26	-0.81**	0.004
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.000	0.26	-0.49, 0.54	0.03	0.923
Sex of children ^^ (N = 138)					
Females (n = 67) ǂ					
Males (n = 72)	0.029	0.26	-1.03, -0.01	-0.52*	0.045
Training in food security and nutrition topics ^^ (N = 110)					
Yes (N = 59)	0.002	0.26	-0.66, 0.37	-0.14	0.583
No (N = 51) ǂ					

Continued

Table 9.4.7 continued: Bivariate analysis between the weight-for-age Z-scores and associating factors (N = 110)

	Weight-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.007	0.34	-0.34, 0.99	0.33	0.335
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.002	0.29	-0.56, 0.59	0.02	0.951
Yes, very comfortable (n = 21)	0.002	0.38	-0.55, 0.89	0.17	0.646
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.001	0.30	-0.48, 0.70	0.11	0.712
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.014	0.53	-1.01, 1.08	0.04	0.945
Male and female jointly + someone else in the household (n = 81)	0.014	0.34	-1.05, 0.27	-0.39	0.246
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.000	0.60	-1.13, 1.21	0.04	0.949

Continued

Table 9.4.7 continued: Bivariate analysis between the weight-for-age Z-scores and associating factors (N = 110)

	Weight-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.021	0.35	-0.90, 0.48	-0.21	0.551
Secondary (n = 11)	0.021	0.51	-0.51, 1.47	0.48	0.341
Age of children in five categories ^^ (N = 139)					
Less than or equal to 11 months (n = 19) ǂ					
Greater than 11 months, but less than or equal to 23 months (n = 32)	0.068	0.44	-1.84, -0.10	-0.97*	0.028
Greater than 23 months, but less than or equal to 35 months (n = 31)	0.068	0.44	-1.71, -0.00	-0.86*	0.049
Greater than 35 months, but less than or equal to 47 months (n = 24)	0.068	0.46	-1.79, 0.01	-0.89*	0.053
Greater than 47 months, but less than or equal to 60 months (n = 33)	0.068	0.43	-2.17, -0.48	-1.33**	0.002
Annual income into four categories ^^ (N = 110)					
Less than USD 100 (n = 13) ǂ					
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.045	0.41	-0.21, 1.38	0.58	0.152
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.045	0.45	0.01, 1.77	0.89*	0.048
Greater than USD 300 (n = 21)	0.045	0.45	-0.79, 0.98	0.10	0.832

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.2.4 Weight-for-length/height for children

Bivariate analysis found that the weight-for-height Z-scores for the children had a statistically significant correlational relationship with the MAHFP scores (P = 0.043), BMI categories for the mothers (P = 0.054), age categories for the children (P = 0.007), annual income categories (P = 0.012) and household assets value categories (P = 0.023) (*Table 9.4.8*).

The analysis failed to provide evidence of statistically significant correlational relationships between the weight-for-height Z-scores for the children and the other variables [HFIAS scores (P = 0.315), IDDS scores (P = 0.496), household size (P = 0.386), age of the mothers (P = 0.279), labour contribution (P = 0.785), sex of the children (P = 0.599), training in food security and nutrition topics (P = 0.826), loan access (P = 0.296), public speaking (P = 0.532), decisions regarding wealth (P = 0.833), decisions regarding food security and nutrition matters (P = 0.267), marital status (P = 0.214) and literacy level (P = 0.558)] (*Table 9.4.8*).

Table 9.4.8: Bivariate analysis between the weight-for-height Z-scores and associating factors (N = 110)

	Weight-for-height Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
HFIAS scores ^ (N = 110)	0.008	0.02	-0.06, 0.02	-0.02	0.315
HHS scores ^ (N = 110)	0.018	0.10	-0.33, 0.04	-0.15	0.120
MAHFP scores ^ (N = 110)	0.030	0.07	0.00, 0.04	0.15*	0.043
IDDS scores for mothers ^ (N = 110)	0.004	0.23	-0.29, 0.61	0.16	0.496
Household size ^ (N = 110)	0.006	0.11	-0.32, 0.12	-0.10	0.386
Age of mother ^ (N = 110)	0.009	0.03	-0.09, 0.03	-0.03	0.279
BMI of mothers in two categories ^^ (N = 110)					
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.042	0.45	-1.74, 0.01	-0.86*	0.054
Normal (18.5 to 24.9) (n = 88) ǂ					
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.001	0.35	-0.79, 0.60	-0.10	0.785
Sex of children ^^ (N = 138)					
Females (n = 67) ǂ					
Males (n = 72)	0.002	0.35	-0.88, 0.51	-0.19	0.599
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.000	0.35	-0.61, 0.77	0.08	0.826
No (n = 51) ǂ					
Loan access ^^ (N = 109)					
No (n = 86)	0.008	0.45	-0.41, 1.36	0.47	0.296
Yes (n = 23) ǂ					

Continued

Table 9.4.8 continued: Bivariate analysis between the weight-for-height Z-scores and associating factors (N = 110)

	Weight-for-height Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.005	0.39	-0.53, 1.02	0.25	0.532
Yes, very comfortable (n = 21)	0.005	0.49	-0.63, 1.30	0.33	0.497
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.000	0.41	-0.71, 0.88	0.09	0.833
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.035	0.71	-0.60, 2.17	0.78	0.267
Male and female jointly + someone else in the household (n = 81)	0.035	0.45	-1.36, 0.40	-0.48	0.282
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.012	0.79	-0.57, 2.53	0.98	0.214
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.007	0.48	-1.21, 0.65	-0.28	0.558
Secondary (n = 11)	0.007	0.68	-1.12, 1.54	0.21	0.760

Continued

Table 9.4.8 continued: Bivariate analysis between the weight-for-height Z-scores and associating factors (N = 110)

	Weight-for-height Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Age of children in five categories ^^ (N = 139)					
Less than or equal to 11 months (n = 19) ǂ					
Greater than 11 months, but less than or equal to 23 months (n = 32)	0.060	0.60	-1.89, 0.48	-0.71	0.242
Greater than 23 months, but less than or equal to 35 months (n = 31)	0.060	0.60	-2.40, -0.06	-1.23*	0.039
Greater than 35 months, but less than or equal to 47 months (n = 24)	0.060	0.63	-2.29, 0.17	-1.06	0.090
Greater than 47 months, but less than or equal to 60 months (n = 33)	0.060	0.59	-2.74, -0.43	-1.59**	0.007
Annual income sales into four categories ^^ (N = 110)					
Less than USD 100 (n = 13) ǂ					
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.080	0.55	0.31, 2.44	1.37**	0.012
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.080	0.60	0.77, 3.13	1.95**	0.001
Greater than USD 300 (n = 21)	0.080	0.61	-0.24, 2.14	0.95	0.116
Household assets values in three categories ^^ (N = 110)					
Less than USD 50 (n = 77) ǂ					
Greater than or equal to USD 50, but < USD 100 (n = 21)	0.054	0.45	-1.91, -0.14	-1.02*	0.023
Greater than or equal to USD 100 (n = 12)	0.054	0.54	-0.47, 1.65	0.59	0.275

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.2.5 BMI-for-age for children

Bivariate analysis found that the BMI-for-age Z-scores for the under-five children had a statistically significant correlational relationship with the age of the children (P = 0.024), MAHFP scores (P = 0.038), BMI categories for the women (P = 0.050), annual income categories (P = 0.002) and household assets value categories (P = 0.016) (*Table 9.4.9*).

The analysis failed to provide evidence of statistically significant correlational relationships between the BMI-for-age Z-scores and the other variables [HHS scores (P = 0.128), marital status (P = 0.189), HFIAS scores (P = 0.251), IDDS scores (P = 0.460), household size (P = 0.293), age of the mothers (P = 0.333), labour contribution (P = 0.813), sex of the children (P = 0.854), training in food security and nutrition topics (P = 0.826), loan access (P = 0.279, public speaking (P = 0.530), decisions regarding wealth (P = 0.999), decisions regarding food security and nutrition matters (P = 0.289) and literacy levels (P = 0.866)] (*Table 9.4.9*).

Table 9.4.9: Bivariate analysis between the BMI-for-age Z-scores and associating factors (N = 110)

	BMI-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Age of children ^ (N = 139)	0.037	0.01	-0.05, -0.00	-0.03*	0.024
HFIAS scores ^ (N = 110)	0.010	0.02	-0.07, 0.02	-0.03	0.251
HHS scores ^ (N = 110)	0.017	0.10	-0.35, 0.04	-0.15	0.128
MAHFP scores ^ (N = 110)	0.031	0.08	0.01, 0.31	0.16*	0.038
IDDS scores for mothers ^ (N = 110)	0.004	0.24	-0.30, 0.65	0.18	0.460
Household size ^ (N = 110)	0.008	0.12	-0.35, 0.11	-0.12	0.293
Age of mother ^ (N = 110)	0.007	0.03	-0.09, 0.03	-0.03	0.333
BMI of mothers in two categories ^^ (N = 110)					
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.028	0.47	-1.83, 0.00	-0.91*	0.050
Normal (18.5 to 24.9) (n = 88) ǂ					
Labour contribution into two categories ^^ (N = 110)					
Highly involved (n = 55) ǂ					
Less + moderately involved (n = 55)	0.000	0.37	-0.81, 0.63	-0.09	0.813
Sex of children ^^ (N = 138)					
Females (n = 67) ǂ					
Males (n = 72)	0.000	0.37	-0.79, 0.65	-0.07	0.854
Training in food security and nutrition topics ^^ (N = 110)					
Yes (n = 59)	0.000	0.37	-0.64, 0.80	0.08	0.826
No (n = 51) ǂ					

Continued

Table 9.4.9 continued: Bivariate analysis between the BMI-for-age Z-scores and associating factors (N = 110)

	BMI-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Loan access ^^ (N = 109)					
No (n = 86)	0.009	0.47	-0.41, 1.43	0.51	0.279
Yes (n = 23) ǂ					
Public speaking in three categories ^^ (N = 110)					
No, not at all comfortable + Yes, but with great deal of difficulty (n = 44) ǂ					
Yes, but with a little difficulty + Yes, fairly comfortable (n = 45)	0.005	0.41	-0.52, 1.09	0.29	0.483
Yes, very comfortable (n = 21)	0.005	0.51	-0.68, 1.32	0.32	0.530
Decisions regarding wealth made in the household ^^ (N = 110)					
Male alone + female alone (n = 27) ǂ					
Male and female jointly (n = 83)	0.000	0.42	-0.83, 0.83	0.00	0.999
Decisions regarding food and nutrition matters made in the household ^^ (N = 110)					
Male alone (n = 19) ǂ					
Female alone (n = 10)	0.031	0.74	-0.71, 2.18	0.73	0.319
Male and female jointly + someone else in the household (n = 81)	0.031	0.47	-1.41, -0.42	-0.49	0.289
Marital status ^^ (N = 110)					
Married living with spouse (n = 104) ǂ					
Married spouse away + widowed (n = 6)	0.013	0.82	-0.53, 2.70	1.08	0.189

Continued

Table 9.4.9 continued: Bivariate analysis between the BMI-for-age Z-scores and associating factors (N = 110)

	BMI-for-age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Literacy in three levels ^^ (N = 110)					
Illiterate (n = 19) ǂ					
Primary (n = 80)	0.004	0.50	-1.23, 0.72	-0.25	0.609
Secondary (n = 11)	0.004	0.71	-1.27, 1.51	0.12	0.866
Annual income into four categories ^^ (N = 110)					
Less than USD 100 (n = 13) ǂ					
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.075	0.57	0.33, 2.56	1.44**	0.011
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.075	0.63	0.74, 3.20	1.97**	0.002
Greater than USD 300 (n = 21)	0.075	0.63	-0.23, 2.25	1.01	0.110
Household assets values in three categories ^^ (N = 110)					
Less than USD 50 (n = 77) ǂ					
Greater than or equal to USD 50, but < USD 100 (n = 21)	0.053	0.47	0.22, 2.06	1.14**	0.016
Greater than or equal to USD 100 (n = 12)	0.053	0.57	-0.66, 1.55	0.44	0.431

* Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.3 Multivariate results

9.4.3.1 BMI for the women

The independent variables, namely age of the mothers (P = 0.004), literacy level (P = 0.018), loan access (P = 0.000), household size (P = 0.100) and decisions regarding food security and nutrition matters (P = 0.100) were entered into the multivariable linear regression analysis model.

A trial and error method was used to adjust the variables. The researcher only observed statistically significant correlational relationships between the BMI scores for the women and age of the mothers (P = 0.034) and loan access (P = 0.003) (*Table 9.4.10*). When the scores for the food insecurity tools (HFIAS, HHS, MAHFP and IDDS for women) were instrumented using multivariable IV regression analysis, a final model was arrived at that showed statistically significant correlational relationships between the BMI for the women and age of the mothers (P = 0.054), loan access (P = 0.004), HFIAS scores (P = 0.007) and HHS scores (P = 0.001) (*Table 9.4.11*).

Therefore, among all the independent variables considered, the final adjusted multivariable IV regression analysis model revealed that only age of the mothers, loan access, HFIAS scores and HHS scores were the statistically significant variables influencing the BMI scores for the women.

Table 9.4.10: Multivariable linear regression analysis model between the BMI scores for the women and associating factors (N = 110)

BMI scores (N = 110)				
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on multivariable linear regression analysis**
Age of the mothers ^ (N = 110)	0.03	0.00, 0.10	0.05*	0.034
Loan access ^^ (N = 109)				
No (n = 86) ǂ				
Yes (n = 23)	0.37	0.40, 1.88	1.14**	0.003

Unadjusted R^2 = 0.078, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

Table 9.4.11: Final multivariable IV regression analysis model between the BMI scores for the women and associating factors (N = 110)

BMI scores for the women (N = 110)				
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on final multivariable IV regression analysis**
Age of the mothers ^ (N = 110)	0.03	-0.00, 0.10	0.05*	0.054
Loan access ^^ (N = 109)				
No (n = 86) ǂ				
Yes (n = 23)	0.37	0.35, 1.82	1.08**	0.004
HFIAS scores ^ (N = 110)	0.03	-0.15, -0.02	-0.09**	0.007
HHS scores ^ (N = 110)	0.14	-0.73, -0.20	-0.46**	0.001

Unadjusted R^2 = 0.125, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.3.2 Length/height-for-age for children

The independent variables, namely age of the mothers (P = 0.019), sex of the children (P = 0.002), the HFIAS categories (P = 0.006), annual income categories (P = 0.102), household assets values (P = 0.078) and marital status (P = 0.184) were entered into the final multivariable random-effects GLS regression analysis model.

A trial and error method was used to adjust the variables. The researcher only observed statistically significant correlational relationships between the height-for-age Z-scores and age categories for the mothers (P = 0.004), sex of the children (P = 0.005), household assets values (P = 0.028), and HFIAS categories (P = 0.006) (*Table 9.4.12*). Therefore, among all the independent variables considered, the final adjusted multivariable random-effects GLS regression analysis model revealed that only age of the mothers, sex of the children, household assets values and HFIAS categories were the statistically significant variables influencing the height-for-age Z-scores for the children.

Table 9.4.12: Final multivariable random-effects GLS regression analysis model between the height-for-age Z-scores and associating factors (N = 110)

	Height-for-age Z-scores (N = 135)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on final random-effects GLS regression analysis**
Age of mother in two categories ^^ (N = 110)				
Less than or equal to 30 years (n = 78) ǂ				
Greater than 30 years (n = 32)	0.35	-1.71, -0.33	-0.02**	0.004
Sex of children ^^ (N = 138)				
Females (n = 67) ǂ				
Males (n = 72)	0.31	-1.46, -0.26	-0.86**	0.005
Household assets values in three categories ^^ (N = 110)				
Less than USD 50 (n = 77) ǂ				
Greater than or equal to USD 50, but < USD 100 (n = 21)	0.43	0.10, 1.80	0.95*	0.028
Greater than or equal to USD 100 (n = 12)	0.48	-0.13, 1.77	0.82	0.090
HFIAS in three categories ^^ (N = 100)				
Food secure + mildly food insecure access (n = 14) ǂ				
Moderately food insecure access (n = 11)	0.63	-2.97, -0.48	-1.73**	0.006
Severe food insecure access (n = 75)	0.45	-1.46, -0.30	-0.58	0.194

Unadjusted R^2 = 0.193, * Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.3.3 Weight-for-age for children

The independent variables, namely household assets values (P = 0.028), age categories for the mothers (P = 0.004), sex of the children (P = 0.045), age categories for the children (P = 0.002), annual income categories (P = 0.048), HHS scores (P = 0.069), MAHFP scores (P = 0.120) and BMI categories for the women (P = 0.126) were entered into the multivariable random-effects GLS regression analysis model.

A trial and error method was used to adjust the variables. The researcher only observed statistically significant correlational relationships between the weight-for-age Z-scores for the children and BMI categories for the mothers (P = 0.016), sex of the children (P = 0.028), household assets values (P = 0.015), age categories for the mothers (P = 0.012) and age categories for the children (P = 0.033). Annual income categories (P = 0.072) and MAHFP scores (P = 0.076) were not statistically significant (*Table 9.4.13*). When the weight-for-age Z-scores were instrumented with the BMI scores for the women/mothers using multivariable IV regression analysis, a final model was arrived at that showed statistically significant correlational relationships between the weight-for-age Z-scores for the children and the BMI scores for the mothers (P = 0.014), sex of the children (P = 0.005), household assets values (P = 0.014), age categories for the mothers (P = 0.001) and age categories for the children (P = 0.015). However, MAHFP scores (P = 0.171) and annual income (P = 0.197) were not statistically significant (*Table 9.4.14*).

Therefore, among all the independent variables considered, the final adjusted multivariable IV regression analysis model revealed that only the BMI scores for the women, sex of children, household assets values, age categories for the mothers and age categories for the children were the statistically significant variables influencing the weight-forage Z-scores for the children. The MAHFP scores and annual income categories were not statistically significant at the 0.05 level of significance.

Table 9.4.13: Multivariable random-effects GLS regression analysis model between the weight-for-age Z-scores and associating factors (N = 110)

	Weight-for-age Z-scores (N = 135)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
BMI of mothers in two categories ^^ (N = 110)				
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.32	-1.38, -0.14	-0.76**	0.016
Normal (18.5 to 24.9) (n = 88) ǂ				
Sex of children ^^ (N = 138)				
Females (n = 67) ǂ				
Males (n = 72)	0.24	-1.02, -0.06	-0.54*	0.028
Household assets values ^ (N = 110)	0.00	0.00, 0.01	0.00**	0.015
MAHFP scores ^ (N = 110)	0.05	-0.01, 0.19	0.09	0.076
Age of mother in two categories ^^ (N = 110)				
Less than or equal to 30 years (n = 78) ǂ				
Greater than 30 years (n = 32)	0.27	-1.23, -0.15	-0.69**	0.012
Age of children in five categories ^^ (N = 139)				
Less than or equal to 11 months (n = 19) ǂ				
Greater than 11 months, but less than or equal to 23 months (n = 32)	0.42	-1.53, 0.11	-0.71	0.090
Greater than 23 months, but less than or equal to 35 months (n = 31)	0.41	-1.57, 0.04	-0.77	0.063
Greater than 35 months, but less than or equal to 47 months (n = 24)	0.43	-1.62, 0.06	-0.78	0.069
Greater than 47 months, but less than or equal to 60 months (n = 33)	0.42	-1.73, -0.07	-0.90*	0.033

Continued

Table 9.4.13 continued: **Multivariable random-effects GLS regression analysis model between the weight-for-age Z-scores and associating factors (N = 110)**

	Weight-for-age Z-scores (N = 135)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on random-effects GLS regression analysis**
Annual income into four categories ^^ (N = 110)				
Less than USD 100 (n = 13) ǂ				
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.38	-0.07, 1.43	0.68	0.074
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.43	-0.07, 1.62	0.77	0.072
Greater than USD 300 (n = 21)	0.44	-0.90, 0.84	-0.03	0.948

Unadjusted $R^2 = 0.257$, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

Table 9.4.14: Final multivariable IV regression analysis model between the weight-for-age Z-scores and associating factors (N = 110)

	Weight-for-age Z-scores (N = 135)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on final IV regression analysis**
BMI scores of mothers ^ (N = 110)	0.17	0.09, 0.74	0.41**	0.014
Sex of children ^^ (N = 138)				
Females (n = 67) ǂ				
Males (n = 72)	0.29	-1.38, -0.25	-0.82**	0.005
Household assets values ^ (N = 110)	0.00	0.00, 0.01	0.01**	0.014
MAHFP scores ^ (N = 110)	0.06	-0.03, 0.18	0.08	0.171
Age of mother in two categories ^^ (N = 110)				
Less than or equal to 30 years (n = 78) ǂ				
Greater than 30 years (n = 32)	0.34	-1.73, -0.42	-1.08**	0.001
Age of children in five categories ^^ (N = 139)				
Less than or equal to 11 months (n = 19) ǂ				
Greater than 11 months, but less than or equal to 23 months (n = 32)	0.45	-1.45, 0.31	-0.57	0.205
Greater than 23 months, but less than or equal to 35 months (n = 31)	0.44	-1.58, 0.16	-0.71	0.108
Greater than 35 months, but less than or equal to 47 months (n = 24)	0.46	-1.83, -0.01	-0.92*	0.047
Greater than 47 months, but less than or equal to 60 months (n = 33)	0.46	-2.00, -0.22	-1.11**	0.015
Annual income into four categories ^^ (N = 110)				
Less than USD 100 (n = 13) ǂ				
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.43	-0.54, 1.15	0.30	0.482
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.47	-0.31, 1.51	0.60	0.197
Greater than USD 300 (n = 21)	0.47	-0.92, 0.94	0.01	0.984

Unadjusted R^2 = 0.212, * Statistical significant at $P \leq 0.05$, ** Statistical significant at $P \leq 0.01$, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.3.4 Weight-for-length/height for children

The independent variables, namely the MAHFP scores (P = 0.043), BMI categories for the mothers (P = 0.054), age categories for the children (P = 0.007), annual income categories (P = 0.012) and household assets value categories (P = 0.023) were entered into the final multivariable random-effects GLS regression analysis model.

A trial and error method was used to adjust the variables. The researcher only observed statistically significant relationships between the weight-for-height Z-scores for the children and BMI categories for the mothers (P = 0.032), MAHFP scores (P = 0.029), age categories for the children (P = 0.008) and annual income from tobacco sales (P = 0.001) (*Table 9.4.15*).

Therefore, among all the independent variables considered, the final adjusted multivariable random-effects GLS regression analysis model revealed that only BMI categories for the mothers, MAHFP scores, age categories for the children and annual income were the statistically significant variables influencing the weight-for-height Z-scores for the children.

Table 9.4.15: Final multivariable random-effects GLS regression analysis model between the weight-for-height Z-scores and associating factors (N = 110)

	Weight-for-height Z-scores (N = 135)			
Variables	**Std Error**	**95% CI**	**Coefficient**	**P-value based on final multivariable random-effects GLS regression analysis**
BMI of mothers in two categories ^^ (N = 110)				
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.43	-1.75, -0.08	-0.91*	0.032
Normal (18.5 to 24.9) (n = 88) ǂ				
MAHFP scores ^ (N = 110)	0.07	0.02, 0.29	0.15*	0.029
Age of children in five categories ^^ (N = 139)				
Less than or equal to 11 months (n = 19) ǂ				
Greater than 11 months, but less than or equal to 23 months (n = 32)	0.58	-1.82, 0.45	-0.68	0.239
Greater than 23 months, but less than or equal to 35 months (n = 31)	0.56	-2.27, -0.05	-1.16*	0.040
Greater than 35 months, but less than or equal to 47 months (n = 24)	0.59	-2.29, 0.05	-1.12*	0.060
Greater than 47 months, but less than or equal to 60 months (n = 33)	0.56	-2.59, -0.39	-1.49**	0.008
Annual income into four categories ^^ (N = 110)				
Less than USD 100 (n = 13) ǂ				
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.53	0.31, 2.39	1.35**	0.011
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.58	0.71, 3.00	1.86**	0.001
Greater than USD 300 (n = 21)	0.60	-0.40, 1.94	0.77	0.194

Unadjusted R^2 = 0.195, * Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.4.3.5 BMI-for-age for children

The independent variables, namely the age of the children (P = 0.024), MAHFP scores (P = 0.038), BMI categories for the women (P = 0.050), annual income categories (P = 0.002), household assets value categories (P = 0.016), HHS scores (P = 0.128) and marital status (P = 0.189) were entered into the final multivariable random-effects GLS regression analysis model.

A trial and error method was used to adjust the variables. The researcher only observed statistically significant relationships between the BMI-for-age Z-scores for the children and BMI categories for the mothers (P = 0.030), age of the mothers (P = 0.029), annual income (P = 0.002) and household assets value categories (P = 0.047). The MAHFP scores were not statistically significant (P = 0.073) (*Table 9.4.16*).

Therefore, among all the independent variables considered, the final adjusted multivariable random-effects GLS regression analysis model revealed that only BMI categories, age of the mothers, annual income categories and household assets value categories were the statistically significant variables influencing the BMI-for-age Z-scores for the children. The MAHFP scores were not statistically significant.

Table 9.4.16: **Final multivariable random-effects GLS regression analysis model between the BMI-for-age Z-scores and associating factors (N = 110)**

	BMI for age Z-scores (N = 135)				
Variables	**Unadjusted R^2**	**Std Error**	**95% CI**	**Coefficient**	**P-value based on final multivariable random-effects GLS regression analysis**
BMI of mothers in two categories ^^ (N = 110)					
Malnutrition (<18.5 and or > = 25.0) (n = 22)	0.206	0.44	-1.83, -0.09	-0.96*	0.030
Normal (18.5 to 24.9) (n = 88) ǂ					
MAHFP scores ^ (N = 110)	0.206	0.07	-0.01, 0.28	0.13	0.073
Age of the mothers ^ (N = 110)	0.206	0.01	-0.05, -0.00	-0.03*	0.029
Annual income into four categories ^^ (N = 110)					
Less than USD 100 (n = 13) ǂ					
Greater than or equal to USD 100, but < USD 200 (n = 49)	0.206	0.54	0.34, 2.47	1.40**	0.010
Greater than or equal to USD 200, but < USD 300 (n = 27)	0.206	0.61	0.73, 3.13	1.93**	0.002
Greater than USD 300 (n = 21)	0.206	0,63	-0.30, 2.18	0.94	0.136
Household assets values in three categories ^^ (N = 110)					
Less than USD 50 (n = 77) ǂ					
Greater than or equal to USD 50, but < USD 100 (n = 21)	0.206	0.47	0.01, 1.84	0.93*	0.047
Greater than or equal to USD 100 (n = 12)	0.206	0.58	-0.87, 1.41	0.27	0.641

* Statistical significant at P ≤ 0.05, ** Statistical significant at P ≤ 0.01, ^ Continuous independent variable, ^^ Categorical independent variable, ǂ Reference category

9.5 DISCUSSION

The status quo on the phenomenon of malnutrition is changing. The recent body of evidence supports the notion of a double-burden of malnutrition (i.e. occurrence of problems of both overnutrition and undernutrition). Globally, the number of overweight under-five children is nearing that of wasting (IFPRI, 2016), and the prevalence of maternal overweight has exceeded that of underweight in all regions (Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-McGregor, Katz, Martorell & Uauy, 2013). However, it seems not much has changed for the tenant women of reproductive age and their under-five children on the smallholder tobacco farms in the northern region of Malawi. Undernutrition is still rampant and higher than overnutrition for both groups as indicated by the results of this study.

For the women's BMI, more than one-fifth of the women (21%) were found to be malnourished. Out of which 15% were underweight, 6% were overweight, while none were found to be obese. Comparatively, higher prevalence rates of overweight and obesity have been reported in some African countries, for instance, in Mozambique (21.8%), South Sudan (27.8%), South Africa (53.9%) and Zimbabwe (30.7%) (IFPRI, 2016). The 2011 Malawi DHS report indicated that more women (17%) were overweight and less (9%) were underweight (Government of Malawi & ICF Macro, 2011; USAID, 2013). Similarly, the WHO indicated that more Malawian women (14%) were overweight and less (9%) were underweight. The report further indicated that 2% of the women were obese (WHO, 2012). In the current study none of the women were found to be obese. This could probably be due to the fact that the study was conducted during the hunger season. It could also be because of the low demographic and socio-economic status of the women as discussed in *chapter 4*, supporting the claim that undernutrition is still rampant in the study group. The anthropometric status for the women has many health and nutrition implications. For instance, low pre-pregnancy BMI and short stature are all risk factors for poor birth outcomes and obstetric complications (Kruger, 2005).

For the under-five children, anthropometric measurements (weight and height) were taken and four nutrition status indicators, namely weight-for-height/length, length/height-for-age, weight-for-age and BMI-for-age were used to assess nutrition status.

For the weight-for-length/height index, 23% of the under-five children were malnourished (i.e. 12% severely wasted, 8% wasted, and 2% overweight, 1% obese). Comparatively, wasting levels are lower in many African countries, i.e. Kenya (4.0%), Mozambique (6.1%), South Africa (4.7%) and Zimbabwe(3.3%) (IFPRI, 2016). According to the DHS, very few under-five children (3%) were also reported to be wasted in Malawi (Government of Malawi & ICF Macro, 2016). The higher proportion of child wasting in the current study, which was done during the hunger months, could depict failure to receive adequate nutrition and or episodes of illnesses in the period immediately preceding the survey (WHO, 2008). The prevalence of wasting in the current study is close to that of South Sudan (22.2%) (IFPRI, 2016).This situation could be considered dire because the findings are extremely higher when compared to the 2015 global wasting estimates (7.4% wasting, 2.5% severe wasting) (UNICEF, WHO & World Bank, 2016).

For the length/height-for-age index, 31.3% of the under-five children were stunted (11.5% severely stunted, 19.8% stunted). Comparatively, stunting levels are also high in many other African countries, i.e. Tanzania (34.7%), Zambia (40%), Nigeria (32.9%), Mozambique (43.1%), South Sudan (31.1%) and Zimbabwe (27.6%) (IFPRI, 2016). The joint report by the UNICEF, WHO and World Bank indicated that in Africa, the number of stunted children is actually rising (UNICEF *et al.*, 2016). According to the DHS, a higher proportion of under-five children (37%) was also reported to be stunted in Malawi (Government of Malawi & ICF Macro, 2016), and the difference with the current study findings is not much. Both the current and national study findings were much higher than the 2015 global stunting estimates (23.2%) (UNICEF *et al.*, 2016). The findings may imply long term nutrition problems in the study group since stunting is said to reflect failure to receive adequate nutrition over a long period, and is also affected by recurrent and chronic illnesses (WHO, 2008). Stunting has affected Malawian children since the 1970s with little improvements being registered up to date (Republic of Malawi, 2009; Government of Malawi & ICF Macro, 2011; Government of Malawi, 2012; Government of Malawi & ICF Macro, 2016).

For the weight-for-age index, 34% of the under-five children were underweight (12% severely underweight, 22% underweight). Comparatively, according to the DHS, a few under-five children (12%) were reported to be underweight (Government of Malawi & ICF

Macro, 2016). Both the current and national study findings were much higher than the 2013 global and African region underweight estimates (15% and 17% respectively) (UNICEF *et al.*, 2014). The weight-for-age index is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition (WHO, 2008).

For the BMI-for-age index, 22.5% of the under-five children were malnourished (i.e. 9.3% severely wasted, 7.8% wasted, and 5.4% overweight, 0% obese). The DHS did not report on the BMI-for-age index, hence it was difficult to compare with nationally representative data. However, the WHO reported that the BMI-for-age index is not very much different from the weight-for-length/height index. In many instances these two indices tend to display similar results and they also use similar cut-off points (WHO, 2008). Therefore, it could be fair to suggest that the BMI-for-age also reflected recent nutrition problems preceding the survey period (WHO, 2008).

In terms of gender, out of the 139 under-five children, 52% were males. The study found that across all the four nutrition status indicators, a higher proportion of the male under-five children were malnourished than their female counterparts. These results are consistent with the meta-analysis review of 16 studies from ten sub-Saharan African countries. In this meta-analysis, it was reported that in sub-Saharan Africa stunting is generally higher in males than in females (Wamani, Åstrøm, Peterson, Tumwine & Tylleskär, 2007). Similar findings were also observed in the DHS and Feed the Future reports in which higher proportions of male under-five children were malnourished than females counterparts (Government of Malawi & ICF Macro, 2011; USAID, 2013; Government of Malawi & ICF Macro, 2016). Indeed, many other studies have reported similar findings across the African continent (Ngare & Muttunga, 1999; Zere & McIntyre, 2003; Wamani, Tylleskär, Åstrøm, Tumwine & Peterson, 2004), Some though have reported otherwise (Leslie, Ciemins & Essama, 1997; Crognier, Baali, Hilali, Villena & Vargas, 2006). The conflicting findings on the role of sex in malnutrition suggests that it is illogical to conclude that males are always at a disadvantage. However, at large, male under-five children are said to be more vulnerable to health inequalities than their female counterparts in the same age groups (Wamani *et al.*, 2007). This could be due to favouritism towards female children as observed in a study in Kenya (Cronk, 1989), or other biological factors, such as illnesses and even death which are consistently higher in male children (Chen, Vohr & Oh, 1993; Kilbride & Daily, 1997).

9.5.1 BMI for women and associating factors

The multivariable IV regression analysis considered age of the mothers (P = 0.004), literacy levels (P = 0.018), loan access (P = 0.000), household size (P = 0.100), decisions regarding food security and nutrition matters (P = 0.100) and the food accessibility measurements (HFIAS, HHS, MAHFP and IDDS for women). The final adjusted model revealed that among all factors age of the mothers (P = 0.054), loan access (P = 0.004), HFIAS scores (P = 0.007) and HHS scores (P = 0.001) were the significant factors influencing the BMI scores for the women.

For the age of the women variable (P = 0.054), the results suggested that an increase in age by one year caused the BMI scores for the women to increase by the factor of 0.05. This could imply that the BMI was likely to be higher in older women. Two separate studies in Norway consistently demonstrated that when followed over time, the mean weight and mean BMI for both male and female participants increased significantly with an increase in age (Drøyvold, Nilsen, Krüger, Holmen, Krokstad, Midthjell & Holmen, 2006; Reas, Nygård, Svensson, Sørensen & Sandanger, 2007).

For the loan access variable (P = 0.004), the results suggested that for the women who accessed loans or credit facilities, their BMI scores increased by the factor of 1.08 when compared to those who did not have access. This could imply that the BMI was likely to be higher in women who had access to loan services. A study in Ethiopia reported that small loan programmes could have an important impact on nutrition status of women and their households (Doocy *et al.*, 2005). Although not directly related to BMI, access to loan facilities in rural Bangladesh households was reported to result in women empowerment, independence and asset holdings which had a significant effect on the wellbeing of their households (Pitt, Khandker & Mundial, 1996). Loan arrangements in both the Ethiopian and Bangladesh studies were more formal than observed in the present study. Still, based on these arguments, it can be speculated that access to loans may also have resulted in the wellbeing of the households of the tenant women and the consequential effect on their BMI.

For the HFIAS scores variable (P = 0.007), the results suggested that an increase in one value of the HFIAS score caused a decrease in the BMI scores for the women by the factor of 0.09. The higher the HFIAS score, the more food insecure the household was in terms of anxiety about food, insufficient quality and inadequate food intake (Coates *et al.*, 2007). Hence this could imply that the BMI of the women in food insecure households was likely to be lower than those of women in food secure households. An Ethiopian study indicated that food secure households, as determined by a better quality diet, was a contributing factor to improved nutrition status of women and their households (Doocy *et al.*, 2005). Conflicting results have been reported in the USA where members of food insecure households were more likely to be overweight (Townsend, Peerson, Love, Achterberg & Murphy, 2001). However, the context of the current study is very much different from the USA context, but a bit alike the Ethiopian study. Considering how disadvantaged the women were, it can still be assumed that food insecurity was a predictor of low BMI for the tenant women in the current study.

For the HHS scores variable (P = 0.001), the results suggested that an increase in one value of the HHS score caused a decrease in the BMI scores for the women by the factor of 0.46. The higher the HHS score, the more hunger the household experienced (Ballard *et al.*, 2011). Hence this could imply that the BMI of the women in hunger stricken households was likely to be lower than those in food secure households. However, conflicting results were reported in the USA where women's BMI was shown to be significantly higher in hunger stricken households in urban areas (Olson, 1999). Evidence is also emerging indicating rapid increases in prevalence rates of overweight and obesity in both urban and rural areas in the poorest countries of sub-Saharan Africa and South Asia (Popkin, Adair & Ng, 2012). However, the modern understanding is that food insecurity is a complex phenomenon that could result in occurrences of both undernutrition and overweight (Tanumihardjo, Anderson, Kaufer-Horwitz, Bode, Emenaker, Haqq, Satia, Silver & Stadler, 2007). With regard to the findings of the current study, there were very few overweight women (6%). According to the literature, the tobacco tenants are considered among the poorest of the poor in Malawi (Torres, 2000; Orr, 2000; ILO, 2011); as such it is not surprising findings that the BMI of the women was likely to be lower in hunger stricken households.

9.5.2 Height-for-age for the children and associating factors

The multivariable random-effects GLS regression analysis considered age of the mothers (P = 0.019), sex of the children (P = 0.002), the HFIAS categories (P = 0.006), annual income categories (P = 0.102), household assets values (P = 0.078) and marital status (P = 0.184). The final adjusted model revealed that age categories for the mothers (P = 0.004), sex of the children (P = 0.005), household assets values (P = 0.028) and HFIAS categories (P = 0.006) were the significant factors influencing the height-for-age Z-scores for the children.

For the age of the mothers variable (P = 0.004), the results suggested that comparatively, the height-for-age Z-scores for children whose mothers were older than 30 years decreased by the factor of 0.02 when compared to those whose mothers were younger than or equal to 30 years old. This could imply that the older women (greater than 30 years old) were more likely to have stunted children. Mixed findings have been reported in the literature on the effects of maternal age on child stunting. One study in Nigeria reported that maternal age had no significant relationship with stunting, though with underweight and wasting (Olusanya, Wirz & Renner, 2010). Also in Nigeria, another study reported that maternal age had no significant relationship with all child nutrition status indicators, including stunting, wasting and underweight (Eze, Olowu, Bamidele & Adeyanju, 2005). A study in Kenya reported that only younger mothers below 20 years of age were more likely to have stunted children (Safari, Masanyiwa & Lwelamira, 2015). Similarly, a 1969 to 1989 prospective study in middle income countries (Brazil, Guatemala, India, Philippines and South Africa) reported that less than 19 year old mothers were more likely to have stunted children than did older mothers, who were older than 34 years (Fall, Sachdev, Osmond, Restrepo-Mendez, Victora, Martorell, Stein, Sinha, Tandon & Adair, 2015). The results in this current study, although puzzling, could still be fairly realistic as similar trends were observed in Sri Lanka where the World Bank reported that mothers either in their teens or their late 30s were significantly more likely to have children suffering from malnutrition (World Bank, 2005).

For the sex of the children variable (P = 0.005), the results suggested that the height-for-age Z-scores for male children decreased by the factor of 0.86 when compared to female children. This could imply that the male children were more likely to be stunted than their female counterparts. These findings are consistent with a meta-analysis review of 16 studies from ten sub-Saharan African countries that reported that in sub-Saharan Africa stunting is generally higher in males than in females (Wamani *et al.*, 2007).

For the household assets values variable (P = 0.028), the results suggested that the height-for-age Z-scores for children in households with assets valued at between USD 50 and USD 100 increased by the factor of 0.95 when compared to those in households with assets valued at less than USD 50. This could imply that the wealthier households were less likely to have stunted children. Effects of household wealth on child nutrition status indicators have been investigated previously. Consistent with the current study, studies in Serbia, Bangladesh, Cambodia and Malawi reported that children in the lowest quintile of wealth were more likely to be stunted (Hong, Banta & Betancourt, 2006; Hong & Mishra, 2006; Janevic, Petrovic, Bjelic & Kubera, 2010; Government of Malawi & ICF Macro, 2016). Another study, using the DHS data from 42 developing countries, revealed existence of positive relationships between nutrition status indicators (including stunting) and household wealth. However, acknowledgements were made regarding country variations in both strength and form of associations (Boyle *et al.*, 2006).

For the HFIAS scores variable (P = 0.006), the results suggested that the height-for-age Z-scores for children in households that were moderately food insecure decreased by the factor of 1.73 when compared to those households that were food secure and mildly food insecure. This could imply that the moderately food insecure households were more likely to have stunted children unlike food secure and mildly food insecure households. Consistently, a Pakistan study reported that households that were food insecure were three times more likely than other households to have a stunted child (Baig-Ansari *et al.*, 2006). A study that used an adapted 8-item Centers for Diseases Control and Prevention Food Insecurity tool in Honduras, reported that generally there was no statistically significant relationship between stunting and food insecurity. However, the author did not dismiss entirely that the two could be related as there was a question (i.e. “How many days could the family eat if they ate only the food that you have in the house right now”?) that indicated a significant relationship with stunting (Gray, Cossman & Powers, 2006).

9.5.3 Weight-for-age for the children and associating factors

The multivariable IV regression analysis considered household assets values (P = 0.028), age categories for the mothers (P = 0.004), sex of the children (P = 0.045), age categories for the children (P = 0.002), annual income categories (P = 0.048), HHS scores (P = 0.069), MAHFP scores (P = 0.120) and BMI categories for the women (P = 0.126). The final adjusted IV model revealed that the BMI scores for the women/mothers (P = 0.014), sex of the children (P = 0.005), household assets values (P = 0.014), age categories for the mothers (P = 0.001) and age categories for the children (P = 0.015) were the significant factors influencing the weight-for-age Z-scores for the children.

For the BMI scores of the women/mothers variable (P = 0.014), the results suggested that an increase in the BMI score for the mothers by one value resulted in the weight-for-age Z-scores for the children to increase by the factor of 0.42. This could imply that the women with high BMI scores were more likely to have less underweight children. Similarly, a study in Bangladesh reported that a decrease in the BMI of the mother related to more severe childhood malnutrition (Huynh, Bleakly, Kache & Chisti, 2015). Another study in Bangladesh reported that children born from a healthy mother were at a lower risk of being underweight than those born from a low BMI mother (Rayhan & Khan, 2006). However, caution needs to be observed as an exceedingly higher maternal BMI (termed obesity), especially during the time of pregnancy, is more likely to increase the risk of obesity for children that could continue into adolescence and early adulthood (Black *et al.*, 2013).

For the sex of the children variable (P = 0.005), the results suggested that the weight-for-age Z-scores for male children decreased by the factor of 0.82 when compared to female children. This could imply that the male children were more likely to be underweight than their female counterparts. As already pointed out, male under-five children are more vulnerable to health inequalities than their female counterparts in the same age groups (Wamani *et al.*, 2007). Therefore, the findings seem unsurprising.

For the household assets values variable (P = 0.014), the results suggested that an increase in household assets values by one US dollar resulted in an equivalent increase in weight-for-age Z-scores by the factor of 0.01. This could imply that the wealthier households were more likely to have less underweight children. Similar results were reported in a study that pooled DHS data from 42 developing countries revealing existence of positive relationships between nutrition status indicators (including underweight) and household wealth. However, acknowledgements were made regarding country variations in both strength and form of associations. For instance, association between the child weight-for-age with higher levels of household wealth were stronger in Egypt than in Mali (Boyle *et al.*, 2006).

For the MAHFP scores variable ($P = 0.171$), the results suggested that a one value increase in MAHFP scores resulted in a weight-for-age increase by the factor of 0.08. This could imply that the food secure households were more likely to have less underweight children. The MAHFP scores were not statistically significant at $P \leq 0.05$. However, the MAHFP scores were regarded crucial by the researcher because they formed part of the final multivariable IV regression analysis model. Comparatively, household access and availability of food were reported to have a statistically significant relationship with underweight in the Dowa district of Malawi (Sassi, 2015).

For the age of the mothers variable ($P = 0.001$), the results suggested that comparatively, the weight-for-age Z-scores for children whose mothers were older than 30 years decreased by the factor of 1.08 when compared to those whose mothers were younger than or equal to 30 years old. This could imply that the older women (greater than 30 years old) were more likely to have underweight children. A study in Sri Lanka reported that mothers either in their teens or their late 30s were significantly more likely to have children suffering from malnutrition (World Bank, 2005). Another study in Nigeria reported that children born to mothers outside the child bearing age of 20 to 35 years were at an increased risk of being underweight (Olusanya *et al.*, 2010).

For the age of the children variable ($P = 0.015$), the results suggested that the weight-for-age Z-scores for children between 35 and 47 months and older than 47 months decreased by the factors of 0.92 and 1.11 respectively, when compared to those of children younger than or equal to eleven months. This could imply that the older children were more likely to be underweight than younger ones. A study in Malawi reported that underweight worsened with an increase in age, although that was only true until a certain age beyond which a child's underweight status started to improve again (Chirwa & Ngalawa, 2008). Another study in the African (Ghana, Malawi, Nigeria, Tanzania, Zambia, and Zimbabwe) and Indian (Uttar Pradesh, Maharashtra, Karnataka, and Tamil Nadu) regions also reported that the proportion of underweight children worsened with an increase in age (Griffiths, Madise, Whitworth & Matthews, 2004). This scenario could be partly explained by a study in Egypt that demonstrated that the mothers of children from two years old and more tended to give less intensive child care as they opted for involvement in economic activities (Ricci, Jerome, Sirageldin, Aly, Moussa, Galal, Harrison & Kirksey, 1996). The tendency to care less for the older children was somehow viewed as beneficial as it encourages children's independency (Ricci *et al.*, 1996). However, the overall ill effects of mother and children separation on the children's nutrition status cannot be neglected. Mother and children separation, coupled with poverty, poor sanitation and episodes of illnesses could possibly facilitate inappropriate complementary feeding practices and family meals. Together these scenarios could result in compromised quantity, quality, adequacy, frequency and consistency of food in older children necessitating a poor nutrition status (Dewey & Adu-Afarwuah, 2008).

For the annual income variable ($P = 0.197$), the results suggested that the weight-for-age Z-scores for children in households that earned between USD 200 and USD 300 increased by the factor of 0.60 when compared to those households that earned less than USD 100. This could imply that the households earning more money were less likely to have underweight children. However, just like the MAHFP scores, annual income was not statistically significant in the final multivariable IV model. A study in Malawi reported that economic empowerment for women through salaried employment and or family business was a predictor of having well-nourished children (Chirwa & Ngalawa, 2008). Other authors also reported that inadequate food intake of a child could be the result of households not having enough resources, such as income for gaining access to food which improves nutrition status (Babu, Gajanan & Sanyal, 2014a).

9.5.4 Weight-for-height for the children and associating factors

The multivariable random-effects GLS regression analysis considered the MAHFP scores ($P = 0.043$), BMI categories for the mothers ($P = 0.054$), age categories for the children (P =

0.007), annual income categories (P = 0.012) and household assets value categories (P = 0.023). The final adjusted model revealed that the BMI categories for the mothers (P = 0.032), MAHFP scores (P = 0.029), age categories for the children (P = 0.008) and annual income (P = 0.001) were significant factors influencing the weight-for-height Z-scores for the children.

For the BMI categories for the mothers variable (P = 0.032), the results suggested that the weight-for-height Z-scores for the children whose mothers were malnourished decreased by the factor of 0.91 when compared to those whose mothers were healthy (BMI between 18.5kg/m^2 to 24.9kg/m^2). This could imply that the malnourished mothers were more likely to have wasted children. Similarly in Bangladesh, a decrease in the BMI of the mother was related to more severe childhood malnutrition (Huynh *et al.*, 2015). Another study in Bangladesh reported that children born to a healthy mother were at a lower risk of being wasted (Rayhan & Khan, 2006).

For the MAHFP scores variable (P = 0.029), the results suggested that a one value increase in the MAHFP scores resulted in a weight-for-height increase by the factor of 0.15. Notice that the higher the MAHFP scores the more food secure the household become (Leah *et al.*, 2013). This could imply that the more food secure households were, the more likely they were to have children with higher weight-for-height Z-scores.

For the age categories of the children variable (P = 0.008), the results suggested that the weight-for-height Z-scores for children between 23 and 35 months and older than 47 months old decreased by the factors of 1.16 and 1.49 respectively when compared to those of children younger than or equal to eleven months old. This could imply that the older children were more likely to be wasted than younger ones. As previously reported, this phenomenon could be partly explained by referring to a study in Egypt that demonstrated that the mothers of children from two years old and more tended to give less intensive child care as they opted for involvement in economic activities (Ricci *et al.*, 1996). The tendency to care less for the older children was somehow viewed as beneficial as it encourages children's independency (Ricci *et al.*, 1996). However, the overall ill effects of mother and children separation on the children's nutrition status cannot be ruled out. Mother and children separation, coupled with poverty, poor sanitation and episodes of illnesses could possibly facilitate inappropriate complementary feeding practices and family meals. Together these scenarios could result in compromised quantity, quality, adequacy, frequency and consistency of food in older children, necessitating a poor nutrition status (Dewey & Adu-Afarwuah, 2008).

For the annual income variable (P = 0.001), the results suggested that the weight-for-height Z-scores for children in households that earned between USD 100 and USD 200, and those that earned between USD 200 and USD 300 increased by the factors of 1.35 and 1.86 respectively when compared to those that earned less than USD 100. This could imply that the households earning more money were more likely to have less wasted children and probably more overweight children. A study in Malawi reported that economic empowerment of women through salaried employment and or family business was a predictor of having well-nourished children (Chirwa & Ngalawa, 2008). In agreement, household resources, such as income, are said to be a means of gaining access to food which can improve adequacy of food intake resulting in improved nutrition status (Babu *et al.*, 2014a). However, such is not always the case as a study in Vietnam reported that there was no clear relationship between income and wasting (Glewwe, Koch & Nguyen, 2004).

9.5.5 BMI-for-age for the children and associating factors

The multivariable random-effects GLS regression analysis considered the age of the children (P = 0.024), MAHFP scores (P = 0.038), BMI categories for the women (P = 0.050), annual income categories (P = 0.002), household assets value categories (P = 0.016), HHS scores (P = 0.128) and marital status (P = 0.189). The final adjusted model revealed that the BMI categories for the mothers (P = 0.030), age of the mothers (P = 0.029), annual income from tobacco sales (P = 0.002) and household assets value categories (P = 0.047) were significant factors influencing the BMI-for-age Z-scores for the children.

For the BMI categories of the mothers variable (P = 0.030), the results suggested that the BMI-for-age Z-scores for the children whose mothers were malnourished decreased by the factor of 0.96 when compared to those whose mothers were healthy (BMI between 18.5kg/m^2 to 24.9kg/m^2). This could imply that the malnourished mothers were more likely to have wasted children. As already reported, a decrease in BMI of the mother related to more severe childhood malnutrition in Bangladesh (Huynh *et al.*, 2015). Another study in Bangladesh reported that children born from a healthy mother were at a lower risk of being wasted (Rayhan & Khan, 2006).

For the age of the mothers variable (P = 0.029), the results suggested that a one year increase in the age of the mothers resulted in a decrease in BMI-for-age Z-scores for children by the factor of 0.03. This could imply that the older women were more likely to have wasted children. As already reported, a Sri Lanka report indicated that mothers either in their teens or their late 30s were significantly more likely to have children suffering from malnutrition (World Bank, 2005). Contrasting results have been reported in Nigeria where maternal age had no significant relationship with all the child nutrition status indicators, including stunting, wasting and underweight (Eze *et al.*, 2005). Another study in Nigeria reported teen age mothers were likely to give birth to wasted children (Olusanya *et al.*, 2010).

For the annual income variable (P = 0.002), the results suggested that the BMI-for-age Z-scores for children in households that earned between USD 100 and USD 200, and those that earned between USD 200 and USD 300 increased by the factors of 1.40 and 1.93 respectively, when compared to those that earned less than USD 100. This could imply that the households earning more money were more likely to have less wasted children and probably more overweight children. A study in Malawi reported that economic empowerment of women through salaried employment and or family business was a predictor of having well-nourished children (Chirwa & Ngalawa, 2008). In agreement, household resources, such as income, are said to be a means of gaining access to food which can improve adequacy of food intake resulting in improved nutrition status (Babu *et al.*, 2014a). However, such is not always the case as a study in Vietnam reported that there was no clear relationship between income and wasting (Glewwe *et al.*, 2004), as previously said.

For the household assets values variable (P = 0.047), the results suggested that the BMI-for-age Z-scores for children in wealthier households (i.e. wealth value between USD 50 and USD 100) increased by the factor of 0.93 when compared to those with a wealth value of less than USD 50. This could imply that the wealthier households were more likely to have less wasted children and probably more overweight children. Consistent with these results, a large sample study that used 24396 Indian children reported that poor households (those characterised by diminished wealth) displayed multiple anthropometric failures, besides wasting (Nandy, Irving, Gordon, Subramanian & Smith, 2005).

9.6 STRENGTH AND LIMITATIONS

9.6.1 Strength

- To the knowledge of the researcher, there is a paucity of studies that have assessed the extent and determinants of malnutrition in women of reproductive age and their under-five children solely focusing on the smallholder tobacco tenants in Malawi. Therefore, this study could be one of a few studies to describe the extent of malnutrition in smallholder tobacco tenants, and provide a comprehensive analysis of the influential determinants of nutrition status. If used properly, the findings from this study could help to improve the nutrition status of the concerned women and children.

9.6.2 Limitations

- The study only used anthropometry (BMI for women, weight-for-age, height-for-age, weight-for-height and BMI-for-age for children) as a measure of nutrition status. This could be a potential limitation because there are several techniques of measuring nutrition status that vary in complexity and each make assumptions that could affect suitability for use in different conditions. Therefore, it is unlikely that a single technique could be optimum in all circumstances (Wells & Fewtrell, 2006).
- There are probably several other associating/determining factors of malnutrition (e.g. mortality, morbidity) which, when included, could have potential to affect the results. Therefore, the conclusions were based only on the factors which were included during the conception of the study.
- Due to the nature of the study design (cross-sectional descriptive correlational), it cannot be claimed that the identified associating or determinants of malnutrition have causal effects. Therefore, this study fell short in that respect.

9.7 CONCLUSION

The successfulness of nutrition policy and programme interventions are often challenged by lack of robust research. Robust research generates relevant information to inform policy makers and programme managers to answers the questions about the extent of the problem, who are the most vulnerable, where are they found, and which among the myriad determining factors have positive or negative associations with nutrition status.

In this chapter some of these questions have been addressed. It can be concluded that malnutrition, specifically undernutrition is a serious problem for the women of reproductive age involved in smallholder tobacco tenant farming and their under-five children. Nutrition status indicators were also affected by different associating/determining factors (e.g. age of mothers, annual income levels, household size, sex of children and the HHS), suggesting the need to view malnutrition as a multifaceted phenomenon, hence the need for collaboration with all stakeholders. The understanding of the factors that are associated with nutrition status indicators in the tobacco tenant women of reproductive age and their children provides a basis for establishing appropriate actions that could be taken to improve those factors, thereby improving the women and children nutrition status.

9.8 RECOMMENDATIONS

- Study designs that could establish the cause-effect relationship between the nutrition status and associating/determining factors for the smallholder tobacco tenants are required to fully unearth the cause of malnutrition for the tenant women and children on smallholder tobacco farms.
- Studies designed to compare nutrition status indicators in both large scale and smallholder farms to provide the real extent of malnutrition and its associating factors on the tobacco farmers are required in future.

CHAPTER 10

EXECUTIVE SUMMARY AND RECOMMENDATIONS

10.1 INTRODUCTION

This chapter presents the summary of the main findings for the entire study. The study was conducted in the Mzimba North district in the northern region of Malawi in three extension planning areas (EPAs), namely Bwengu, Engucwini and Njuyu. The study was implemented during the hunger season between January and March 2016, focusing on a representative sample of households of women of reproductive age involved in tobacco tenant work on smallholder farms, and their under-five children.

The chapter is organised in the following sections: introduction, aim and objectives, study design, main findings, framework summary, strengths and limitations, conclusions and recommendations.

10.2 AIM AND OBJECTIVES

10.2.1 Aim

To assess and describe the food accessibility and nutrition status of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months) on smallholder farms in the Mzimba North district in the northern region of Malawi, as well as to determine and report correlational relationships amongst demographic and socio-economic factors, food accessibility measurements and nutrition status indicators.

10.2.2 Objectives

10.2.2.1 Demographic and socio-economic factors

10.2.2.1.1 To assess and describe the demographic and socio-economic characteristics in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.2 Household food insecurity

10.2.2.2.1 To assess and describe the severity of the experience of food insecurity access in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the validated HFIAS developed by Coates *et al.* (2007). (*Refer to Appendix 10 for the HFIAS questionnaire.*)

10.2.2.2.2 To determine and report the relationships between the HFIAS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.3 Household hunger

10.2.2.3.1 To assess and describe the severity of hunger in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the validated HHS developed by Ballard *et al.* (2011). (*Refer to Appendix 10, last three questions of the HFIAS questionnaire*.)

10.2.2.3.2 To determine and report the relationships between the HHS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.4 Months of food provisioning

10.2.2.4.1 To assess and describe the annual prevalence of hunger in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by using the MAHFP tool developed by Bilinsky and Swindale (2007). (*Refer to Appendix 9 for the MAHFP questionnaire.*)

10.2.2.4.2 To determine and report the relationships between the MAHFP scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.5 Individual dietary diversity

10.2.2.5.1 To assess and describe the IDDS of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (24 to 59 months old) on smallholder farms by using the validated IDDS questionnaire developed by Kennedy *et al.* (2011). (*Refer to Appendices 11 and 12.*)

10.2.2.5.2 To determine and report the relationship between the IDDS scores for the tobacco tenant women of reproductive age (15 to 49 years old) and the IDDS scores for their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.5.3 To determine and report the relationships between the IDDS scores and associating factors (demographic and socio-economic) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.2.2.6 Nutrition status

10.2.2.6.1 To assess and describe the nutrition status of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms by use of anthropometric indicators: body mass index (BMI), weight-for-age (underweight), weight-for-height (wasting), height-for-age (stunting) and BMI for age indices.

10.2.2.6.2 To determine and report the relationships between nutrition status indicators and associating factors (demographic, socio-economic, HFIAS scores, HHS scores, MAHFP scores and IDDS scores) in the households of the tobacco tenant women of reproductive age (15 to 49 years old) and their under-five children (0 to 59 months old) on smallholder farms.

10.3 STUDY DESIGN

The study used a quantitative cross-sectional descriptive correlational design. The study was conducted in the Mzimba North district in the northern region of Malawi in Bwengu, Engucwini and Njuyu EPAs.

The sample size was 110 households (110 women of reproductive age and 139 under-five children) sampled through the proportional systematic random sampling technique.

The sample size was calculated using nQuery version 7 computer package based on 47% prevalence of malnutrition among under-five children in Malawi (Government of Malawi & ICF Macro, 2011), estimated at 95% CI to the accuracy of 10%.

The participants were included in the study if they were women of reproductive age between 15 to 49 years old; they had under-five child/ren between zero to 59 months old; they were responsible for cooking and or preparing food for their households; they were involved in tobacco farming on smallholder farms as tenants for at least two consecutive seasons; they were residing in the selected study areas; they gave consent (≥ 18 years) and assent (15 to 18 years) for themselves and their under-five children to participate in the study.

Willing participants were excluded from the study if they had any health related conditions known to interfere with the data collection process and the results of the study, such as pregnancy status.

10.3.1 Data collection

The data were collected from the three EPAs (Bwengu, Engucwini and Njuyu) of the Mzimba North district during the hunger season (January to March 2016). The EPAs were purposively selected based on the high tobacco farming activities. The data, including demographic and socio-economic information (*refer to Appendices 2 to 5, 7 and 8*), HFIAS (*refer to Appendix 10*), HHS (*refer to Appendix 10*), MAHFP (*refer to Appendix 9*), IDDS (*refer to Appendices 11 and 12*) and anthropometric measurements (*refer to Appendix 6*) were captured through face-to-face interviews by administering the predefined structured questionnaires to the eligible women of reproductive age.

The questionnaires were translated from English to the local Chewa and Tumbuka languages. The translation process followed the six major steps as suggested by Ballard *et al.* (2011). The first step was initial translation, and was done by a separate translator who possessed interview skills and was knowledgeable of both the Chewa and Tumbuka languages. The second step was identification of terms and phrases to be adapted and clarified. The third step was interaction and checking of the translated questionnaires with communities and key informants, such as field staff and leaders. The emphasis was to cross-check the understanding of the identified terms and phrases, as well as to verify the local food names in the case of the IDDS questionnaire. The fourth step was refining of the questionnaires in which feedback from the key informant and community meetings was incorporated in the questionnaires. The fifth step was back translation by an independent translator, who was knowledgeable of the English language and had no initial knowledge of the questionnaires. Lastly, the questionnaires were then pretested in the field with the women of reproductive age. (*Refer to section 3.5.3 for pilot study details*.)

The data collection was done by the researcher and a team of field investigators comprising of the food and nutrition officers at the ADD and district levels, as well as with the assistance from health and agriculture field staff. The team of field investigators was trained on all the data collection tools. The field investigators were also involved in the piloting of the questionnaires. (*Refer to section 3.5.3 for pilot study details*.)

The nutrition status assessments for the women of reproductive age and under-five children were achieved by taking anthropometric measurements (weight and height) during the face-to-face interviews. Electronic scales (Safeway digital scales with a maximum weight of 150kg, made in Cambodia) were used to measure weight, while adjustable wooden height boards were used to measure height. The weight was recorded to the nearest 0.1kg, while height was recorded to the nearest 0.1cm to ensure accuracy (Cogill, 2003). The children were weighed together with the mothers. The weight of the under-five child was calculated by subtracting the weight of the mother alone from the total weight of mother carrying the under-five child (Cameron, 2013). Under-five children younger than 24 months were measured lying down on the board (recumbent length), and standing height was measured for older under-five children (≥ 24 months) (Geissler & Powers, 2011). Standard protocols were followed during collection of anthropometric data, including taking height and weight measurements twice per subject to calculate the mean measure, ensuring participants were in minimal clothing, and ensuring study participants were familiar with the anthropometric equipment (Cogill, 2003; WHO, 2008; Cameron, 2013). (*Refer to section 3.5.2 on validity and reliability of the data for details on standard protocols*.)

Age of the under-five children was also collected as it is useful during taking of anthropometric measurements and later during analysis and interpretation of the data. The usefulness of age in anthropometry requires it to be as precise as possible. Documentary evidence of the birth date (e.g. birth and or baptismal certificate) was used to cross-examine the date of birth even if the mother indicated to know it (Cogill, 2003).

10.3.2 Delimitations of the study

The first delimitation was that the study findings would only be generalised to the population from which the sample was drawn. The sample was drawn from the households of tobacco tenant women of reproductive age and under-five children living on smallholder farms in Mzuzu ADD in the northern region of Malawi. The choice of this study population was based on evidence that they are one of the most vulnerable groups in Malawi in as far as food insecurity and malnutrition are concerned (Torres, 2000; ILO, 2011).

The second delimitation was that only the food security and nutrition status measurement tools used in the study were considered. The tools included the HFIAS developed by Coates *et al.* (2007), the HHS developed by Ballard *et al.* (2011), the IDDS developed by Kennedy *et al.* (2011), the MAHFP developed by Bilinsky and Swindale (2007) and anthropometry. The tools were selected because of their complementary effect to provide various perspectives of the occurrence of food insecurity, as well as due to their simplicity and inexpensiveness, while also considering their respective potential validity and reliability features in capturing the conditions of food insecurity and malnutrition.

The third delimitation was that only two food security pillars, namely accessibility and utilisation were considered. The methods typically used to measure food availability (for example, Food Balance Sheets) and stability (for example, Household Economy Approach and Integrated Phase Classification) are complex and costly (Ballard *et al.*, 2013). Therefore, the food accessibility and utilisation pillars were chosen due to their relative easiness and convenience to measure food security at both household and individual levels.

The last delimitation was that only the demographic and socio-economic factors outlined in the questionnaires were considered for analysis (*refer to Appendices 2 to 5, 7 and 8*). These factors were chosen with evidence from the review of literature and their bearing on women empowerment as suggested by Alkire *et al.* (2013).

10.4 MAIN FINDINGS

The research study sampled 110 households and interviewed 110 women of reproductive age (15 to 49 years) about household information, including information for their 139 under-five children (0 to 59 months). The data were collected from all the sampled women of reproductive age. Therefore, the response rate was 100%. However, the response rate slightly varied due to none responses to specific questions and or missing data. For instance, sample size (N) for the height-for-age and weight for age Z-scores for the under-five children were 131 and 133 respectively instead of 139, due to missing weight and height values.

10.4.1 Demographic and socio-economic factors

10.4.1.1 Demographic factors

- Most of the women of reproductive age (44%) were young adults between 21 to 26 years old, while older adults between 45 to 49 years were very few (1%). The mean age for the women was 27.3 ± 6 years.
- Most of the under-five children (24%) were between 48 to 59 months old, and an almost similar proportion (23%) were between 12 to 23 months. The mean age of the under-five children was 28.8 ± 15 months. There were more male under five children (52%).
- The household sizes were relatively large considering the overall status of these households. The mean household size was about five members. Almost one in every two households (49%) had between five to seven household members.

- Almost all the interviewed women (95%) were married and living with their spouses on the farms and or the villages surrounding the farms. Very few (5%) were married with their spouses away from the farms at the time of the interviews. Only 1% was widowed. Farm owners have a tendency to recruit married tenants to benefit from almost free labour from female spouses and children (ILO, 2011).
- Literacy levels were very low. About one-fifth (17%) had never gone to school. The majority (73%) had only accessed primary education. Only a few (10%) reached secondary education, and none reported that they possessed a certificate as proof of completion of the claimed level of education.
- *Refer to chapter 4 for further details on the demographic factors.*

10.4.1.2 Economic factors

The households of women of reproductive age were basically characterised by compromised economic status.

- The annual incomes were low. The households were earning a mean of USD 209.94 ± 129.69 per annum. Almost half of the households (45%) were earning between USD 100.00 to 199.00 annually and very few (1%) earned between USD 600.00 to USD 699.00. None of the interviewed women were above the current World Bank poverty line threshold of USD 1.90 per day (Ferreira *et al.*, 2016).
- The value of household assets was low. The mean value of assets was USD 55.10 ± 62.80. About nine in every ten households (89%) had their assets valued at less than USD 99.00. Households mainly possessed non-productive assets. None reported the possession of valuable farm production assets such as ox-carts, ploughs, sprayers, water pumps, trailers, iron roofed houses, milk churns and motorbikes. Less than half of the households possessed assets such as bicycles or cell phones, TVs, radios, sickles, axes, improved charcoals stove, machete, shovel, chairs, tables, sofa set, forage choppers, livestock structures or combinations of these.
- Very few, about one-fifth of the women (21%), said they had access to loans in the previous 12 months. They mainly accessed the loans from informal lenders, i.e. 91% said they had borrowed cash from their friends and relatives.

- *Refer to chapter 4 for further details on the economic factors.*

10.4.1.3 Social factors

- One in every two women (50%) reported that they were highly involved in tobacco labour. Close to half (44%) felt that they were moderately involved, while very few (6%) felt that their contribution towards tobacco labour was minimal. This means that the majority of the women were highly involved in tobacco labour.
- More than half of the women (54%) reported to have received training in food security and nutrition topics.
- Public speaking, representation and leadership positions in community development are crucial for women empowerment (Alkire *et al.*, 2013). There was low participation of women in this regard. About eight in every ten women (81%) said they either did not at all feel comfortable or that they could speak in public, but with great difficulty. Only very few (19%) felt they were very comfortable to speak in public.
- Most of the women said that they were involved in the household decision making processes. Almost eight in every ten women (75%) reported that they were involved in the decision making processes regarding household wealth. However, some (21%) said that only the males made these decisions. Likewise, seven in every ten women (72%) reported that they were involved in food security and nutrition decisions in the households, while few (17%) said that only the males made these decisions.
- *Refer to chapter 4 for further details on the social factors.*

10.4.2 Household Food Insecurity Access Scale (HFIAS)

The severity of the experience of household food insecurity access was high among the tobacco tenant households in Mzimba north district, Malawi. The majority of the households (75%) were severely food insecure, 11% moderately food insecure and 7% mildly food insecure. Very few households (7%) were found to be food secure.

More than half of the households reported to have experienced each of the three domains of food insecurity. For the first domain, 75% reported that they were anxious and uncertain about access to food. For the second domain, a mean of 77% reported that they had insufficient food quality, while a mean of 61% had insufficient food intake which is the last domain.

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the HFIAS scores and age of the mothers ($P = 0.001$), household size ($P = 0.000$), marital status ($P = 0.044$), literacy level ($P = 0.014$) and loan access ($P = 0.002$). Non-significant relationships were observed between the HFIAS scores and training in food security and nutrition topics ($P = 0.118$), labour contribution ($P = 0.320$), annual income ($P = 0.969$), household assets values ($P = 0.098$), public speaking ($P = 0.404$), decision making regarding wealth ($P = 0.188$) and decision making regarding food security and nutrition matters ($P = 0.175$).

The multivariable linear regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final adjusted model revealed that loan access ($P = 0.015$) and household size ($P = 0.000$) were the only significant factors influencing the HFIAS scores at 0.05 level of significance. (*Refer to chapter 5 for further details on the HFIAS.*)

10.4.3 Household Hunger Scale (HHS)

The severity of hunger was high among the tobacco tenant households in Mzimba north district, Malawi. More than half of the households (55%) were found to be hungry. Specifically, 36% were moderately hungry, while 19% were severely hungry. Less than half (45%) of the households were found to have little or no hunger.

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the HHS scores and household size ($P = 0.000$), marital status ($P = 0.018$), age of the mothers ($P = 0.033$), literacy level ($P = 0.005$), training in food security and nutrition topics ($P = 0.015$), loan access ($P = 0.054$), decisions regarding wealth ($P = 0.044$), decisions regarding food security and nutrition matters ($P = 0.047$). Non-significant relationships were observed between the HHS scores and labour contribution ($P = 0.368$), annual income (P = 0.783), household assets values (P = 0.591) and public speaking (P = 0.865).

The multivariable linear regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final adjusted model revealed that training in food security and nutrition topics (P = 0.046), marital status (P = 0.045), as well as household size (P = 0.000) were the only significant factors influencing the HHS scores at 0.05 level of significance. (*Refer to chapter 6 for further details on the HHS.*)

10.4.4 Months of Adequate Household Food Provisioning (MAHFP)

The annual prevalence of hunger was high among the tobacco tenant households in Mzimba north district, Malawi. The mean MAHFP score was 8.45 ± 2.42 months, representing that households had access to adequate food for about eight months out of a possible 12 months (i.e. a one year period).

Most of the households (44%) had inadequate access to food for one to three months in the previous 12 months. About four in every ten households (41%) had inadequate access to food for more than or equal to four months in the previous 12 months. A few households (15%) reported that they did not struggle to access the food. The worst months in which more than half of the households had inadequate access to food were January (64%) and February (70%), which is the lean season in Malawi.

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the MAHFP scores and household size (P = 0.012), age of the mother (P = 0.052), labour contribution (P = 0.029), loan access (P = 0.045), decisions regarding wealth (P = 0.052), decisions regarding food security and nutrition matters (P = 0.055). Non-significant relationships were observed between the MAHFP scores and training in food security and nutrition topics (P = 0.150), annual income (P = 0.105), literacy levels (P = 0.125), marital status (P = 0.264), household assets values (P = 0.328) and public speaking (P = 0.977).

The multivariable linear regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final adjusted model revealed that labour contribution (P = 0.038), annual income (P = 0.008), as well as household size (P = 0.001) were the only significant factors influencing the MAHFP scores at 0.05 level of significance. (*Refer to chapter 7 for further details on the MAHFP*.)

10.4.5 Individual Dietary Diversity Scale (IDDS)

The IDD was seriously low for both the women of reproductive age and their under-five children in the tobacco tenant households in Mzimba north district, Malawi. The mean IDDS score was 2.5 ± 0.8 food groups for the women, and 2.5 ± 0.9 food groups for the children. This suggests that the women and children only consumed a mean of two food groups out of a possible nine food groups in the previous 24 hours.

The majority of the participants (91% women, 91% children) consumed less than or equal to three food groups. A few (9% women, 9% children) consumed four to six food groups, while none of the women or children consumed more than or equal to seven food groups (out of the nine food groups).

The diet was basically monotonous. Staples were the mostly consumed food group (99% women, 98% children), followed by dark-green leafy vegetables (80% women, 77% children). Consumption of legumes was low (9% women, 9% children), followed by meat (10% women, 11% children) and vitamin A fruits and vegetables (13% women, 16% children). Both the women and children did not consume organ meat, eggs and or dairy and dairy products.

The consumption of micronutrient dense foods was basically only from plant foods. None of the women or children consumed vitamin A rich animal source foods, such as organ meat, eggs or dairy and dairy products. The majority (93% women, 95% children) consumed plant foods rich in vitamin A, such as vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits. A few (10% women, 11% children) consumed foods that were good sources of haem-iron, such as organ meat, flesh meat, or fish.

There was high statistical significant correlational relationship between the IDDS scores for the women and their children (P = 0.000). This could suggest that the children were not given special nutrition attention in terms of the consumption of diversified foods according to their specific needs.

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the IDDS scores for the mothers and labour contribution (P = 0.001), annual income (P = 0.000), decisions regarding food security and nutrition matters (P = 0.028). Non-significant relationships were observed between the IDDS scores for the women and marital status (P = 0.184), age of mothers (P = 0.061), household size (P = 0.272), literacy levels (P = 0.924), household assets values (P = 671), training in food security and nutrition topics (P = 0.904), loan access (P = 0.268), public speaking (P = 0.220) and decisions regarding wealth (P = 323).

The multivariable linear regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final adjusted model revealed that labour contribution (P = 0.001), decisions regarding food security and nutrition matters (P = 0.004), age of the mothers (P = 0.033) and annual income (P = 0.000) were the only significant factors influencing the IDDS scores for the women at 0.05 level of significance. (*Refer to chapter 8 for further details on the IDDS.*)

10.4.6 Nutrition status

Malnutrition, specifically undernutrition, was a problem for both the women of reproductive age and their under-five children in the tobacco tenant households in Mzimba north district, Malawi.

The study revealed that 21% of the women of reproductive age were malnourished; out of which 15% were underweight, 6% were overweight, while none were obese.

For the under-five children, with respect to the weight-for-length/height, 20% were wasted. For the length/height-for-age, 31.3% were stunted. For the weight-for-age, 34% were underweight and for the BMI-for-age, 17.1% were wasted.

More male than female under-five children were malnourished. For the weight-for-length/height, more males (28.8%) than females (10.8%) were wasted. For the length/height-for-age, more males (34.4%) than females (28.4%) were stunted. For the weight-for-age, more males (44.8%) than females (22.7%) were underweight. For the BMI-for-age, more males (24.6%) than females (9.4%) were wasted. (*Refer to chapter 9 for further details on the nutrition status of the women of reproductive age and their under-five children*.)

Different nutrition status indicators for the women and children were affected by different associating factors (demographic, socio-economic and food accessibility). The following sections provide a summary of significant and non-significant associating factors.

10.4.6.1 BMI for the women

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the BMI scores for the women and the age of the mothers (P = 0.004), literacy levels (P = 0.018) and loan access (P = 0.000). Non-significant relationships were observed between the BMI scores for the women and household size (P = 0.100), decisions regarding food security and nutrition matters (P = 0.100), marital status (P = 0.437), labour contribution (P = 0.997), annual income (P = 0.644), household assets values (P = 0.623), training in food security and nutrition topics (P = 0.679), public speaking (P = 0.778) and decisions regarding wealth (P = 0.713).

The multivariable linear regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The adjusted model revealed that the age of the mothers (P = 0.034) and loan access (P = 0.003) were significant factors influencing the BMI scores for the women at 0.05 level of significance.

The multivariable IV regression analysis was used to instrument the food insecurity tools (HFIAS, HHS, MAHFP and IDDS for women). The final adjusted model revealed that the age of the mothers (P = 0.054), loan access (P = 0.004), HFIAS scores (P = 0.007) and HHS scores (P = 0.001) were the significant factors influencing the BMI scores for the women at 0.05 level of significance.

10.4.6.2 Height-for-age for the children

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the height-for-age Z-scores for the under-five children and age of the mothers (P = 0.019), sex of the children (P = 0.002), as well as the HFIAS categories (P = 0.006). Non-significant correlational relationships were observed between the height-for age Z-scores for the children and annual income categories (P = 0.102), household assets values (P = 0.078), marital status (P = 0.184), age of children (P = 0.965), HHS scores (P = 0.475), MAHFP scores (P = 0.571), IDDS scores (P = 297), household size (P = 0.921), BMI categories of mothers (P = 0.872), labour contribution (P = 0.648), training in food security and nutrition topics (P = 0.231), loan access (P = 0.956), public speaking (P = 0.919), decisions regarding wealth (P = 0.703), decisions regarding food security and nutrition matters (P = 0.786) and literacy levels (P = 0.296).

The multivariable random-effects GLS regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final model revealed that the age categories for the mothers (P = 0.004), sex of the children (P = 0.005), household assets values (P = 0.028) and HFIAS categories (P = 0.006) were the significant factors influencing the height-for-age Z-scores for the children at 0.05 level of significance.

10.4.6.3 Weight-for-age for the children

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the weight-for-age Z-scores for the under-five children and the household assets values (P = 0.028), age categories of the mothers (P = 0.004), sex of the children (P = 0.045), age categories of the children (P = 0.002) and annual income categories (P = 0.048). Non-significant relationships were observed between the weight-for-age Z-scores for the children and HHS scores (P = 0.069), MAHFP scores (P = 0.120), BMI categories for the women (P = 0.126), HFIAS scores (P = 0.489), IDDS scores for the women (P = 0.907), household size (P = 0.344), labour contribution (P = 0.923), training in food security and nutrition topics (P = 0.583), loan access (P = 0.335), public speaking (P =

0.646), decisions regarding wealth (P = 0.712), decisions regarding food security and nutrition matters (P = 0.246), marital status (P = 0.949) and literacy levels (P = 0.341).

The multivariable random-effects GLS regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The adjusted model revealed that the BMI categories for the mothers (P = 0.016), sex of the children (P = 0.028), household assets values (P = 0.015), age categories for the mothers (P = 0.012) and age categories for the children (P = 0.033) were significant factors influencing the weight-for-age Z-scores for the children at 0.05 level of significance.

The multivariable IV regression analysis was used to instrument the BMI scores for the women. The final adjusted model revealed that the BMI scores for the mothers (P = 0.014), sex of the children (P = 0.005), household assets values (P = 0.014), age categories for the mothers (P = 0.001) and age categories for the children (P = 0.015) were the significant factors influencing the weight-for-age Z-scores for the children at 0.05 level of significance.

10.4.6.4 Weight-for-height for the children

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the weight-for-height Z-scores for the children and the MAHFP scores (P = 0.043), the BMI categories for the mothers (P = 0.054), age categories for the children (P = 0.007), annual income categories (P = 0.012) and household assets value categories (P = 0.023). Non-significant relationships were observed between the weight-for-height Z-scores for the children and the HFIAS scores (P = 0.315), IDDS scores (P = 0.496), household size (P = 0.386), age of the mothers (P = 0.279), labour contribution (P = 0.785), sex of the children (P = 0.599), training in food security and nutrition topics (P = 0.826), loan access (P = 0.296), public speaking (P = 0.532), decisions regarding wealth (P = 0.833), decisions regarding food security and nutrition matters (P = 0.267), marital status (P = 0.214) and literacy level (P = 0.558).

The multivariable random-effects GLS regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The final adjusted model revealed that the BMI categories for the mothers (P = 0.032), MAHFP scores

(P = 0.029), age categories for the children (P = 0.008) and annual income (P = 0.001) were the significant factors influencing the weight-for-height Z-scores for the children at 0.05 level of significance.

10.4.6.5 BMI-for-age for the children

The bivariate analysis using linear regression revealed statistically significant correlational relationships between the BMI-for-age Z-scores and the age of the children (P = 0.024), the MAHFP scores (P = 0.038), BMI categories for the women (P = 0.050), annual income categories (P = 0.002) and household assets value categories (P = 0.016). Non-significant relationships were observed between the BMI-for-age Z-scores and the HHS scores (P = 0.128), marital status (P = 0.189), HFIAS scores (P = 0.251), IDDS scores (P = 0.460), household size (P = 0.293), age of the mothers (P = 0.333), labour contribution (P = 0.813), sex of the children (P = 0.854), training in food security and nutrition topics (P = 0.826), loan access (P = 0.279, public speaking (P = 0.530), decisions regarding wealth (P = 0.999), decisions regarding food security and nutrition matters (P = 0.289) and literacy levels (P = 0.866).

The multivariable random-effects GLS regression analysis considered all the independent variables that showed statistical significance at least at 0.1 level of significance. The adjusted model revealed that the BMI categories for the mothers (P = 0.030), age of the mothers (P = 0.029), annual income (P = 0.002) and household assets value categories (P = 0.047) were the significant factors influencing the BMI-for-age Z-scores for the children at 0.05 level of significance.

10.5 FRAMEWORK SUMMARY

This section presents a summary of the study findings based on the conceptual framework. The framework of the study was conceptualised based on the premise that the households' living conditions, i.e. demographic and socio-economic factors affect household food accessibility, individual food accessibility, food utilisation and nutrition status of women of reproductive age and their under-five children (*refer to Figure 3.3.1 for a conceptual framework*). Research has demonstrated that there are correlational relationships between demographic and socio-economic factors with the food security and nutrition status of individuals (Makombe *et al.*, 2010; Teller & Yimer, 2015). Furthermore, many researchers have also reported that food security and nutrition status of an individual are related (Gross *et al.*, 2000; Geissler & Powers, 2011; Aurino, 2014; Hendriks, 2015).

10.5.1 Food accessibility

For the data from all the food accessibility measurements, the multivariable linear regression analysis was used.

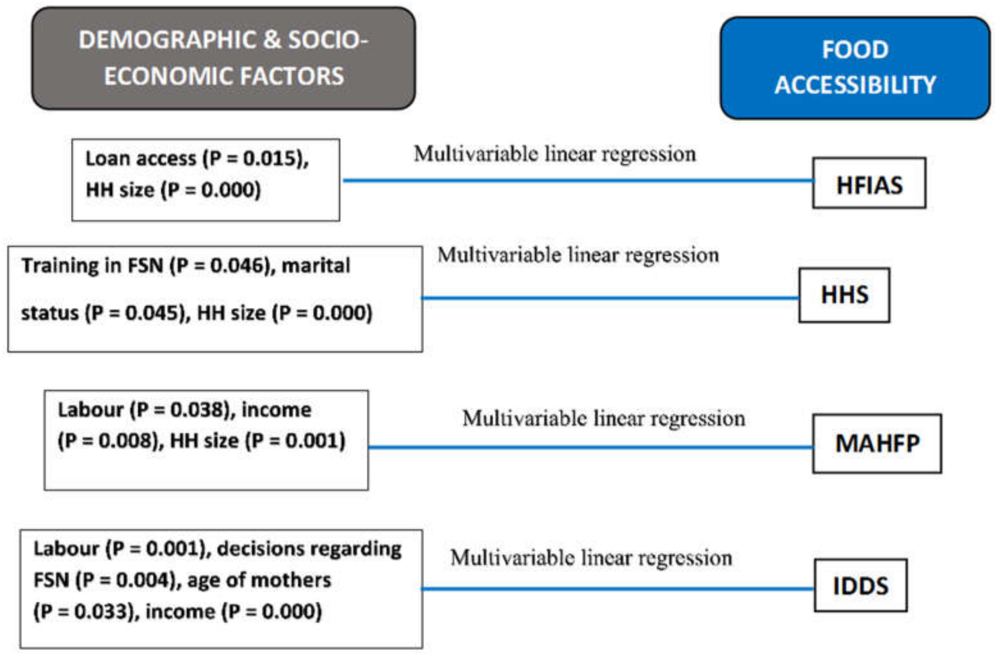
The associating factors that were significantly influencing the severity of the experience of food insecurity access (HFIAS) were the household size (P = 0.000) and loan access (P = 0.015) (*Figure 10.5.1*). For the household size variable, the results suggested that for every one member increase in the household size, the HFIAS scores were increasing by the factor of 1.44. This could imply that the households with larger number of members were more likely to experience food accessibility problems as compared to those with a smaller number of members. Note that the higher the HFIAS score, the more food insecurity access was experienced by the households (Coates *et al.*, 2007). For the loan access variable, the results suggested that comparatively, for the households that did not access loans, their HFIAS scores increased by the factor of 3.04. This could imply that the households that did not have access to loans were more likely to experience food accessibility problems as compared to those that had accessed loans. (*Refer to chapter 5; section 5.6 for detailed discussion on the HFIAS.*)

The associating factors that were significantly influencing the prevalence of hunger (HHS) were the training in food security and nutrition topics (P = 0.046), marital status (P = 0.045) and household size (P = 0.000) (*Figure 10.5.1*). For the household size variable, the results suggested that for any additional household member in the household, the HHS scores increased by the factor of 0.27. This could imply that hunger was more likely to be experience by the households with more members than those with fewer members. Note that the higher the HHS score, the more hunger the household experienced (Ballard *et al.*, 2011). For the marital status variable, the results suggested that as compared to the households where both spouses were present, there was an increase in the HHS scores by the factor of

1.03 in the households where only female spouses were present and or in widowed households. This could imply that the households that did not have both spouses were more likely to experience hunger compared to those where both spouses were present. For the training in food security and nutrition topics variable, the results suggested that compared to households that received training in food security and nutrition topics, there was an increase in the HHS scores by the factor of 0.47 in the households that did not receive any training. This could imply that the households that did not receive training in food security and nutrition topics were more likely to experience hunger compared to those that received the training. (*Refer to chapter 6; section 6.6 for detailed discussion on the HHS*.)

The associating factors that were significantly influencing the annual prevalence of hunger (MAHFP) were the tobacco labour contribution (P = 0.038), annual income (P = 0.008) and household size (P = 0.001) (*Figure 10.5.1*). For the household size variable, the results suggested that for any additional household member in the household, the MAHFP scores decreased by the factor of 0.36. This could imply that the annual prevalence of hunger was more likely to be experienced by the households with more members than those with fewer members. Note that the lower MAHFP score depicts a food insecure situation (Leah *et al.*, 2013). For the annual income variable, the results suggested that for any additional US dollar to the household, the MAHFP scores increased by the factor of 0.0036. This could imply that the annual prevalence of hunger was more likely to be experienced by the households with reduced income than those with a higher income. For the labour contribution variable, the results suggested that as compared to the women who were highly involved in tobacco labour, there was an increase in the MAHFP scores by the factor of 0.65 in the women who were less and or moderately involved. This could imply that the households with women who were less and or moderately involved in tobacco labour were more likely to have less annual prevalence of hunger compared to the households with women who were highly involved in tobacco labour. (*Refer to chapter 7; section 7.6 for detailed discussion on the MAHFP*.)

The associating factors that were significantly influencing the dietary diversity (IDDS for the women) were the tobacco labour contribution (P = 0.001), decisions regarding food security and nutrition matters (P = 0.004), age of the mothers (P = 0.033) and the annual income (P = 0.000) (*Figure 10.5.1*). For the annual income variable, the results suggested that an increase in one US dollar to the household resulted in a 0.001 factor increase in the IDDS scores for the women. This could imply that the women in the households with more income were more likely to consume diversified food groups as compared to those in the households with less income. Note that the higher the IDDS score, the better the diversification of food groups (Kennedy *et al.*, 2011). For the age of the mothers/women variable, the results suggested that an increase in the age of the mothers by one year resulted in a decrease in the IDDS scores for the mothers by the factor of 0.02. This could imply that the older women were more likely to consume less diversified food groups compared to the younger women. For the labour contribution variable, the results suggested that the IDDS scores for the women who felt they were less and or moderately involved in tobacco labour increased by the factor of 0.33, as compared to those who felt they were highly involved in tobacco labour. This could imply that the women, who were less and or moderately involved in tobacco labour, were more likely to consume diversified food groups compared to the women, who were highly involved in tobacco labour. For the decisions regarding food security and nutrition matters variable, the results suggested that there was an increase in the IDDS scores by the factor of 0.56 when females alone made decisions regarding food security and nutrition matters in the household compared to when the decisions were made by the men alone. This could imply that the women, who made decisions alone regarding food security and nutrition matters in the household, were more likely to consume diversified food groups compared to when the decisions were made by the men alone. (*Refer to chapter 8; section 8.6 for detailed discussion on the IDDS.*)



= Correlational relationships between food accessibility assessments and demographic and socio-economic factors; FSN= Food security and nutrition; HH = household; P = p-value; IDDS = Individual Dietary Diversity Scale scores; MAHFP = Months of Adequate Household Food Provisioning scores; HHS = Household Hunger Scale scores; HFIAS = Household Food Insecurity Access Scale scores

Figure 10.5.1: Framework illustrating multivariable linear regression analysis between various food accessibility assessments and demographic and socio-economic factors

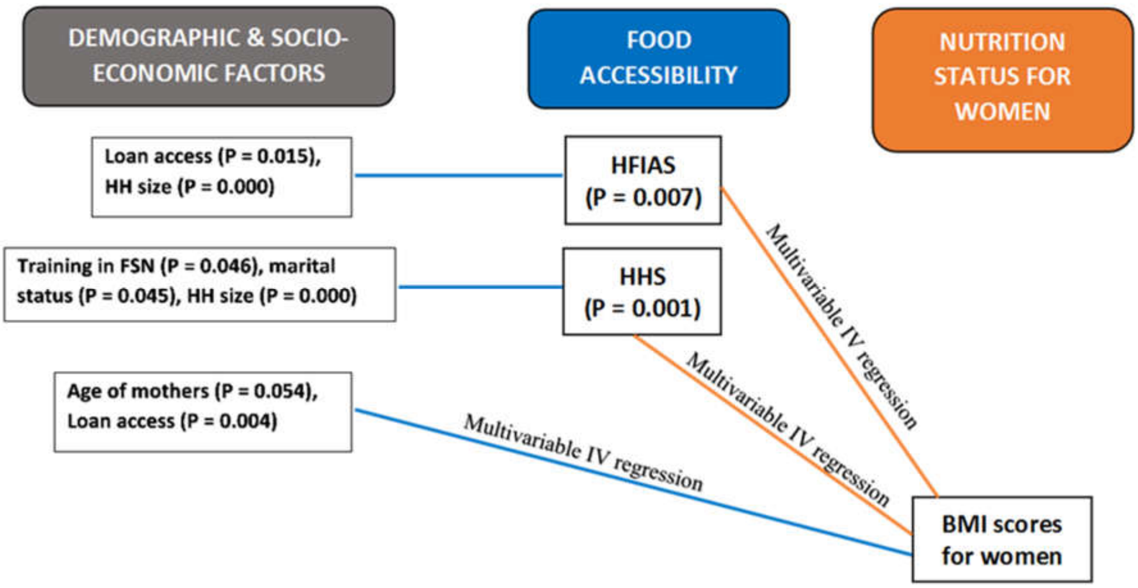
10.5.2 Nutrition status

Two type of analyses were used for the nutrition status of the women of reproductive age and under-five children, namely the multivariable IV regression analysis and multivariable linear regression analysis.

10.5.2.1 Multivariable IV regression analysis

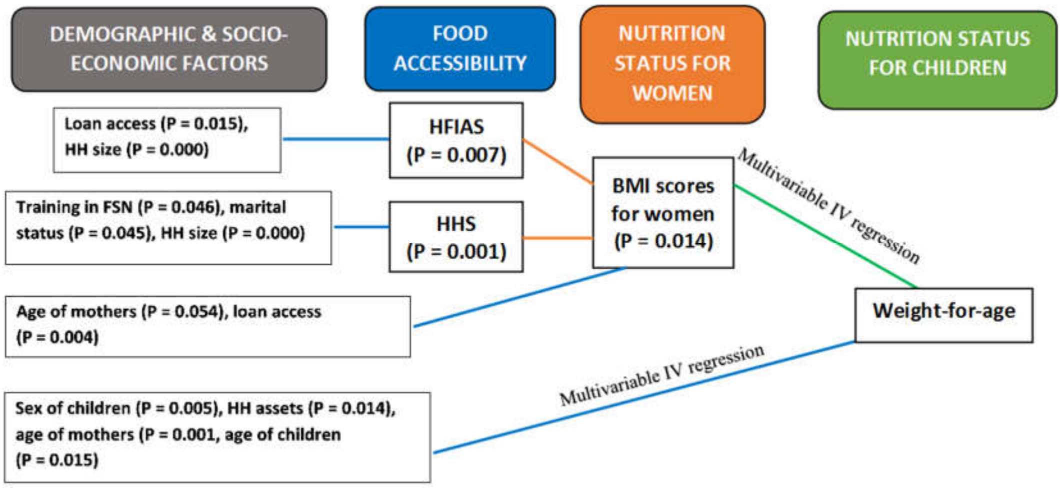
Using the multivariable IV regression analysis, the associating factors that were significant in influencing the BMI scores for the women were the HFIAS scores (P = 0.007), the HHS scores (P = 0.001), age of the mothers (P = 0.054) and loan access (P = 0.004) (*Figure 10.5.2*). For the age of the women variable, the results suggested that an increase in age by one year caused the BMI scores for the women to increase by the factor of 0.05. This could imply that the BMI was more likely to be higher in older women than younger ones. For the loan access variable, the results suggested that for the women who accessed loans, their BMI scores increased by the factor of 1.08 when compared to those who did not have access to loans. This could imply that the BMI was more likely to be higher in women who had access to loans than those without access. For the HFIAS scores variable, the results suggested that an increase in one value of the HFIAS scores caused a decrease in the BMI scores for the women by the factor of 0.09. This could imply that the BMI for women in food insecure households was more likely to be lower than the BMI for women in food secure households. For the HHS scores variable, the results suggested that an increase in one value of the HHS score caused a decrease in the BMI scores for the women by the factor of 0.46. Note that the higher the HHS score, the more hunger the household experienced (Ballard *et al.*, 2011). Hence this could imply that the BMI for the women in hunger stricken households was likely to be lower than those in food secure households. (*Refer to chapter 9; section 9.5.1 for detailed discussion on BMI for women and associating factors*.)

For the under-five children, the associating factors that were significant in influencing the weight-for-age Z-scores were the BMI scores for the women/mothers (P = 0.014), sex of the children (P = 0.005), household assets values (P = 0.014), age categories for the mothers (P = 0.001) and age categories for the children (P = 0.015) (*Figure 10.5.3*). For the BMI scores of the women/mothers' variable, the results suggested that an increase in the BMI scores of the mothers by one value resulted in the weight-for-age Z-scores for the children to increase by the factor of 0.42. This could imply that the women with higher BMI scores were more likely to have less underweight children than those with lower BMI scores. For the sex of the children variable, the results suggested that the weight-for-age Z-scores for male children decreased by the factor of 0.82 when compared to female children. This could imply that the male children were more likely to be underweight than their female counterparts. For the household assets values variable, the results suggested that an increase in household assets values by one US dollar resulted in an equivalent increase in weight-for-age Z-scores by the factor of 0.01. This could imply that the wealthier households were more likely to have less underweight children than their counterparts. For the age of the mothers' variable, the results suggested that comparatively, the weight-for-age Z-scores for children whose mothers were older than 30 years decreased by the factor of 1.08 when compared to those whose mothers were younger than or equal to 30 years old. This could imply that the older women above 30 years were more likely to have underweight children than those younger than or equal to 30 years old. For the age of the children variable, the results suggested that the weight-for-age Z-scores for children between 35 and 47 months and older than 47 months decreased by the factors of 0.92 and 1.11 respectively when compared to those of children younger than or equal to eleven months. This could imply that the older children were more likely to be underweight than younger ones. (*Refer to chapter 9; section 9.5.3 for detailed discussion on weight-for-age Z-scores for the children and associating factors*.)



— = Correlational relationships between food accessibility assessments and demographic and socio-economic factors, as well as between BMI scores for women and demographic and socio-economic factors; — = Correlational relationships between BMI scores for women and food accessibility assessments; FSN= Food security and nutrition; HH = household, P = p-value; HHS = Household Hunger Scale scores; HFIAS = Household Food Insecurity Access Scale scores; BMI = Body Mass Index; IV = Instrumental Variable

Figure 10.5.2: Framework illustrating multivariable IV regression analysis between BMI scores for the women, food accessibility assessments, and demographic and socio-economic factors



= Correlational relationships between food accessibility assessments and demographic and socio-economic factors, between BMI scores for women and demographic and socio-economic factors, as well as between weight-for-age Z-scores and demographic and socio-economic factors; = Correlational relationships between BMI scores for women and food accessibility assessments; = Correlational relationships between weight-for-age Z-scores and BMI scores for women; FSN= Food security and nutrition; HH = household, P = p-value; HHS = Household Hunger Scale scores; HFIAS = Household Food Insecurity Access Scale scores; BMI = Body Mass Index: IV = Instrumental Variable

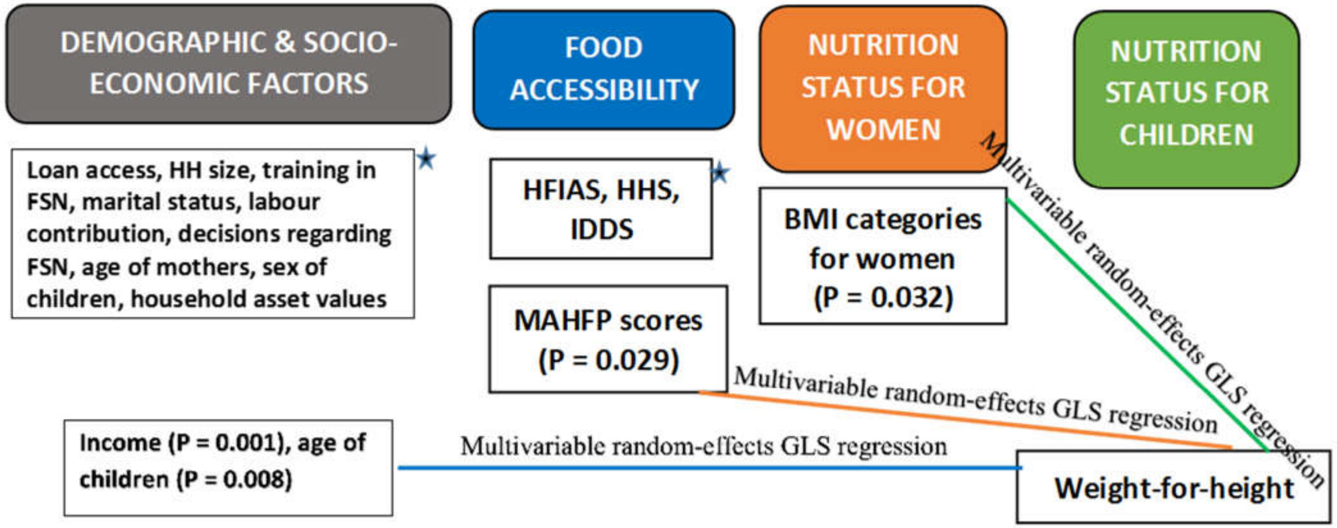
Figure 10.5.3: Framework illustrating multivariable IV regression analysis amongst weight-for-age, BMI scores for the women, food accessibility assessments, and demographic and socio-economic factors

10.5.2.2 Multivariable random-effects GLS regression analysis

Using the multivariable random-effects GLS regression analysis, the associating factors that were significant in influencing the children's weight-for-height were the BMI categories for the mothers (P = 0.032), MAHFP scores (P = 0.029), annual income (P = 0.001) and age categories for the children (P = 0.008) (*Figure 10.5.4*). For the BMI categories for the mothers/women variable, the results suggested that the weight-for-height Z-scores for the children whose mothers were malnourished decreased by the factor of 0.91 when compared to those whose mothers were healthy (BMI between 18.5kg/m^2 to 24.9kg/m^2). This could imply that the malnourished mothers were more likely to have wasted children. For the MAHFP scores variable, the results suggested that a one value increase in the MAHFP scores resulted in a weight-for-height increase by the factor of 0.15. This could imply that the more food secure households (less annual prevalence of hunger) were, the more likely they were to have children with higher weight-for-height Z-scores. For the age categories of the children variable, the results suggested that the weight-for-height Z-scores for children between 23 and 35 months and older than 47 months old decreased by the factors of 1.16 and 1.49 respectively when compared to those of children younger than or equal to eleven months old. This could imply that the older children were more likely to be wasted than younger ones. For the annual income variable, the results suggested that the weight-for-height Z-scores for children in households that earned between USD 100 and USD 200, and those that earned between USD 200 and USD 300 increased by the factors of 1.35 and 1.86 when compared to those that earned less than USD 100. This could imply that the households earning more money were more likely to have less wasted children. (*Refer to chapter 9; section 9.5.4 for detailed discussion on weight-for-height Z-scores for the children and associating factors*.)

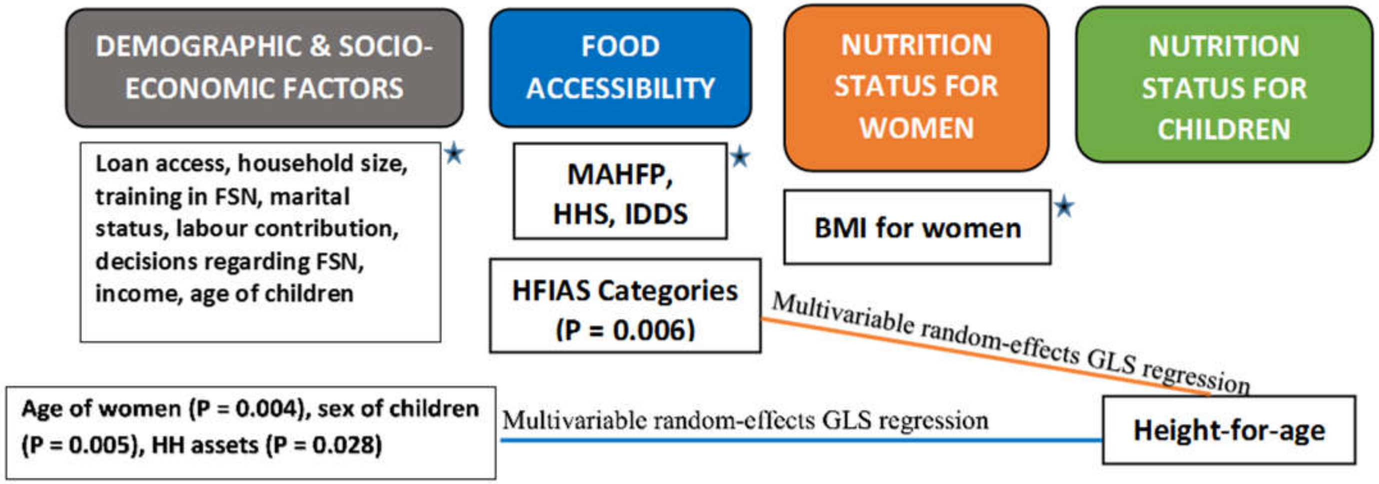
For the children's height-for-age, the significant factors were the HFIAS categories (P = 0.006), age categories for the mothers (P = 0.004), sex of the children (P = 0.005) and household assets values (P = 0.028) (*Figure 10.5.5*). For the age of the mothers' variable, the results suggested that comparatively, the height-for-age Z-scores for children whose mothers were older than 30 years decreased by the factor of 0.02 when compared to those whose mothers were younger than or equal to 30 years old. This could imply that the older women (greater than 30 years old) were more likely to have stunted children than those younger than or equal to 30 years old. For the sex of the children variable, the results suggested that the height-for-age Z-scores for male children decreased by the factor of 0.86 when compared to female children. This could imply that the male children were more likely to be stunted than female children. For the household assets values variable, the results suggested that the height-for-age Z-scores for children in households with assets valued at between USD 50 and USD 100 increased by the factor of 0.95 when compared to those in households with assets valued at less than USD 50. This could imply that the wealthier households were less likely to have stunted children. For the HFIAS variable, the results suggested that the height-for-age Z-scores for children in households that were moderately food insecure decreased by the factor of 1.73 when compared to those households that were food secure and mildly food insecure. Therefore, this could imply that the moderately food insecure households were more likely to have stunted children unlike food secure and mildly food insecure households. (*Refer to chapter 9; section 9.5.2 for detailed discussion on height-for-age Z-scores for the children and associating factors*.)

For the children's BMI-for-age, the significant factors were the BMI categories for the mothers (P = 0.030), age of the mothers (P = 0.029), annual income (P = 0.002) and household assets value categories (P = 0.047) (*Figure 10.5.6*). For the BMI categories of the mothers variable, the results suggested that the BMI-for-age Z-scores for the children whose mothers were malnourished decreased by the factor of 0.96 when compared to healthy mothers (BMI between 18.5kg/m^2 to 24.9kg/m^2). This could imply that the malnourished mothers were more likely to have wasted children compared to healthy mothers (BMI between 18.5kg/m^2 to 24.9kg/m^2). For the age of the mothers' variable, the results suggested that a one year increase in the age of the mothers resulted in a decrease in BMI-for-age Z-scores for children by the factor of 0.03. This could imply that the older women were more likely to have wasted children than younger ones. For the annual income variable, the results suggested that the BMI-for-age Z-scores for children in households that earned between USD 100 and USD 200, and those that earned between USD 200 and USD 300 increased by the factors of 1.40 and 1.93 respectively when compared to those that earned less than USD 100. This could imply that the households earning more money were more likely to have less wasted children. For the household assets values variable, the results suggested that the BMI-for-age Z-scores for children in wealthier households (i.e. wealth value of between USD 50 and USD 100) increased by the factor of 0.93 when compared to those with a wealth value of less than USD 50. This could imply that the wealthier households were more likely to have less wasted children. (*Refer to chapter 9; section 9.5.5 for detailed discussion on BMI-for-age Z-scores for the children and associating factors*.)



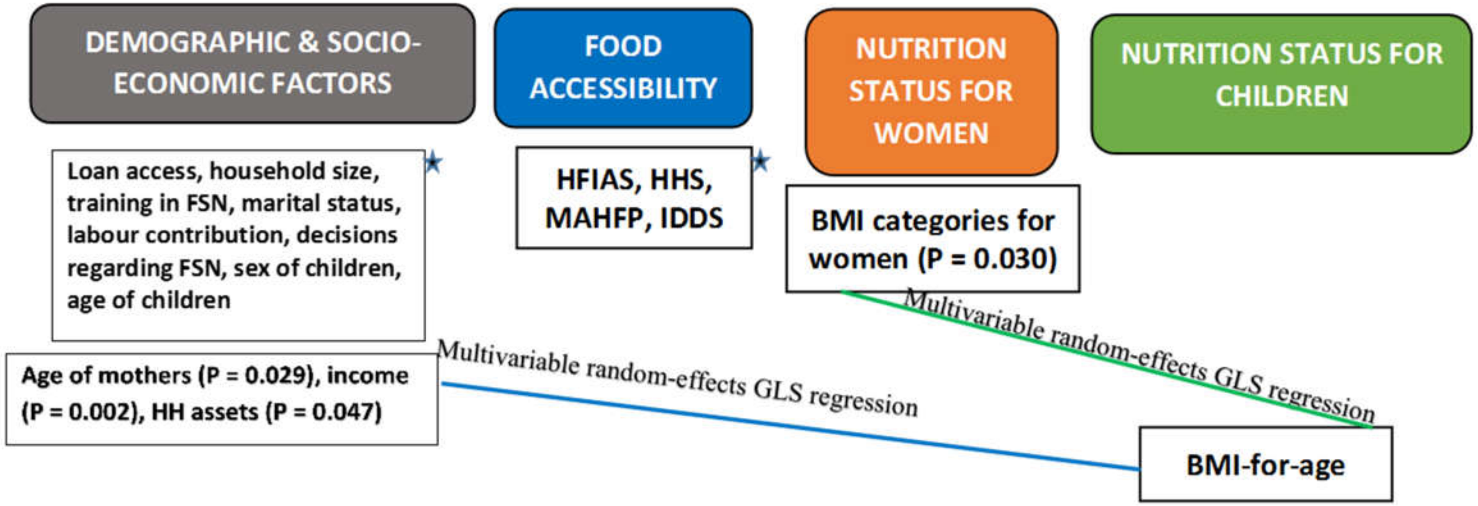
★Non-significant relationships; — = Correlational relationships between weigh-for-height Z-scores and demographic and socio-economic factors; — = Correlational relationships between weight-for-height Z-scores and Months of Adequate Food Provisioning scores; — = Correlational relationships between weight-for-height Z-scores and BMI scores for women; FSN = Food security and nutrition; HH = household, P = p-value; HHS = Household Hunger Scale scores; MAHFP = Months of Adequate Household Food Provisioning scores; HFIAS = Household Food Insecurity Access Scale scores; IDDS = Dietary Diversity Scale scores; BMI = Body Mass Index: GLS = Generalised Least Squares

Figure 10.5.4: Framework illustrating multivariable random-effects GLS regression analysis between weight-for-height, BMI for the women, food accessibility assessments, and demographic and socio-economic factors



★Non-significant relationships; ▬ = Correlational relationships between height-for-age Z-scores and demographic and socio-economic factors; ▬ = Correlational relationships between height-for-age Z-scores and Household Food Insecurity Access Scale score categories; FSN = Food security and nutrition; HH = household, P = p-value; HHS = Household Hunger Scale scores; MAHFP = Months of Adequate Household Food Provisioning scores; HFIAS = Household Food Insecurity Access Scale scores; IDDS = Dietary Diversity Scale scores; BMI = Body Mass Index; GLS = Generalised Least Squares

Figure 10.5.5: Framework illustrating multivariable random-effects GLS regression analysis between height-for-age and food accessibility assessments, as well as demographic and socio-economic factors



★Non-significant relationships; — = Correlational relationships between BMI-for-age Z-scores and demographic and socio-economic factors; — = Correlational relationships between BMI-for-age Z-scores and BMI score categories for the mothers/women; FSN = Food security and nutrition; HH = household, P = p-value; HHS = Household Hunger Scale scores; MAHFP = Months of Adequate Household Food Provisioning scores; HFIAS = Household Food Insecurity Access Scale scores; IDDS = Dietary Diversity Scale scores; BMI = Body Mass Index; GLS = Generalised Least Squares

Figure 10.5.6: Framework illustrating multivariable random-effects GLS regression analysis between BMI-for-age, food accessibility assessments, and demographic and socio-economic factors

10.6 STRENGTHS AND LIMITATIONS

10.6.1 Strengths

- The use of comprehensive demographic and socio-economic data provided diversified options for the tracking of pathways and correlational relationships.
- The use of trained field investigators and validated questionnaires ensured validity and reliability of food accessibility and nutrition status measurements.
- The proportional random sampling technique used to sample the households is a strength enabling generalisation of results to other households of women of reproductive age involved in tenant work on other smallholder tobacco farms and their under-five children in Mzimba North district, northern region of Malawi.
- The ability to track statistically significant correlational relationships amongst demographic and socio-economic factors, food accessibility measurements and nutrition status indicators for the women of reproductive age and under-five children to establish the pathways and linkages amongst these variables is a strength of this study.
- The use of different tools to assess and describe food accessibility at household and individual levels ensured triangulation that revealed consistent trends in the food insecurity picture for the women of reproductive age and their under-five children, thereby increasing the validity of the study findings.

10.6.2 Limitations

- Food security is a complex phenomenon that is usually better explained by four pillars, namely food availability, accessibility, utilisation and stability. This study addressed and assessed only two out of the four pillars of food security, i.e. the food accessibility pillar (captured by the HFIAS, HHS, MAHFP, IDDS), and food utilisation (captured by anthropometric measurements of women of reproductive age and their under-five children). The study did not address the availability and stability pillars of food security.
- The cross-sectional descriptive correlational study design used did not allow for the establishment of causal relationships between independent and dependent variables.

Therefore, the findings of this study would only describe mere linear relationships between the variables.

- The seasonality of food accessibility and nutrition status across the year could not be captured. This is due to the fact that the study was only conducted in one season (January to March 2016) that is characterised by hunger. Although the MAHFP tool captured seasonality of food (availability and consumption) to some extent (World Bank, 2013), this did not necessarily give the types of foods available and the dietary patterns of food consumption during the course of the year. The MAHFP was also dependent on the ability of the household to recall their food access during the previous 12 months (Coates *et al.*, 2007). The possibility of recall bias cannot be ruled out.
- Data on actual portion sizes of foods accessed and consumed were not collected. As such, it was impossible to report on actual amount of nutrients obtained from the foods consumed.

10.7 CONCLUSIONS

As revealed by this study, the smallholder tobacco tenant women of reproductive age and their under-five children in Mzimba North district, in the northern region of Malawi are trapped in the vicious circle of food insecurity and malnutrition.

The demographic and socio-economic status of these women and their children was generally compromised. Their status was largely characterised by high illiteracy, low income and wealth, relatively large household sizes, inability to access loans, high involvement in tobacco labour, non-affiliation to farmer groups, non-representation in leadership positions and inability to speak in public.

The food accessibility status of these women of reproductive age and their under-five children as assessed by the various measurement tools was poor. Eight in every ten households reported that they were anxious and uncertain about access to food and they had insufficient food quality, while six in every ten households had insufficient food intake. About one-fifth were severely hungry and most households had access to adequate food for only about eight months of a one year cycle. The women and children only consumed a mean of two food groups in the previous 24 hours.

The nutrition status of these women of reproductive age and their under-five children, as measured by the anthropometry, was poor. More than one-fifth of the women of reproductive age were malnourished of whom the majority were affected by undernutrition. For the under-five children, more than one-fifth were wasted, more than three in every ten were stunted and more than three in every ten were underweight. The study also revealed that more male than female under-five children were malnourished.

The significant factors influencing the food accessibility status were loan access, household size, training in food security and nutrition topics, marital status, tobacco labour contribution, annual income, decisions regarding food security and nutrition matters and age of the mothers.

The significant factors influencing the nutrition status indicators for the women of reproductive age were age of the mothers, loan access, HFIAS scores and HHS scores. The significant factors influencing the nutrition status indicators for the under-five children were age of the mothers, sex of the children, household assets values, HFIAS scores, BMI for the mothers/women, age of the children, MAHFP scores and annual income.

Despite the gloomy picture on the food accessibility and nutrition status of the participants, some positive results on the status of the women of reproductive age were indicated as most women were married, had good attendance to under-five clinics, most received training in food security and nutrition topics, and were involved in household decision making. These positive aspects are potential anchors that can be utilised when planning interventions to address the food accessibility and nutrition status situation of the women and their children.

The findings on the food accessibility and nutrition status of women of reproductive age and their under-five children on smallholder tobacco farms inform stakeholders about the extent of the problem, and where and who have been neglected in the claimed inclusive fight to eradicate food insecurity and malnutrition as the viewed birth right in Malawi. The statistically proven correlational relationships amongst demographic and socio-economic factors, food accessibility measurements and nutrition status indicators have been reported and pathways can be traced. This offers clues to policy makers and programme designers on where interventions need to be directed. For instance, to improve food accessibility, interventions need to deliberately address issues of loan access, household sizes (i.e. family planning), food and nutrition education, gender issues, labour regulations, income and wealth creation, women empowerment and age dynamics.

The multisectoral and multidisciplinary nature of the findings of this study also align directly and or indirectly to most of the Sustainable Development Goals (SDGs) adopted in 2015 by the United Nations with renewed inclusive and sustainable commitments to development. For instance, the findings and recommendations align directly to two SDGs. The first is Goal 2 which aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The second is Goal 5 which aims to achieve gender equality and empower all women and girls. Therefore, addressing the findings and recommendations of this study provides major opportunities to translate the SDGs commitments into practical actions in Malawi.

10.8 RECOMMENDATIONS

10.8.1 Implementation of interventions

- On the basis of the study findings and conclusions drawn, there is an urgent need to deliberately prioritise the tobacco tenant farmers (women of reproductive age and under-five children) in developmental programmes, such as social transfers focusing on the dire need to improve their food insecurity and malnutrition status.
- The study determined and reported on the correlational relationships amongst demographic and socio-economic factors, food accessibility and nutrition status. On this basis, implementation of programmes and interventions need to consider addressing issues of loan access, household sizes, food and nutrition education, marital status, labour, income, women empowerment and age dynamics to improve the status of the tobacco tenant women of reproductive age and their under-five children in Malawi.
- There is need for continued attention to address gender issues in the North Mzimba district in the northern region of Malawi. For instance, women should be recognised

for their involvement in informal labour settings and remunerated accordingly for their involvement to improve the food accessibility and nutrition status of households.

- The nation of Malawi has good and sound food and nutrition policies, but the findings of this study, as well as in the literature proves existence of flaws in the implementation process of these policies. To realise fruition of sound food and nutrition policies in this post-2015 SDGs era, several multisectoral and multidisciplinary commitments should be renewed and reinforced in crucial sectors:
    - Agricultural programming needs to boost diversified crop and animal production, keep commodity prices low, and increase household incomes.
    - Education programming needs to invest in nutrition, early child development and women empowerment.
    - Social welfare programming needs to address the immediate, underlying and basic causes of malnutrition. Such programming should aim to improve diet quantity, quality, and diversity; decrease vulnerability to food insecurity; decrease child mortality; and help children reach their full potential.
    - Public health programming needs to be linked to food and nutrition, for instance, promotion of consumption of nutritious foods and balanced meals to prevent deaths from other illnesses and delivery of food and nutrition education through health centres.
    - There is also need to strengthen implementation and facilitation of effective monitoring and evaluation systems to track performance of food and nutrition outputs, outcomes and impacts of policies and programmes.

10.8.2 Future research

- Wider coverage studies focusing on both tobacco tenants on large-scale and smallholder farms with large samples, increased power and study population variability, as well as the use of appropriate and validated measurement tools to cultivate the real extent of food accessibility and nutrition status and their associating factors need to be implemented in Malawi.

- Comprehensive multidisciplinary studies focusing on all the four pillars of food security, namely availability, accessibility, utilisation and stability need to be implemented, monitored and evaluated in Malawi.
- Research to understand and establish the roles and responsibilities of farm owners in the food security scenario and nutrition status of the tobacco tenants needs to be considered in future. In Malawi, the farm owner enters into an oral arrangement with the tenant to grow tobacco on the farm owner's land. Besides providing all the inputs to the tenant, the farm owner also provides the tenant and his household with an amount of maize (and possibly other foods) each month for the agreed period. The tenant in turn is responsible for growing the tobacco and selling it back to the owner at the end of the season (Torres, 2000). Although the tenants have other sources of food, it generally means that the farm owners are critical in influencing the food security (availability and accessibility) and nutrition status of the tenants. The farm owners need to take on responsibility to provide nutritious food rations to the tenants to ensure food security.

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LIST OF APPENDICES

Women of Reproductive Age (15 to 49 years Old) and Under-five Children (0 to 59 Months) Survey Questionnaire

STUDY TITLE:

Food accessibility and nutrition status of tenant women of reproductive age and under-five children on smallholder tobacco farms in northern Malawi

Appendix 1: Informed and signed consent

It is a great pleasure to be given an opportunity to visit your household. I am a postgraduate student from University of Pretoria (South Africa). I also work as Food and Nutrition Officer with the Ministry of Agriculture (Mzuzu Agriculture Development Division).

I am conducting a research to learn about the food security and nutrition status of women aged between **15 to 49 years old** and children aged between **0 to 5 years old** involved in tobacco tenant farming. You have been selected because you meet these criteria but your participation is purely voluntary.

Elsewhere studies have shown that food insecurity and malnutrition are rampant among women and children. As a result government and many non-governmental organisations rolled out various interventions in this ADD to help households and individuals cope with the issues of food insecurity and malnutrition. However, not much locally generated knowledge concerning women and children food insecurity and malnutrition status is known to support realistic implementation of these interventions. As such a research was proposed to quantify and document the extent of food insecurity and malnutrition status of women and children in the ADD. This research is intended to help government and non-governmental organisations in evidence-based planning of interventions which has a bearing in appropriate targeting of the really needy and vulnerable households and individuals. The research will include questions about the individual and household living characteristics. In addition, nutrition information, including taking of body measurements of women of reproductive age (15 to 49 years) and under-five children (0 to 5 years) will also be collected.

If you agree to have this discussion with me, the questions and body measurements will in total take approximately 1-2 hours to complete. You are free to choose to stop at any time or to skip any questions you do not want to answer. It is also my strong value and obligation to keep your answers completely confidential. Your information that identifies you will not be shared with anyone from this point on to data capturing, analysis and reporting.

Do you have any questions, comments and concerns about the research or what I have said? If in the future you have any questions regarding this research, you are welcomed to contact me (**Justice Munthali**) by calling **+265 991 267 997** or my supervisor (**Ms Gerda Gericke**) at University of Pretoria by calling **+27 836 762 134** and or my boss (**Mrs A.P. Moyo**) at Ministry of Agriculture where I work by calling **+265 888 364 375**.

Do you agree to participate in this research? Do you agree to take your body measurements and that of under-five children? Please sign in the form below to state your position.

Name of respondent	**Consent to participate in study (tick one box)**		**Signature or mark**
	Yes	**No**	
Name of witness			

Appendix 2: Interview background

Respondent Name	Surname:					
	Other Names:					
Phone Number	Line 1:					
	Line 2:					
ADD						
District						
EPA						
Section/Sub-Section						
Traditional Authority						
Group Village Headman						
Village						
Interviewed by (Field Investigator Name)						
Date of Interview	Day:		Month:		Year:	
Date Checked	Day:		Month:		Year:	
Date Entered	Day:		Month:		Year:	
Entered By:						

Appendix 3: Demographic characteristics

Note for question number 1: The target respondent is a woman of reproductive age (between 15 and 49 years old) responsible for cooking. However, all household members must be listed to get household composition data.

Serial number	Name of household member (start with respondent)	Sex **Codes A**	Marital status **Codes B**	Age (years)	Education (years) **Codes C**	Relation to HH **Codes D**	Occupation **Codes E**		Own farm labour contribution **Codes F**
							Main	Secondary	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
01									
02									
03									
04									
05									
06									
07									
08									
	Children between 0 and 59 months old								
09									
10									
11									
12									
13									

Codes A	**Codes B**	**Codes C**	**Codes D**	**Codes E**	**Codes F**
1. Female 2. Male	1. Married living with spouse 2. Married but spouse away 3. Divorced/separated 4. Widow/widower 5. Never married 6. Other, specify……	0. None/Illiterate 1. Adult education 2. Primary 3. Secondary 4. Tertiary	1. Household head 2. Spouse 3. Son/daughter 4. Parent 5. Son/daughter in-law 6. Grand child 7. Other relative 8. Hired worker 9. Other, specify……	1. Farming (crop + livestock) 2. Salaried employment 3. Self-employed off-farm 4. Casual labourer on-farm 5. Casual labourer off-farm 6. School/college child 7. Non-school child 8. Herding 9. Household chores 10. None 11. Other, specify.....................	1. Highly involved 2. Moderately involved 3. Less involved 4. None

Appendix 4: Detailed income sources

No	List occupations mentioned earlier in "Appendix 3 question 7 and 8" starting with main occupation, then secondary occupation	Annual income (MK)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Total Cash income from other sources MK…………………………………………….

Appendix 5: Detailed on-farm labour contribution

Note: The questions are intended to get a detailed picture of women of reproductive age's involvement and contribution to tobacco labour.

Routine work	Frequency in carrying out the activity **(codes A)**	Number of people involved in the activity	Time (hours) devoted to the activity per person per day
	9a	**9b**	**9c**
1.Clearing and ridging			
2. Nursery Management			
3. Transplanting			
4. Basal dressing			
5. Weeding			
6.Banding			
7.Top dressing			
8.Making of barns			
9.Harvesting			
10.Drying			
11.Baling			
12. Other, specify			

Codes A
1=Once a day 2=Twice a day 3=Three times a day 4=Every two days 5=Weekly 6=Monthly 7=Other, specify...

Questionnaire Identification Number (______________)

Appendix 6: Anthropometric measurements of women of reproductive age (15 to 49 years) and under-five children (0 to 59 months)

NOTE: Take two anthropometric readings for weight and height per subject

Serial Number	Are you currently pregnant or have you given birth in the previous 6 months? **Codes A**	Weigh the woman of reproductive age in "kg" to the nearest 0.1 kg.		Measure the height of woman of reproductive age in "cm" to the nearest 0.1 cm	
	10	**11**		**12**	
		Kg	0.1 kg	cm	0.1 cm
01					
02					
03					
04					
	Codes A				
	1. Yes>> Skip 0. No 2. Don't know				

From APPENDIX 3: Count how many under-five children of the woman of reproductive age are between 0 to 59 months old. From each age group of 0 to 23 months and 24 to 59 months randomly select one child and take their anthropometric measurements). **NOTE: Take recumbent length for children below 24 months and height for older children**						
Serial Number	Do you go to under-five clinics with the child? **Codes A**	If yes, how often do you go to under-five clinics? **Codes B**	Weigh the under-five children in "kg" to the nearest 0.1 kg		Measure the height/length of under-five children in "cm" to the nearest 0.1 cm	
	13	**14**	**15**		**16**	
			kg	0.1 kg	cm	0.1 cm
01						
02						
03						
04						
	Codes A	**Codes B**				
	1. Yes 0. No 2. Don't know	1. Every six months 0. Whenever I want 2. Not sure 3. Other specify: (_________)				

Appendix 7: Household assets

Production equipment and major household items

No	Asset	Number (if no equipment put zero)	Original purchase price (MWK) (if more than two items reported in column 2 take average price)	If you would sell [....] how much would you receive from the sale? (MWK) (if more than two items reported in column 2 take average price)	Total current Value
	17	**17a**	**17b**	**17c**	**17d= 17a*17c**
1	Donkey cart				
2	Horse/Mule saddle				
3	Push cart				
4	Ox-plough				
5	Sickle				
6	Pick Axe				
7	Axe				
8	Hoe				
9	Knapsack sprayer				
10	Motorized grain mill				
11	Hand/foot water pump				
12	Motorized water pump				
13	Spade or shovel				
14	Radio or music player				
15	Cell phone				
16	Improved charcoal/wood stove				
17	Bicycle				
18	Motorbike				
19	Trailers				
20	TV				
21	Chairs or set of chairs				
22	Table				
23	Grass roofed house				
24	Iron roofed house				
25	Sofa.				
26	Bed				
27	Beddings				
28	Forage chopper				
29	Livestock structures				
30	Milk churn				
31	Other, specify.....				

Questionnaire Identification Number (______________)

Appendix 8: Farmer organisations and public representation

Id	Do you belong to any farmer organisation or farmer group (FBO) **Codes A**	If No, do you intend to join any? **Codes A**	Name of FBO (s)	Type of FBO **Codes C**	When did you join the group? **Codes D**	Do you hold a Position in the FBO? **Codes A**	What position do you hold? **Codes E**	Have you ever received training on food security and nutrition topics? **Codes A,**	Title/ topic of training **Codes F**	Who trained you? **Codes G**	When was training conducted? **Codes D**	Have you ever taken or borrowed any cash in the previous 12 months **Codes A**	If Yes from where **Codes H**	Do you feel comfortable speaking in public about community developments	How are decisions regarding household wealth made in your household? **Codes J**	How are decisions regarding food and nutrition matters made in your household? **Codes K**
	18	**18a**	**18b**	**18c**	**18d**	**18e**	**18f**	**19**	**19a**	**19b**	**19c**	**20**	**20a**	**21**	**22**	**23**

<table>
<tr><th>Codes A</th><th colspan="2">Codes B</th><th>Codes C</th><th>Codes D</th><th>Codes E</th><th>Codes G</th><th>Codes H</th><th>Codes I</th></tr>
<tr><td rowspan="2">0 = No
1 = Yes</td><td rowspan="2">1 = For credit access (fertilizer, cash, seed, livestock etc)

2 = For access to free inputs

3 = For market access</td><td rowspan="2">4 = For Extension Services access

5 = other specify</td><td rowspan="2">1 = Club
2 = Pre association
3 = association
4= pre cooperative
5= cooperative
6 =Other specify</td><td rowspan="2">1 = This year
2 = last year
3 = 2 years ago
4 = more than 3 years ago</td><td>1 = Executive Member
2 = Ordinary Member</td><td>1= Govt department
2 = NGO
3 = Other, specify</td><td>1 = NGO
2 = Informal Lender
3 = Formal Lender (Banks)
4 = Friends/relatives
5 = Group lending i.e. SACCOs</td><td>1 = No, not at all comfortable
2 = Yes, but with great deal of difficulty
3 = Yes, but with a little difficulty
4 = Yes fairly comfortable
5 = Yes, very comfortable</td></tr>
<tr><td colspan="2">Codes F
1 =Dietary diversification
2= Storage& post-harvest losses
3= Food Processing
4= Agribusiness Training
5. Financial Management
6=Other, (Specify)</td><td>Codes J
1 = male alone
2 = Female alone
3 = male and female jointly
4 = Someone else in the household</td><td>Codes K
1 = male alone
2 = Female alone
3 = male and female jointly
4 = Someone else in the household
5.No say since food is given by tenant owner</td></tr>
</table>

Questionnaire Identification Number (_____________)

Appendix 9: Months of Adequate Household Food Provisioning (MAHFP) questionnaire

Now I would like to ask you about your household's food supply during different months of the year. When responding to these questions, please think back over the previous 12 months, from now to the same time last year.

ID	QUESTIONS AND FILTERS	CODING OPTIONS	CODING CATEGORIES	SKIP
1.	Were there months, in the previous 12 months, in which you did not have enough food to meet your household's needs?	Place **1 = YES** **0 = NO**	(_______)	If the answer is "**NO**" end here
2	If "**YES**", which were the months in the previous 12 months during which you did not have enough food to meet your family's needs?			
	• This includes any kind of food from any source, such as own production, purchase or exchange, food aid, or borrowing. • Do not read the list of months aloud. Place a "**1**" in the Box if the respondent identifies that month as one in which the household did not have enough food to meet their needs. If the respondent does not identify that month, place a "**0**" in the box. • Probe to make sure the respondent has thought about the entire previous 12 months.			
A	January	Place	(_______)	
B	December		(_______)	
C	November	**1 = YES**	(_______)	
D	October	**0 = NO**	(_______)	
E	September		(_______)	
F	August		(_______)	
G	July		(_______)	
H	June		(_______)	
I	May		(_______)	
J	April		(_______)	
K	March		(_______)	
L	February		(_______)	

Questionnaire Identification Number (_____________)

Appendix 10: Household Food Insecurity Access Scale (HFIAS) questionnaire

Each of the questions in the following table is asked with a recall period of four weeks (30 days or 1 month). The respondent is first asked an occurrence question – that is, whether the condition in the question happened at all in the previous four weeks ("**YES**" or "**NO**"). If the respondent answers "**YES**" to an occurrence question, a frequency-of-occurrence question is asked to determine whether the condition happened rarely (**ONCE or TWICE**), sometimes (**THREE TO TEN TIMES**) or often (**MORE THAN TEN TIMES**) in the previous four weeks.

For example:

- In the previous four weeks/30 days/1Month, did you worry that your household would not have enough food? Place…... if ……..
    - 0 = No (**skip to Q2**)
    - 1 = Yes (**then go to Q1a**)

- How often did this happen?
    - 1 = Rarely (once or twice in the previous four weeks)
    - 2 = Sometimes (three to ten times in the previous four weeks)
    - 3 = Often (more than ten times in the previous four weeks)

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the previous four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	(______)
1.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(______)
2.	In the previous four weeks, 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 Q3) 1=Yes	(______)
2.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(______)

Questionnaire Identification Number (_______________)

3.	In the previous four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q4) 1 = Yes	(_______)
3.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)
4.	In the previous four weeks, 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 food	0 = No (skip to Q5) 1 = Yes	(_______)
4.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)
5.	In the previous four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q6) 1 = Yes	(_______)
5.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)
6.	In the previous four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No (skip to Q7) 1 = Yes	(_______)
6.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)

7.	In the previous four weeks, 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 Q8) 1 = Yes	(_______)
7.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)
8.	In the previous four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1 = Yes	(_______)
8.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)
9.	In the previous four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (questionnaire is finished) 1 = Yes	(_______)
9.a	How often did this happen?	1 = Rarely (once or twice in the previous four weeks) 2 = Sometimes (three to ten times in the previous four weeks) 3 = Often (more than ten times in the previous four weeks)	(_______)

Questionnaire Identification Number (______________)

Appendix 11: Individual Dietary Diversity Scale (IDDS) indicator questionnaire for women of reproductive age (15 to 49 years)

1. **Please describe all the foods (meals, snacks and beverages) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.**

- The foods must be written down in table below. When composite/mixed dishes are mentioned, ask for the list of ingredients.
- When the respondent has finished, probe for meals and snacks not mentioned.

Breakfast	Snack	Lunch	Snack	Dinner	snack

Questionnaire Identification Number (_____________)

2. When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

ID #	FOOD GROUP	EXAMPLES	1 = YES 0 = NO	FOOD NOT SURE
1	**Cereals**	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. msima, porridge or paste*		
2	**White Roots and Tubers**	White potatoes, white yam, white cassava, or other foods made from roots		
3	**Vitamin A Rich Vegetables and Tubers**	Pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*		
4	**Dark Green Leafy Vegetables**	Dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves, such as amaranth, cassava leaves, kale, spinach*		
5	**Other Vegetables**	Other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*		
6	**Vitamin A Rich Fruits**	Ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*		
7	**Other Fruits**	Other fruits, including wild fruits and 100% fruit juice made from these		

Questionnaire Identification Number (_____________)

8	**Organ Meat**	Liver, kidney, heart or other organ meats or blood-based foods		
9	**Flesh Meats**	Beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects		
10	**Eggs**	Eggs from chicken, duck, guinea fowl or any other egg		
11	**Fish and Sea Food**	Fresh or dried fish or shellfish		
12	**Legumes, Nuts and Seeds**	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)		
13	**Dairy and dairy Products**	Dairy, cheese, yogurt or other dairy products		
14	**Oils and Fats**	Oil, fats or butter added to food or used for cooking		
15	**Sweets**	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods, such as chocolates, candies, cookies and cakes		
16	**Spices, Condiments and Beverages**	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages		
Did you eat anything (meal or snack) OUTSIDE the home yesterday				

3. Final calculation of women of reproductive age's (15 to 49 years old) dietary diversity score is based on 9 food groups with some of the food groups indicated above being combined as below:

ID	IDD FOOD GROUP	1 = YES 0 = NO
1	Starch Staples	
2	Dark green leafy Vegetables	
3	Other Vitamin A Rich Fruits and Vegetables	
4	Other Fruits and Vegetables	
5	Organ meat	
6	Flesh Meat	
7	Eggs	
8	Legumes/ Nuts	
9	Dairy	
	Total Dietary Diversity Scores	

Questionnaire Identification Number (_____________)

Appendix 12: Individual Dietary Diversity Scale (IDDS) indicator questionnaire for under-five children (24 to 59 months old)

4. **Please describe all the foods (meals, snacks and beverages) that the under-five child (24 to 59 months) ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.**

- The foods must be written down in table below. When composite/mixed dishes are mentioned, ask for the list of ingredients.

- When the respondent has finished, probe for meals and snacks not mentioned.

Breakfast	Snack	Lunch	Snack	Dinner	snack

Questionnaire Identification Number (_____________)

5. When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

ID #	FOOD GROUP	EXAMPLES	1 = YES 0 = NO	FOOD NOT SURE
1	**Cereals**	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. msima, porridge or paste*		
2	**White Roots and Tubers**	White potatoes, white yam, white cassava, or other foods made from roots		
3	**Vitamin A Rich Vegetables and Tubers**	Pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*		
4	**Dark Green Leafy Vegetables**	Dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves, such as amaranth, cassava leaves, kale, spinach*		
5	**Other Vegetables**	Other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*		
6	**Vitamin A Rich Fruits**	Ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*		

7	**Other Fruits**	Other fruits, including wild fruits and 100% fruit juice made from these		
8	**Organ Meat**	Liver, kidney, heart or other organ meats or blood-based foods		
9	**Flesh Meats**	Beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects		
10	**Eggs**	Eggs from chicken, duck, guinea fowl or any other egg		
11	**Fish and Sea Food**	Fresh or dried fish or shellfish		
12	**Legumes, Nuts and Seeds**	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)		
13	**Dairy and Dairy products**	Dairy, cheese, yogurt or other dairy products		
14	**Oils and Fats**	Oil, fats or butter added to food or used for cooking		
15	**Sweets**	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods, such as chocolates, candies, cookies and cakes		
16	**Spices, Condiments and Beverages**	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages		
Did you eat anything (meal or snack) OUTSIDE the home yesterday				

6. **Final calculation of under-five child's (24 to 59 months) dietary diversity score is based on 9 food groups with some of the food groups indicated above being combined as below:**

ID	**IDD FOOD GROUP**	**1 = YES** **0 = NO**
1	Starch Staples	
2	Dark green leafy Vegetables	
3	Other Vitamin A Rich Fruits and Vegetables	
4	Other Fruits and Vegetables	
5	Organ meat	
6	Flesh Meat	
7	Eggs	
8	Legumes/ Nuts	
9	Dairy	
	Total Dietary Diversity Scores	

*************** **THANK YOU VERY MUCH FOR YOUR TIME** ****************

Appendix 13: University of Pretoria Ethics Committee letter of acceptance (LOA)

Faculty of Natural and Agricultural Sciences

Ethics Committee

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10 February 2016

Mr J Munthali
Department of Human Nutrition
University of Pretoria
Pretoria
0002

Reference: EC151215-028 Title: Food accessibility and nutrition status of tenant women of reproductive age and under-five children on smallholder tobacco farms in the Northern Malawi

Dear Mr Munthali
Your application conforms to the requirements of the NAS Ethics Committee. We wish you well with your research.

Kind regards

Prof NH Casey Chairman: NAS Ethics Committee

NAS Ethics Committee +27 12 420 4107 ethics.nas@up.ac.za

Appendix 14: Detailed anthropometric indicators of the under-five children with sexes combines

Set 1: Sexes combined*													
Weight-for-length/height (%)													
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**% > +1SD**	**(95% CI)**	**% > +2SD**	**(95% CI)**	**% > +3SD**	**(95% CI)**	**Mean**	**SD ±**
131	12.2	(11.1%, 13.4%)	19.8	(12.3%, 30.4%)	12.2	(5.2%, 26.1%)	3.1	(0.9%, 9.5%)	0.8	(0%, 33.9%)	-0.83	1.69
Length/height-for-age (%)													
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**Mean**	**SD ±**	**-**	**-**	**-**	**-**	**-**	**-**
131	11.5	(2.3%, 41.3%)	31.3	(11.9%, 60.6%)	-1.22	1.53	-	-	-	-	-	-
Weight-for-age (%)													
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**Mean**	**SD ±**	**-**	**-**	**-**	**-**	**-**	**-**
133	12	(4.9%, 26.6%)	33.8	(16.4%, 57.1%)	-1.39	1.36	-	-	-	-	-	-
BMI-for-age (%)													
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**% > +1SD**	**(95% CI)**	**% > +2SD**	**(95% CI)**	**% > +3SD**	**(95% CI)**	**Mean**	**SD ±**
129	9.3	(2.4%, 29.9%)	17.1	(11.8%, 24%)	14.7	(6.7%, 29.4%)	5.4	(3.6%, 8.2%)	0	(-, -)	-0.64	1.66

(-,-) There are no 95% CIs for prevalence's (p) ≤ 0.00005 or ≥ 0.99995, (*) Values are based on WHO standards, % < -2 SD includes % < -3 SD; % > +2 SD includes % > +3 SD; % > +1 SD includes % > +2 SD and % > +3 SD.

Appendix 15: Detailed anthropometric indicators of the male under-five children

Set 2: Males *													
Weight-for-length/height (%)													
N	% < -3SD	(95% CI)	% < -2SD	(95% CI)	% > +1SD	(95% CI)	% > +2SD	(95% CI)	% > +3SD	(95% CI)	Mean	SD ±
66	18.2	(9.3%, 32.4%)	28.8	(13.9%, 50.4%)	12.1	(3.5%, 34.4%)	6.1	(1.8%, 18.4%)	1.5	(0%, 44.8%)	-1.02	1.91
Length/height-for-age (%)													
N	% < -3SD	(95% CI)	% < -2SD	(95% CI)	Mean	SD ±	-	-	-	-	-	-
64	14.1	(1.7%, 61.4%)	34.4	(14.6%, 61.5%)	-1.33	1.56	-	-	-	-	-	-
Weight-for-age (%)													
N	% < -3SD	(95% CI)	% < -2SD	(95% CI)	Mean	SD ±	-	-	-	-	-	-
67	17.9	(9%, 32.4%)	44.8	(35.4%, 54.5%)	-1.7	1.46	-	-	-	-	-	-
BMI-for-age (%)													
N	% < -3SD	(95% CI)	% < -2SD	(95% CI)	% > +1SD	(95% CI)	% > +2SD	(95% CI)	% > +3SD	(95% CI)	Mean	SD ±
65	13.8	(1.5%, 62.8%)	24.6	(15.7%, 36.5%)	15.4	(7.9%, 27.7%)	7.7	(1.8%, 27%)	0	(-, -)	-0.8	1.91

(-,-) There are no 95% CIs for prevalence's (p) ≤ 0.00005 or ≥ 0.99995, (*) Values are based on WHO standards, % < -2 SD includes % < -3 SD; % > +2 SD includes % > +3 SD; % > +1 SD includes % > +2 SD and % > +3 SD.

Appendix 16: Detailed anthropometric indicators of the female under-five children

Set 3: Females*											
Weight-for-length/height (%)											
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**% > +1SD**	**(95% CI)**	**% > +2SD**	**(95% CI)**	**% > +3SD**	**(95% CI)**	**Mean**	**SD ±**
65	6.2	(1.2%, 26.4%)	10.8	(6.3%, 17.8%)	12.3	(2.2%, 46.3%)	0	(-, -)	0	(-, -)	-0.63	1.42
Length/height-for-age (%)												
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**Mean**	**SD ±**	-	-	-	-	-	-
67	9	(2.4%, 28.2%)	28.4	(10.1%, 58.3%)	-1.12	1.5	-	-	-	-	-	-
Weight-for-age (%)												
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**Mean**	**SD ±**	-	-	-	-	-	-
66	6.1	(0.6%, 41.2%)	22.7	(3%, 73.6%)	-1.07	1.17	-	-	-	-	-	-
BMI-for-age (%)												
N	**% < -3SD**	**(95% CI)**	**% < -2SD**	**(95% CI)**	**% > +1SD**	**(95% CI)**	**% > +2SD**	**(95% CI)**	**% > +3SD**	**(95% CI)**	**Mean**	**SD ±**
64	4.7	(1.3%, 15.1%)	9.4	(2.6%, 28.5%)	14.1	(1.7%, 60.2%)	3.1	(0.1%, 48.8%)	0	(-, -)	-0.48	1.36

(-,-) There are no 95% CIs for prevalence's (p) ≤ 0.00005 or ≥ 0.99995, (*) Values are based on WHO standards, % < -2 SD includes % < -3 SD; % > +2 SD includes % > +3 SD; % > +1 SD includes % > +2 SD and % > +3 SD.